

NASA

Earth Resources  
A Continuing  
Bibliography  
with Indexes

NASA SP-7041 (26)  
July 1980

National Aeronautics and  
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## PREVIOUS EARTH RESOURCE BIBLIOGRAPHIES

Remote Sensing of Earth Resources	(NASA SP-7036)
Earth Resources	(NASA SP-7041(01))
Earth Resources	(NASA SP-7041(02))
Earth Resources	(NASA SP-7041(03))
Earth Resources	(NASA SP-7041(04))
Earth Resources	(NASA SP-7041(05))
Earth Resources	(NASA SP-7041(06))
Earth Resources	(NASA SP-7041(07))
Earth Resources	(NASA SP-7041(08))
Earth Resources	(NASA SP-7041(09))
Earth Resources	(NASA SP-7041(10))
Earth Resources	(NASA SP-7041(11))
Earth Resources	(NASA SP-7041(12))
Earth Resources	(NASA SP-7041(13))
Earth Resources	(NASA SP-7041(14))
Earth Resources	(NASA SP-7041(15))
Earth Resources	(NASA SP-7041(16))
Earth Resources	(NASA SP-7041(17))
Earth Resources	(NASA SP-7041(18))
Earth Resources	(NASA SP-7041(19))
Earth Resources	(NASA SP-7041(20))
Earth Resources	(NASA SP-7041(21))
Earth Resources	(NASA SP-7041(22))
Earth Resources	(NASA SP-7041(23))
Earth Resources	(NASA SP-7041(24))
Earth Resources	(NASA SP-7041(25))

# **EARTH RESOURCES**

**A Continuing Bibliography  
With Indexes  
Issue 26**

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between April 1 and June 30, 1980 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*

# INTRODUCTION

The technical literature described in this continuing bibliography may be helpful to researchers in numerous disciplines such as agriculture and forestry, geography and cartography, geology and mining, oceanography and fishing, environmental control, and many others. Until recently it was impossible for anyone to examine more than a minute fraction of the earth's surface continuously. Now vast areas can be observed synoptically, and changes noted in both the earth's lands and waters, by sensing instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 480 reports, articles, and other documents announced between April 1 and June 30, 1980 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in *STAR* and *IAA*.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations and abstracts are reproduced exactly as they appeared originally in *STAR*, or *IAA*, including the original accession numbers from the respective announcement journals. This procedure, which saves time and money, accounts for the variation in citation appearance.

Under each of the nine categories, the entries are presented in one of two groups that appear in the following order:

*IAA* entries identified by accession number series A80-10,000 in ascending accession number order;

*STAR* entries identified by accession number series N80-10,000 in ascending accession number order.

After the abstract section, there are five indexes:

subject, personal author, corporate source, contract number and report/accession number.

# AVAILABILITY OF CITED PUBLICATIONS

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All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies of accessions are available at \$7.00 per document up to a maximum of 40 pages. The charge for each additional page is \$0.25. Microfiche<sup>(1)</sup> of documents announced in *IAA* are available at the rate of \$3.00 per microfiche on demand, and at the rate of \$1.25 per microfiche for standing orders for all *IAA* microfiche. The price for the *IAA* microfiche by category is available at the rate of \$1.50 per microfiche plus a \$1.00 service charge per category per issue. Microfiche of all the current AIAA Meeting Papers are available on a standing order basis at the rate of \$1.50 per microfiche.

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E09	20.50	41.50
E10	22.50	45.50
E11	24.50	49.50
E12	27.50	55.50
E13	30.50	61.50
E14	33.50	67.50
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E99 - Write for quote		
N01	28.00	40.00

# TABLE OF CONTENTS

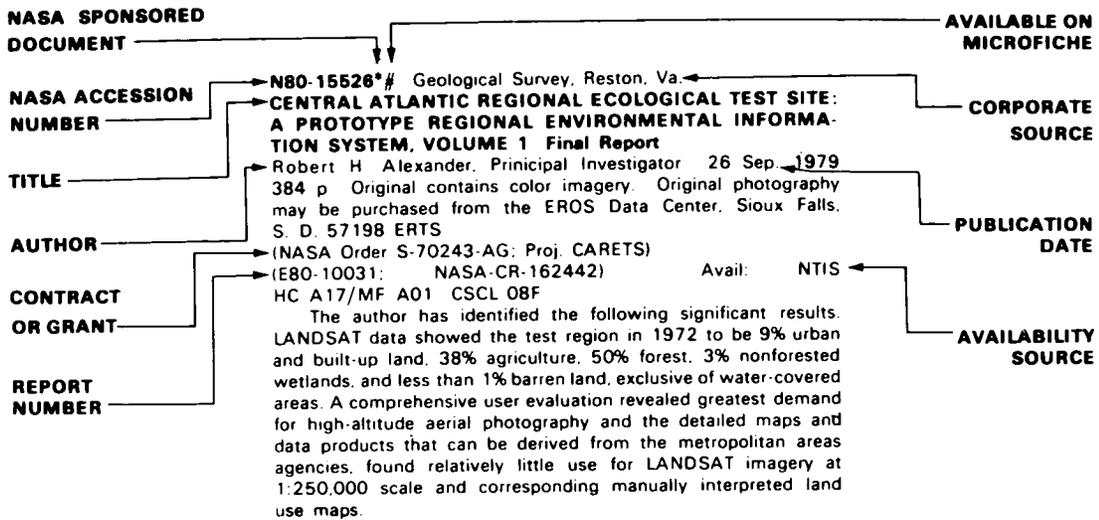
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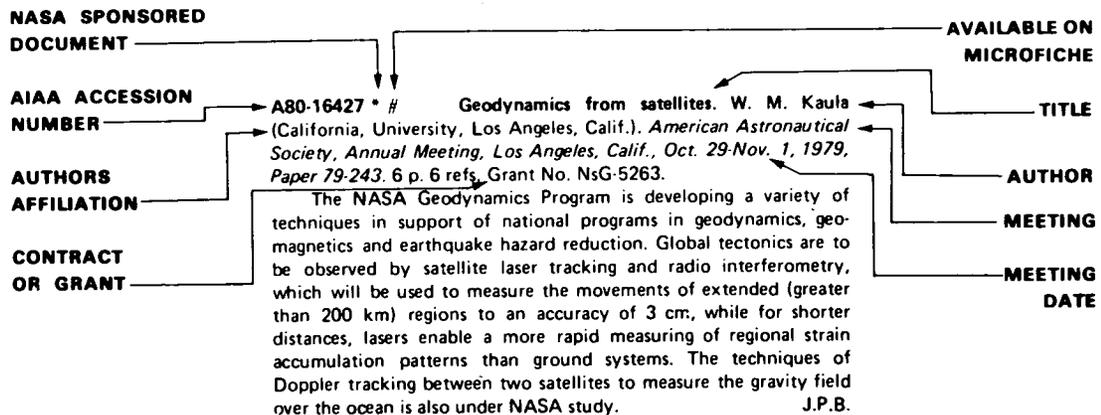
*page:*

<b>01 AGRICULTURE AND FORESTRY</b>	<b>59</b>
Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.	
<b>02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES</b>	<b>75</b>
Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.	
<b>03 GEODESY AND CARTOGRAPHY</b>	<b>81</b>
Includes mapping and topography.	
<b>04 GEOLOGY AND MINERAL RESOURCES</b>	<b>87</b>
Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.	
<b>05 OCEANOGRAPHY AND MARINE RESOURCES</b>	<b>93</b>
Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.	
<b>06 HYDROLOGY AND WATER MANAGEMENT</b>	<b>101</b>
Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.	
<b>07 DATA PROCESSING AND DISTRIBUTION SYSTEMS</b>	<b>107</b>
Includes film processing, computer technology, satellite and aircraft hardware, and imagery.	
<b>08 INSTRUMENTATION AND SENSORS</b>	<b>115</b>
Includes data acquisition and camera systems and remote sensors.	
<b>09 GENERAL</b>	<b>121</b>
Includes economic analysis.	
<b>SUBJECT INDEX</b> .....	<b>A-1</b>
<b>PERSONAL AUTHOR INDEX</b> .....	<b>B-1</b>
<b>CORPORATE SOURCE INDEX</b> .....	<b>C-1</b>
<b>CONTRACT NUMBER INDEX</b> .....	<b>D-1</b>
<b>REPORT/ACCESSION NUMBER INDEX</b> .....	<b>E-1</b>

## TYPICAL CITATION AND ABSTRACT FROM STAR



## TYPICAL CITATION AND ABSTRACT FROM IAA



# EARTH RESOURCES

*A Continuing Bibliography (Issue 26)*

JULY 1980

01

## AGRICULTURE AND FORESTRY

Include crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns.

**A80-21446** Preliminary results of an investigation into the potential application of X-band SLR images for crop-type inventory purposes. M. K. Smit (Delft, Technische Hogeschool, Delft, Netherlands). *IEEE Transactions on Geoscience Electronics*, vol. GE-17, Oct. 1979, p. 303-308. 11 refs.

Preliminary results are reported of an investigation into the potential application of SLR images (that is, both SAR and SLAR images) for crop-inventory purposes employing temporal dependency to obtain multi-dimensional observations. To evaluate this potential, SLR-image data are simulated and subsequently classified. The results, which are restricted to VV-polarized X-band data, 'taken' at a typical SLAR angle of 20 deg (grazing), indicate that an overall average error fraction of less than 20% can be reached for the region involved, with less than 5% error for some crops. (Author)

**A80-21896** Advances in earth resources management. R. E. Tokerud (Lockheed Remote Sensing Applications Laboratory, Plainfield, N.J.). *Lockheed Horizons*, Winter 1979-1980, p. 32-36.

The Large Area Crop Inventory Experiment (LACIE), a joint program under NASA, USDA and NOAA is discussed. The aim was to find out if the technologies being developed in remote sensing and weather monitoring can be used to estimate agricultural crops on a global basis through Landsat pictures. Landsat's primary instrument is a multispectral scanner that simultaneously observes the earth in four parts of the electromagnetic spectrum. The data are telemetered to earth, and either converted into photographs or used in a digital computer format for spectral pattern recognition analysis. The paper gives an account of the exploratory studies made over the U.S. Great Plains and the U.S.S.R. in 1977 and shows that the obtained estimates proved to be quite accurate. L.M.

**A80-22386 #** Precision of crop-area estimates. G. A. Hanuschak (U.S. Department of Agriculture, Statistical Research Div., Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 117-125. 6 refs.

Precision and controlled accuracy are the major criteria used by ESCS for evaluating crop-area estimates. Regression estimates which

use both Landsat data and ESCS June Enumerative Survey data were substantially more precise than direct expansion estimates (ground data only) for the 1978 Iowa Landsat Project. The regression estimates were input to the USDA Crop Reporting Board's Annual Crop Summary for Iowa released January 1979. The repeatability of such efforts, however, is highly dependent on rapid Landsat data delivery to ESCS and cloud-free coverage of the analysis areas. B.J.

**A80-22387 \* #** Accuracy assessment in the Large Area Crop Inventory Experiment. A. G. Houston, D. E. Pitts, A. H. Feiveson, G. Badhwar, M. Ferguson (NASA, Johnson Space Center, Houston, Tex.), E. Hsu, J. Potter, R. Chhikara, M. Rader, and C. Ahlers (Lockheed Electronics Co., Houston, Tex.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 127-146. 19 refs.

The Accuracy Assessment System (AAS) of the Large Area Crop Inventory Experiment (LACIE) was responsible for determining the accuracy and reliability of LACIE estimates of wheat production, area, and yield, made at regular intervals throughout the crop season, and for investigating the various LACIE error sources, quantifying these errors, and relating them to their causes. Some results of using the AAS during the three years of LACIE are reviewed. As the program culminated, AAS was able not only to meet the goal of obtaining accurate statistical estimates of sampling and classification accuracy, but also the goal of evaluating component labeling errors. Furthermore, the ground-truth data processing matured from collecting data for one crop (small grains) to collecting, quality-checking, and archiving data for all crops in a LACIE small segment. B.J.

**A80-22388 \* #** The role of phenology in statistical crop acreage measurement. P. A. Castruccio (ECOsystems International, Inc., Gambrills, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 147-165. Contract No. NAS8-32408.

In order to achieve market acceptance, the accuracy of remote sensing systems needs to be increased from the historically achieved average level of approximately 80-85% to 96-98%, i.e., by a factor of at least three, preferably five. A theory of discrimination is developed based on the fine-grained spectral data from LACIE supersites. It is shown that significant improvements in discrimination accuracy are possible by exploiting the differentials of crop spectra occurring between different phenologic stages. The major effects of such techniques on data system design are examined with respect to recurrence frequency, data volume, and information extraction. B.J.

**A80-22389 #** A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing. W. G. Rohde, W. A. Miller, K. G. Bonner, E. Hertz, and M. F. Engel

## 01 AGRICULTURE AND FORESTRY

(Technicolor Graphic Services, Inc., EROS Data Center, Sioux Falls, S. Dak.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 167-179. 15 refs. U.S. Geological Survey Contract No. 14-08-001-06439.

Landsat digital data and large-scale aerial photographs were used in a stratified-cluster sampling procedure to estimate the area of wildland vegetation cover types in northwestern Arizona. The Landsat data were used to stratify the project area into relatively homogeneous strata, partition each stratum into sample units, summarize estimates within each sample unit, and select and locate sample units for more precise measurement on large-scale aerial photographs. Aerial photographs at a 1:6000 scale were used to estimate the area of each vegetation cover type within the selected sample units. The results suggest that Landsat data and large-scale aerial photographs can be effectively used to inventory wildland vegetation.

B.J.

**A80-22405 # State of the art and needs of the earth platform.** L. B. Kuechle, D. P. DeMaster, and D. B. Siniff (Minnesota, University, Minneapolis, Minn.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 505-518. 10 refs.

It is noted that while there is interest in satellite tracking by biologists, especially in cases where animals are inaccessible using ordinary location and tracking techniques, little has been done in actual application of satellite tracking, due to the high cost of satellite packages and their excess size and weight. The paper surveys the current state of the art in designing the animal platform segment for use in satellite location systems. Discussion also covers areas where compromises may be possible allowing use in a wider range of applications. Finally, problems with batteries, antenna design and oscillator stability are discussed.

M.E.P.

**A80-22412 # Estimated winter wheat yields from Landsat MSS using spectral techniques.** T. W. Brakke and E. T. Kanemasu (Kansas State University of Agriculture and Applied Science, Manhattan, Kan.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 629-641. 11 refs.

An evapotranspiration (ET) model developed for winter wheat in Kansas was used with Landsat-based estimates of leaf area index to predict yields in Kansas, Texas, Idaho, and Washington. Yield equations were based on (1) the daily transpiration to potential evapotranspiration ratio (ET yield model) and (2) the partitioning of photosynthates between the reproductive and vegetative parts of the plant through the use of a partitioning function (photo model). Two different partitioning functions were evaluated. Correlation coefficients were 0.81 and 0.68 for the photo models and 0.72 for the ET yield model.

(Author)

**A80-22413 \* # The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE.** R. G. Stuff and T. L. Barnett (NASA, Johnson Space Center, Houston, Tex.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 645-657. 26 refs.

The object of the paper is to assess the results of the Large Area Crop Inventory Experiment (LACIE) and closely related research on yield estimation techniques based on remote sensing variables. The exploratory research conducted during LACIE substantiated the hypothesis of yield related information contained in Landsat multispectral scanner data and indicated some of its empirical characteristics. It is noted that leaf area and possibly other foliage features can be derived from spectral data for yield estimation

through agrometeorological models and that multiple vegetative and grain related features may be discernable by Landsat derived wheat spectra at different points in the crop development.

V.T.

**A80-22414 \* # Determination of range biomass using Landsat.** J. C. Harlan, R. H. Haas, W. E. Boyd (Texas A & M University, College Station, Tex.), and D. W. Deering (NASA, Goddard Space Flight Center, Greenbelt, Md.; Texas A & M University, College Station, Tex.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 659-673. 18 refs. NASA-supported research.

With the successful launch of Landsat-1 a series of rangeland investigations was begun by Texas A & M University. This series has been continuous and has evolved from the initial research phase of examining what Landsat could do into the present stage of evaluating the transfer of information and technology to the agri-business community. The discussion presented here consists of three parts: a brief history of rangeland Landsat work; present research efforts and results; and the present information transfer investigation. (Author)

**A80-22415 # Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables.** C. H. Tom and L. D. Miller (Texas A & M University, College Station, Tex.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 675-692. 12 refs.

**A80-22423 # Forest statistics by ARIES classification of Landsat multispectral images in northern Canada.** Z. D. Kalensky (Université Laval, Quebec, Canada), W. C. Moore, G. A. Campbell, D. A. Wilson (Petawawa National Forestry Institute, Chalk River, Ontario, Canada), and A. J. Scott (DIPIX Systems, Ltd., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 789-811. 21 refs.

The usefulness of Landsat multispectral images for forest classification in the northern transitional forest zone is examined. An effective procedure for operational use is proposed, and its cost, time, and manpower requirements are assessed.

V.P.

**A80-22424 # Radar discrimination of crops.** S. Parashar, D. Day, J. Ryan, D. Strong, R. Worsfold (Remotec Applications, Inc., St. John's, Newfoundland, Canada), and G. King (Department of Agriculture, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 813-823. 19 refs.

An analysis of crop imagery is presented with the consideration of available ground truth information in the form of row spacing and direction, plant density and moisture, soil type and moisture, and growth state and cover. The ability of each channel to image various crops is discussed in terms of radar sensitivity to plant and soil parameters and conditions; the information available from combining data from the four channels is greater than that provided by an individual channel, but the utility of each channel in crop discrimination should be based on the results of digital analysis.

A.T.

**A80-22437 # An evaluation of Landsat-D for Canadian applications.** A. K. McQuillan and W. M. Strome (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 957-964.

A Landsat-D workshop was held to evaluate the capabilities of this satellite in meeting user requirements, and to address questions related to the design of the system to be developed to make data available to Canadian users. A wide range of applications were addressed, including potential benefits of Landsat data for forest inventory and protection, global wheat production forecasting, farm management, rangeland monitoring, streamflow forecasting, water quality studies, petroleum and mineral exploration, sea ice monitoring, and mapping activities. (Author)

**A80-22438 # Temporal study on Paddy /rice/ using X-band scatterometer.** O. P. N. Calla, N. S. Pillai, O. P. Kaushik, and S. Sivaprasad (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 965-970.

With a view to explore and establish the possibilities of using active Microwave Sensors for operational spaceborne crop monitoring applications and to find the appropriate system parameters, a temporal study has been carried out on Paddy, one of the prime crops of India, using an X-band ground based scatterometer. This paper presents the results of this preliminary study. The results indicate that there is a significant change in scattering coefficient during the harvest period. (Author)

**A80-22439 \* # Small forest cuttings mapped with Landsat digital data.** E. Bryant (NASA, Goddard Institute for Space Studies, New York, N.Y.); Dartmouth College, Hanover, N.H.), A. G. Dodge (New Hampshire, University, Durham, N.H.), and M. J. E. Eger (Dartmouth College, Hanover, N.H.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 971-981. 5 refs.

The Cooperative Landsat Applications Research Group used computer classification of Landsat digital data to map forest cuttings (clearcuts) in northern New Hampshire. Cuttings as small as 3 hectares were identified. Several ages or conditions of clearcuts could be distinguished. Progress in two methods of duplicating classification categories from one Landsat pass to another are discussed. One method was used in making maps of areas in 1973, 1975, and 1978. (Author)

**A80-22450 \* # Remote sensing as a source of land cover information utilized in the universal soil loss equation.** D. R. Morris-Jones, K. M. Morgan, R. W. Kiefer, and F. L. Scarpace (Wisconsin, University, Madison, Wis.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1107-1115. U.S. Environmental Protection Agency Grant No. G-005139-01; Grant No. NGL-50-002-127.

In this study, methods for gathering the land use/land cover information required by the USLE were investigated with medium altitude, multi-date color and color infrared 70-mm positive transparencies using human and computer-based interpretation techniques. Successful results, which compare favorably with traditional field study methods, were obtained within the test site watershed with airphoto data sources and human airphoto interpretation techniques. Computer-based interpretation techniques were not capable of identifying soil conservation practices but were successful to varying degrees in gathering other types of desired land use/land cover information. (Author)

**A80-22453 \* # An evaluation of several different classification schemes - Their parameters and performance.** D. Scholz, N. Fuhs, and M. Hixson (Purdue University, West Lafayette, Ind.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1143-1149. 8 refs. Contract No. NAS9-15466.

The overall objective of this study was to apply and evaluate several of the currently available classification schemes for crop identification. The approaches examined were: (1) a per point Gaussian maximum likelihood classifier, (2) a per point sum of normal densities classifier, (3) a per point linear classifier, (4) a per point Gaussian maximum likelihood decision tree classifier, and (5) a texture sensitive per field Gaussian maximum likelihood classifier. Three agricultural data sets were used in the study: areas from Fayette County, Illinois, and Pottawattamie and Shelby Counties in Iowa. The segments were located in two distinct regions of the Corn Belt to sample variability in soils, climate, and agricultural practices. (Author)

**A80-22456 # Estimation of primary production of vegetation in agricultural and forested areas using Landsat data.** Y. Mukai and S. Takeuchi (Remote Sensing Technology Center of Japan, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1177-1188. 5 refs.

A method to estimate the vegetal primary production from Landsat data is shown. Since vegetal resources are grouped into two categories, agricultural and forested one, a test area for each category was selected. Multitemporal Landsat scenes covering test areas with some ground truth data were obtained. For the agricultural test area, paddyfield area data and the dry biomass data related to each growth stage were collected; for the forest test area, area data of each forest type and timber volume data were collected. Crop classification or forest type classification was performed for the respective test area using multi-temporal Landsat images, and the results of the classification were compared with corresponding ground truth data. (Author)

**A80-22473 # Forest inventory of clearcuts utilizing remote sensing techniques.** D. L. Hawley (EG & G, Inc., Las Vegas, Nev.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1385-1407.

The feasibility of utilizing Landsat MSS data in assessing surface cover types and areal extent of clearcut and shelterwood cut harvest sites in southern Oregon was investigated. The usefulness of various scales of panchromatic natural color and color infrared vertical aerial photography was evaluated for cover type mapping of clearcuts and shelterwood cuts. The photographic data were used in support of computer processing of Landsat. The research suggests that the application of Landsat MSS data in assessing cover types within clearcuts is limited but possible when appropriate ground truth information and computer processing are utilized. C.F.W.

**A80-22474 # Sampling techniques to monitor forest area change.** G. S. Smith (Michigan, University, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1409-1418. 11 refs.

The effectiveness of three sampling methods, with varying sampling unit sizes and number of sampling units, in the establishment of a national, continental, or global monitoring program to follow the ever-changing acreages of forest area is evaluated. Ratio estimation calculations for the second stage of this design appear to be the most desirable for inclusion in the overall project. By increasing sampling unit size, number of sampling units, or a combination of the two, acceptable forest area results can be obtained. V.P.

**A80-22485 # Mapping New Zealand's moisture rich soils from Landsat.** I. L. Thomas (Department of Scientific and Industrial Research, Physics and Engineering Laboratory, Lower Hutt, New Zealand). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceed-

# 01 AGRICULTURE AND FORESTRY

ings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1531-1540. 8 refs.

**A80-22486 \* # Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data.** A. H. Strahler, C. E. Woodcock (California, University, Santa Barbara, Calif.), and T. L. Logan (California Institute of Technology, Jet Propulsion Laboratory; Informatics, Inc., Pasadena, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1541-1557. 10 refs.

Accurate timber inventory data for cost-effective forest management is the primary goal of a Forest Classification and Inventory System (FOCIS) designed to provide estimates of timber volume by species aggregated by compartments, townships, or other spatial management units. FOCIS uses Landsat spectral data, including a synthesized texture channel, and Forest Service ground sample data to produce timber volume-homogeneous classes through a two-step unsupervised clustering process. Registered digital terrain data, including derived slope angle and slope aspect channels, are used to predict species proportions through a trend surface model, again using ground sample data for model calibration. In the final stage of FOCIS, volume estimates and predicted species proportions are merged and aggregated to yield timber volumes by species within management areas. (Author)

**A80-22487 # Agricultural and resource assessment in Jamaica using an area sampling frame.** H. F. Huddleston (U.S. Department of Agriculture, Washington, D.C.) and R. Russell (Jamaican Ministry of Agriculture, Kingston, Jamaica). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1559-1566. 5 refs.

The paper presents a technology for using remote sensing in implementing an information system in a country with limited resources and known agricultural data needs. Specifically, Landsat imagery and infrared photography are obtained along with conventional topographic maps to develop an area sampling frame to inventory crop acreages, production and related agricultural information. (Author)

**A80-22497 # Forest stand classification in western Washington using Landsat and computer-based resource data.** G. R. Johnson, E. W. Barthmaier (Technicolor Graphic Services, Inc., EROS Data Center, Sioux Falls, S. Dak.), T. W. D. Gregg, and R. E. Aulds (Washington Department of Natural Resources, Olympia, Wash.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1681-1696. 6 refs. U.S. Geological Survey Contract No. 14-08-0001-16439.

A study to determine if forest stand classification obtained from the analysis of digital Landsat data might be able to supplement present methods of acquiring forest resource information in Washington state is presented. Landsat data were clustered, and geometrically corrected and aligned with conventionally obtained forest stand data. Landsat classifications (composed of clear-cut, established plantations, and older forest classes) agreed with resource data in 87% of the independent samples of resource plots, and in 56% of the plots for discrete age and stocking classes. J.P.B.

**A80-22500 # Area estimates by Landsat - Kansas 1976 winter wheat.** M. W. Craig, R. S. Sigman, and M. Cárdenas (U.S. Department of Agriculture, Statistical Research Div., Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1727-1736.

This paper describes research on the estimation of area planted to winter wheat in Kansas. Landsat multispectral scanner data were used as the auxiliary variable and ground survey data as the primary variable in a regression estimator. The main goal of the project was to improve the ground survey estimation procedures at state, multi-county, and individual county levels. Achievement of the goal was measured by the reduction in variance of the planted-area estimate computed using Landsat and ground data in comparison with the estimate computed using only ground data. The use of Landsat reduced the variation for the multi-county areas by 68 to 92 percent. Several new concepts aided this project in achieving its goals. The major new concept used was the combined regression, a statistical technique allowing estimation of certain parameters in areas that normally would not have enough samples, along with 'masked' classification and pseudo-counties. (Author)

**A80-22501 # Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data.** E. N. Lorenzo, B. R. de Jesus, Jr., and R. S. Jara (Ministry of Natural Resources, Natural Resources Management Center, Quezon City, Philippines). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1737-1745.

**A80-22502 \* # Temporal resolution for crop discrimination estimated using J-M distance.** J. W. Baran, J. C. Conrad, Jr. (General Electric Co., Space Div., Philadelphia, Pa.), and D. B. Wood (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1747-1756. Contract No. NAS5-23412.

A study is presented which examines techniques utilizing spectral/phenological data to classify and mensurate target crops at predetermined accuracies in order to estimate the temporal resolution requirements for a remote sensing system. An analysis is made of the physical target (crop) characteristics as they vary in time. A model is developed relating the frequency required to attain a particular probability of correct discrimination with N accumulated observations to that required with single observations. Finally, results for a multicrop spectral data set are shown to substantiate the theoretically-modeled results. M.E.P.

**A80-22505 \* # Possible future directions in crop yield forecasting.** J. E. Colwell (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1781-1788. 10 refs. Contract No. NAS9-15476.

This paper examines present and future possible applications of remote sensing to crop yield forecasting. It is concluded that there are ways in which Landsat data could be used to assist in crop yield forecasting using present technology. A framework for global crop yield forecasting which uses remote sensing, meteorological, field and ancillary data, as available, is proposed for the future. (Author)

**A80-23294 Coniferous tree species mapping using Landsat data.** S. J. Walsh (Oklahoma State University, Stillwater, Okla.). *Remote Sensing of Environment*, vol. 9, Feb. 1980, p. 11-26. 22 refs.

The paper deals with the application of Landsat digital data to the identification and mapping of 12 surface-cover types, including seven classes of coniferous tree species. The cover-types were mapped with an average accuracy of 88.8%, as compared with detailed ground truth. The combined effect of a quantity and quality of ground truth, the use of the controlled clustering classification technique, and the prudent placement of ISA (Intensive Study Areas) on the image-processing CRT screen for training static collection provided very subtle spectral reflectance differences among the coniferous tree species. V.P.

**A80-23295** Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures. G. J. R. Soer (Netherlands Interdepartmental Working Community for the Application of Remote Sensing Techniques, Delft; Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen, Netherlands). *Remote Sensing of Environment*, vol. 9, Feb. 1980, p. 27-45. 25 refs.

**A80-23296** Wombats detected from space. E. Löffler and C. Margules (Commonwealth Scientific and Industrial Research Organization, Div. of Land Use Research, Canberra, Australia). *Remote Sensing of Environment*, vol. 9, Feb. 1980, p. 47-56. 13 refs.

The hairy-nosed wombat is a large marsupial that occurs in great numbers on the Nullarbor Plain, South Australia. Because of the animal's burrowing and mound building, which creates areas of bare ground and freshly dug soil, its approximate distribution can be mapped from digitally enhanced color Landsat imagery, and even to some degree from good quality band-7 black-and-white imagery. The feasibility of monitoring the spread of wombats by satellite imagery to provide farm and grazing land protection is discussed. V.P.

**A80-23299** Estimation of grain yields by remote sensing of crop senescence rates. S. B. Idso, P. J. Pinter, Jr., R. D. Jackson, and R. J. Reginato (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Remote Sensing of Environment*, vol. 9, Feb. 1980, p. 87-91. 10 refs.

A promising approach to crop yield estimation is that of crop reflectance assessment, using the system of Landsat satellites. In the present paper, a technique relying solely on Landsat data is developed on the basis of the concept of ageing or senescence. The technique may prove to be effective if satellite-derived spectral reflectances become available on a more frequent basis than is presently the case. V.P.

**A80-24052** Remote sensing and soils - An application (La télédétection et les sols - Une mise au point). F. Bonn (Sherbrooke, Université, Sherbrooke, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 3-14. 11 refs. In French.

The application of remote sensing techniques to the identification of soils and the monitoring of changes in rapidly varying soil properties (moisture content, air content, and temperature) is discussed. The principle methods of soil identification and mapping using the spectral characteristics of reflected radiation in the visible and near-infrared ranges are considered, taking into account measurements of soil texture, structure, and mineral content. Methods for characterizing the dynamic thermal and hydrological properties of soils are then examined, with attention given to the determination of soil moisture and temperature by means of passive and active (radar) microwave equipment, and determinations of soil temperature and thermal inertia in the thermal infrared and by the Heat Capacity Mapping Mission. It is concluded that although the remote sensing of soils is still in its initial stages, developments in sensing methods are expected to be quite useful, especially in the area of moisture determination. A.L.W.

**A80-24053** Remote sensing applied to soils (La télédétection appliquée aux sols). J. Cihlar (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 15-27. 47 refs. In French.

The use of remote sensing techniques for soil mapping and the evaluation of soil properties is reviewed. Consideration is given to the nature of remote sensing data, and applications of remote sensing techniques from black-and-white aerial photographs to Landsat to the mapping of soil units and the determination of the soil properties organic matter content, salinity, erosion and moisture content are

presented. Future prospects for the remote sensing of soils are discussed, and it is concluded that the application of remote sensing techniques to soil management, as well as the research and development of new methods, will continue to expand. A.L.W.

**A80-24055** Remote sensing studies of vegetation (Etudes de la végétation par télédétection). L. S. Wittgenstein (Department of the Environment, Forest Management Institute, Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 45-52. 17 refs. In French.

Applications of remote sensing to the study of the identity, distribution, size, number, physical state, and health vegetation are discussed. Remote sensing has been used for forest inventories; the estimation of the biomass contained in forests and prairies; studies of animal habitats; forest fire localization; the detection and mapping of insect damage; disease and pollution damage to vegetation; flood, wind, and landslide damage determinations; the mapping of regions of forest cutting; and environmental monitoring by means of aerial photography and satellite observations. It is concluded that the utilization of satellite information represents a great advance, but cannot replace aerial photography. Recommendations concerning the expansion of Landsat data interpretation, remote sensing for local forest management, the remote detection of principal insect damage, vegetation monitoring, and biomass evaluation are also presented. A.L.W.

**A80-24056** Remote sensing and forestry in Quebec (La télédétection et la foresterie au Québec). J. Beaubien (Department of the Environment, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 53-57. In French.

The possible application of advanced techniques of remote sensing to forest inventories and insect damage evaluation in Quebec is discussed. The present use of conventional black-and-white moderate-scale (1:15,000 to 1:20,000) aerial photography for forest inventories and mapping is noted. The applicability of aerial color infrared photography to the evaluation of spruce budworm and gypsy moth damage to forests and of Landsat imagery and radar to forest mapping is considered. It is concluded that color infrared photographs contain more useful information than conventional black-and-white photography, even at a smaller scale, while Landsat data could be used for the mapping of large forest territories, for forest mapping after fires or large-scale cutting, and for the mapping of northern forests. A.L.W.

**A80-24063** Vegetation mapping in the Caniapiscou-Koksoak corridor using the automatic classification of Landsat images (Cartographie de la végétation du corridor Caniapiscou-Koksoak par classification automatique des images Landsat). P. Laframboise and J.-M. Levasseur (Société de Développement de la Baie James, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 143-149. In French.

**A80-24064** Radiometric correction of topographic effects on Landsat images of forest lands (Correction radiométrique des effets topographiques sur des images Landsat de territoires forestiers). G. Rochon, H. Audirac, A. Larrivée (Université Laval, Quebec, Canada), J. Beaubien (Department of the Environment, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada), and P. Gignac (Ministère des Terres et Forêts, Service de la Recherche, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 151-163. In

## 01 AGRICULTURE AND FORESTRY

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The classification of Landsat data often experiences the combined effect of topography, angles of view from the satellite, and the solar illumination angles. In order to study the relationships between these factors, contour lines of a topographic map at a scale of 1:50,000 were digitized over various areas of forest lands in Quebec contained in a Landsat image. Balsam fir, black spruce, and white birch were the dominant species. For each pixel, the equation in polar coordinates of the normal to the terrain was computed and used to deduce the angles between the sun and the normal to each elementary plane and also between the satellite and the normal. B.J.

**A80-24065** Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm (*La photographie aérienne couleur infrarouge pour l'évaluation de la mortalité laissée par la tordeuse des bourgeons de l'épinette*). J. Beaubien and G. Simard (Department of the Environment, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 165-168. In French.

**A80-24066** The utilization of a stereotransferoscope and very-small-scale photography for the acquisition of forest maps at a scale of 1:20,000 (*Utilisation d'un stéréotransferoscope et de photographies à très petites échelles pour la mise à jour des cartes forestières à l'échelle de 1:20,000*). P. Gignac (Ministère des Terres et Forêts, Service de la Recherche, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 169-173. In French.

**A80-24067** Utilization of a portable thermograph in the Ministère des Terres et Forêts (*Utilisation d'un thermographe portatif au Ministère des Terres et Forêts*). B. Drolet (Ministère des Terres et Forêts, Service de la Protection Contre le Feu, Quebec, Canada) and H. Audet (Ministère des Terres et Forêts, Centre Québécois de Coordination de la Télédétection, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 175-179. In French.

Since 1978 the fire protection service of the Ministère des Terres et Forêts has been using a portable thermograph (the AGA Thermovision 750) for the final phase of certain forest fires. Used from an aircraft, the detector reveals, on the perimeter of a fire under control, areas that conceal latent centers of fire; the detector is thus a useful tool for the chief of operations in determining priorities. During the winter the thermograph is used for purposes of energy conservation. B.J.

**A80-24069** Remote sensing and the agricultural zoning of lands (*Télédétection et zonage agricole des terres*). H. Gagnon (Ottawa, University, Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 197-204. 5 refs. In French.

Various aspects of remote sensing applied to agricultural zoning are discussed. Attention is given to the following: (1) the correction of differences in maps of agricultural potential, (2) the detection of variations in the intensity of agricultural land use, (3) the analysis of modifications in the draining pattern, (4) the evaluation of the

quality of constructions and environmental protection norms, (5) the analysis of conflicting zoning units, (6) the surveillance of maple groves, and (7) the measurement of the homogeneity of a zoning unit. The use of Landsat images, infrared color photography, and thermography is examined. B.J.

**A80-25569 #** Crop-area estimates from Landsat - Transition from research and development to timely results. G. Hanuschak, R. Sigman, M. Craig, M. Ozga, R. Luebbe, P. Cook, D. Kleweno, and C. Miller (U.S. Department of Agriculture, Washington, D.C.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 86-96. 7 refs.

Recent efforts by the USDA in developing timely, precise crop-area estimates over Iowa from Landsat are described, and the relevant data processing systems hardware and software, as well as data management, are examined. Statistical methodology is considered, including direct expansion estimation using ground data only, and regression estimation which also uses computer classified Landsat data. It is found that the major benefit of Landsat regression estimates is substantial improvements in precision with no increase in the respondent burden associated with ground surveys. J.P.B.

**A80-25570 \*** Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach. M. M. Hixson, M. E. Bauer (Purdue University, West Lafayette, Ind.), and B. J. Davis (Indiana Bell Telephone Co., Indianapolis, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 97-104. 8 refs. Contract No. NAS9-14970.

The objective of this investigation was to evaluate the effect of sampling on the accuracy (precision and bias) of crop area estimates made from classifications of Landsat MSS data. Full-frame classifications of wheat and non-wheat for eighty counties in Kansas were repetitively sampled to simulate alternative sampling plans. Four sampling schemes involving different numbers of samples and different size sampling units were evaluated. The precision of the wheat area estimates increased as the segment size decreased and the number of segments was increased. Although the average bias associated with the various sampling schemes was not significantly different, the maximum absolute bias was directly related to sampling unit size. (Author)

**A80-25571** Multi-temporal classification of winter wheat using a growth state model. C. A. Hlavka, S. M. Carlyle (Kansas University, Lawrence, Kan.), R. Yokoyama (Itawe University, Itawe, Japan), and R. M. Haralick (Virginia Polytechnic Institute and State University, Blacksburg, Va.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 105-115. 34 refs.

A multi-temporal classification procedure for crops in Landsat scenes is described. The method involves the creation of crop signatures which characterize multi-spectral observations as functions of phenological growth states. The phenological signature models spectral reflectance explicitly as a function of crop maturity rather than a function of observation date. Instead of stacking spectral vectors of one observation on another, as is usually done for multi-temporal data, for each possible crop category there is established a correspondence of time to growth state which minimizes the smallest difference between the given multi-spectral multi-temporal vector and the category mean vector indexed by growth state. The results of applying this procedure to winter wheat show that the method is capable of discrimination with about the same degree of accuracy as more traditional multi-temporal classifiers. It also has potential for labelling the degree of maturity of the crop without crop condition information in the training set. (Author)

**A80-25573 #** Landsat-2 data for inventorying rangelands in south Texas. J. H. Everitt, A. J. Richardson, A. H. Gerbermann, C. L. Wiegand, and M. A. Alaniz (U.S. Department of Agriculture, Weslaco, Tex.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 132-141. 17 refs.

The effectiveness of Landsat 2 multispectral scanner data in the inventory of rangelands and other land-use categories is investigated for a rangeland area in south Texas. MSS computer compatible tapes and corresponding color images from two Landsat 2 overpasses of the study area were used to identify wetlands, agricultural lands, barren lands, water, and the rangeland subcategories of grasslands, mixed brush rangelands, and live oak rangelands by a training-field classification approach. Computer-estimated land-use percentages are found to correlate significantly with photo-estimated percentages based on a ground-correlated Landsat color composite print for the Landsat overpass in October, but not for the December overpass due to the misclassification of mixed brush as grassland. It is concluded that Landsat 2 data can be used successfully to identify level I land use in both October and December, while level II rangeland land use categories could best be identified in October. A.L.W.

**A80-25576** Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography. W. D. McFarland, T. W. Barney, and C. J. Johannsen (Missouri-Columbia University, Columbia, Mo.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 159-165.

**A80-25582 \*** Pasture/wheat surface temperature differences - Indicator of relative soil moisture differences. W. D. Rosenthal, J. C. Harlan, B. J. Blanchard (Texas A & M University, College Station, Tex.), and G. Coleman (U. S. Department of Agriculture, Chickasha, Okla.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 224-233. 5 refs. Contract No. NAS5-24383.

**A80-25583** Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana. C. E. Seubert, M. F. Baumgardner, R. A. Weismiller (Purdue University, West Lafayette, Ind.), and F. R. Kirschner (U.S. Department of Agriculture, Soil Conservation Service, West Lafayette, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 234-239. 9 refs.

**A80-25584** Extraction of soil information from a vegetated area. M. Fukuhara, S. Hayashi (Hokkaido National Agricultural Experimental Station, Hokkaido, Japan), Y. Yasuda, I. Asanuma, Y. Emori (Chiba University, Chiba, Japan), and J. Iisaka (IBM Japan, Ltd., Tokyo Scientific Center, Tokyo, Japan). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 242-252. 7 refs.

In order to extract soil information from a vegetated area and to analyze soil conditions, a simple ratio transformation was derived which eliminates the influence of vegetation reflectance from soil reflectance. The usefulness of the transformation was investigated by multispectral pattern recognition. It is found that a combination of channels, namely Landsat 5, Landsat 7, the new transformation, and Landsat (7-5)/(7+5), gives the best results, since the soil classes and other vegetation classes are not distinguishable using only the transformation channel. J.P.B.

**A80-25585** Extension of laboratory-measured soil spectra to field conditions. E. R. Stoner, M. F. Baumgardner, R. A. Weismiller, L. L. Biehl, and B. F. Robinson (Purdue University, West Lafayette, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 253-263. 23 refs.

A study was made to differentiate between two humid mesic region glaciated soils, Chalmers silty clay loam and Fincastle silt loam, on the basis of spectroradiometric response under varied field and laboratory conditions, and to verify the validity of laboratory-measured soil spectra for characterizing soil reflectance in the field. Results indicate that laboratory-measured spectra of moist soil are directly proportional to the spectral response of that same moist bare soil in the field over the 0.52 to 1.75 micron wavelength range. In addition, the magnitude of differences in spectral response between identically treated Chalmers and Fincastle soils is greatest in the 0.6 to 0.8 micron transition region between the visible and near infrared, regardless of field condition or laboratory preparation studied. J.P.B.

**A80-25586** Predictability of change in soil reflectance on wetting. J. B. Peterson, B. F. Robinson (Purdue University, West Lafayette, Ind.), and R. H. Beck (Illinois, University, Urbana, Ill.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 264-274. 14 refs.

**A80-25595 \*** Using guided clustering techniques to analyze Landsat data for mapping forest land cover in northern California. L. Fox, III and K. E. Mayer (Humboldt State University, Arcata, Calif.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 364-367. 8 refs. Grants No. NSG-2244; No. NSG-2341.

**A80-25596 \*** A forester's look at the application of image manipulation techniques to multitemporal Landsat data. D. L. Williams (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.), M. L. Stauffer, and K. C. Leung (Computer Sciences Corp., Silver Spring, Md.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 368-376. 11 refs.

Registered, multitemporal Landsat data of a study area in central Pennsylvania were analyzed to detect and assess changes in the forest canopy resulting from insect defoliation. Images taken July 19, 1976, and June 27, 1977, were chosen specifically to represent forest canopy conditions before and after defoliation, respectively. Several image manipulation and data transformation techniques, developed primarily for estimating agricultural and rangeland standing green biomass, were applied to these data. The applicability of each technique for estimating the severity of forest canopy defoliation was then evaluated. All techniques tested had highly correlated results. In all cases, heavy defoliation was discriminated from healthy forest. Areas of moderate defoliation were confused with healthy forest on northwest (NW) aspects, but were distinct from healthy forest conditions on southeast (SE)-facing slopes. (Author)

**A80-25597 \*** Machine processing of Landsat MSS data and DMA topographic data for forest cover type mapping. M. D. Fleming and R. M. Hoffer (Purdue University, West Lafayette, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 377-390. 9 refs. Contract No. NAS9-14016.

A study with the objective of developing and testing techniques which utilize both digital topographic data and Landsat MSS spectral

## 01 AGRICULTURE AND FORESTRY

data to map forest cover types is examined. Emphasis is given to the topographic distribution model (TDM), which combines point-by-point information about forest species, elevation, slope, and aspect to quantitatively describe topographic positions. Results show the stratified random sample approach to be very effective for developing the TDM, while the use of topographic data significantly improved the overall classification accuracy of forest cover types as compared to using spectral data alone. J.P.B.

**A80-25598**      **Texture analysis by space filter and application to forest type classification.** J. Iisaka (IBM Japan, Ltd., Tokyo Scientific Center, Tokyo, Japan). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 392, 393.

**A80-25599**      **Computer recognition of citrus infestations.** D. H. Williams (Texas, University, El Paso, Tex.) and J. K. Aggarwal (Texas, University, Austin, Tex.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 398-407. 17 refs.

A computer software system is described that uses digitized color information from aerial color infrared transparencies to detect the presence of citrus mealybug (*Pseudococcus citri* Risso), brown soft scale (*Coccus hesperidum* L.), and Rio Grande gummosis in individual citrus trees. The color coordinates at each spatial point, and color differences at adjacent points are used to locate the trees and to detect the infestations; compensation is made for the variation in color characteristics between different transparencies. The system requires the input of four parameters; a flag denoting the presence of heavy shadows in the image, nominal tree size and spacing of the citrus trees, and a flag denoting the season of the year when the transparency was taken. An index of recognition, Iq, was defined and used as a measure of recognition effectiveness. For unknown data, Iq ranged from 43% to 81%, with nominal values of 60% to 80% for all three infestations. (Author)

**A80-25600**      **An interactive color display system for labeling crops.** T. Kaneko, L. K. Moore, and R. T. Smart (IBM Corp., Federal Systems Div., Houston, Tex.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 408-419. 14 refs.

The paper describes a computer based interactive display system for assisting photo-interpreters. The principle of the system is to reduce contact time and to increase labelling accuracy. Attention is given to the conversion of descriptive crop phenology on a crop calendar into quantitative growth index curves. It is demonstrated that this method offers an effective solution to alleviating problems associated with current manual labelling processes. C.F.W.

**A80-26086 \* #**      **LACIE - An application of meteorology for United States and foreign wheat assessment.** J. D. Hill (NASA, Johnson Space Center, Houston, Tex.); NOAA, Center for Environmental Assessment Service, Columbia, Mo.), N. D. Strommen, C. M. Sakamoto, and S. K. LeDuc (NOAA, Center for Environmental Assessment Service, Columbia, Mo.). *Journal of Applied Meteorology*, vol. 19, Jan. 1980, p. 22-34. 8 refs.

This paper describes the overall Large Area Crop Inventory Experiment technical approach utilizing the global weather-reporting network and the Landsat satellite to make a quasi-operational application of existing research results, and the accomplishments of this cooperative experiment in utilizing the weather information. Global weather data were utilized in preparing timely yield estimates for selected areas of the U.S. Great Plains, the U.S.S.R. and Canada. Additionally, wheat yield models were developed and pilot tested for Brazil, Australia, India and Argentina. The results of the work show

that heading dates for wheat in North America can be predicted with an average absolute error of about 5 days for winter wheat and 4 days for spring wheat. Independent tests of wheat yield models over a 10-year period for the U.S. Great Plains produced a root-mean-square error of 1.12 quintals per hectare (q/ha) while similar tests in the U.S.S.R. produced an error of 1.31 q/ha. Research designed to improve the initial capability is described as is the rationale for further evolution of a capability to monitor global climate and assess its impact on world food supplies. (Author)

**A80-26312 #**      **Crop identification in a parkland environment using aerial photography.** P. H. Crown (Alberta, University, Edmonton, Canada). *Canadian Journal of Remote Sensing*, vol. 5, Dec. 1979, p. 128-135. 5 refs. Research supported by the Alberta Hail and Crop Insurance Corp. and Alberta Environment.

The estimation of crop production using remote sensing techniques first requires a correct identification of the crops found in a given area. In Western Canada, the identification of field crops is hampered by the occurrence of confusion crops such as spring grains. These follow crop calendars and/or possess spectral signatures similar to each other. The results of an interpretation test using color and color infrared photography show a higher percent correct identification of spring grains with the color photography. This is attributed in part to the differences in visible colors often noted in the field during the vegetative period between darker green wheat crops and lighter green oat and barley crops. A higher percent correct identification of fallow fields was attained with the color infrared photography. Relatively high percent commission errors were made for grain and hay crops with both types of photography. (Author)

**A80-26313 \***      **Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula.** H. C. Sweet, T. O. Peoples (Central Florida, University, Orlando, Fla.), J. E. Poppleton (Environmental Science and Engineering, Inc., Tampa, Fla.), and A. G. Shuey (Conservation Consultants, Palmetto, Fla.). *Remote Sensing of Environment*, vol. 9, Mar. 1980, p. 93-108. 6 refs. Grant No. NGR-10-122-006.

**A80-26315**      **Assessment of the fertilizer requirement of improved pasture from remote sensing information.** P. J. Vickery, D. A. Hedges (Commonwealth Scientific and Industrial Research Organization, Pastoral Research Laboratory, Armidale, New South Wales, Australia), and M. J. Duggin (Commonwealth Scientific and Industrial Research Organization, Minerals Research Laboratory, Ryde, New South Wales, Australia; New York, State University, Syracuse, N.Y.). *Remote Sensing of Environment*, vol. 9, Mar. 1980, p. 131-148. 20 refs.

**A80-26318 \***      **A spectral method for determining the percentage of green herbage material in clipped samples.** C. J. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). *Remote Sensing of Environment*, vol. 9, Mar. 1980, p. 175-181. 10 refs.

A laboratory radiometric method for the rapid determination of green and brown vegetation percentages in clipped grass samples has been developed and tested. The method uses red and photographic infrared radiance or reflectance differences between green and brown vegetation. Mixtures of green and brown material were found to have radiances or reflectances proportional to the percentage of green material present. This method may permit the use of rapid green/brown radiometric determinations to replace the tedious hand sorting now generally used. It may also have application in remote sensing of vegetation ground-truth work where the determination of dry green biomass in clipped samples is necessary. (Author)

**A80-26752 #**      **The NIRAD survey of forest resources - An application of SLAR in Nigeria.** J. A. Allan (London, University, London, England). (*Association of American Geographers, Remote Sensing Workshop, New Orleans, La., Mar. 9-12, 1978.*) *Remote Sensing Quarterly*, vol. 2, Jan. 1980, p. 36-44. 13 refs.

Resource studies in many tropical areas have been impeded by prevalent cloud cover and weather sensitive systems such as aerial photography and Landsat have yielded little useful information in such areas. The NIRAD (Nigerian radar survey of forest resources) survey was commissioned by the Nigerian Federal Department of Forestry to provide a national inventory of forest resources. The field checking carried out to date has shown the imagery to be effective in mapping ecological boundaries in the moist south of the country, but in the north Landsat images and the extensive air-photo cover have proved to be a richer source of vegetation and land use data. (Author)

**A80-27435 \*** **Landsat-based multiphase estimation of California's irrigated lands.** S. L. Wall, R. W. Thomas (California, University, Berkeley, Calif.), and L. R. Tinney (California, University, Santa Barbara, Calif.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 221-236. 6 refs. Grant No. NSG-2207; Contract No. NAS5-20969.

Currently, inventory of California's irrigated lands is performed on a seven year cycle. Since 1975, the University of California in cooperation with NASA and the California Department of Water Resources has been developing and testing techniques to utilize a Landsat based remote sensing system to produce statewide estimates in a single year. The proposed system utilizes multiphase sampling, stratification and multitemporal Landsat imagery to produce the estimate. Early research concentrated on regional estimates to develop the techniques. This year, an inventory of the entire state of California is being performed. In addition, research on the utilization of digital analysis for estimating irrigated acreage and the determination of specific crop types (manual and digital analysis) is also underway. (Author)

**A80-27437** **Use of low altitude aerial biosensing with color infrared photography as a crop management service.** J. J. Baber, Jr. and A. D. Flowerday (OMAX Biosensing, Omaha, Neb.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 252-259.

**A80-27458 \*** **Crop emergence date determination from spectral data.** G. D. Badhwar (NASA, Johnson Space Center, Houston, Tex.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Mar. 1980, p. 369-377. 7 refs.

Estimating the emergence of a given crop, such as wheat or barley, is proposed using an analytic method which relies on the hypothesis that in the region ( $\lambda = 0.70-1.35$  microns) a given crop, after emergence, has a unique spectral profile in time. If the crop emerges early or late, relative to a reference standard determined for a given segment, the profile is displaced but has the same shape. Therefore, given the crop specific constants of the reference profile and a sufficient number of Landsat observations of reflectivity at specific times, the emergence date of a field can be determined. J.P.B.

**A80-30921** **Landsat wildland mapping accuracy.** W. J. Todd, D. G. Gehring (Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.), and J. F. Haman (National Park Service, Denver, Colo.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Apr. 1980, p. 509-520. 8 refs. U.S. Geological Survey Contract No. 14-08-0001-16439.

A Landsat-aided classification of ten wildland resource classes was developed for the Shivwits Plateau region of the Lake Mead National Recreation Area. Single stage cluster sampling (without replacement) was used to verify the accuracy of each class. For verification, 63 plots were randomly selected throughout the classification image (gridded into 52 ha cells), located on 1:30,000 scale black-and-white aerial photographs, and gridded into nine 5.8

ha cells each. Resource specialists interpreted the 5.8 ha cells, field checked selected sites from light aircraft, and re-checked their photointerpretation. Construction of contingency tables revealed that there was less confusion between aggregated (more generalized) resources classes - grouped on the basis of soils, terrain, and vegetative cover similarities - than detailed resource categories. Parametric calculations of percentages correct and confidence intervals fully supported those findings. (Author)

**A80-32270 #** **Experience with the use of synthesized color images for the interpretation of agricultural objects (Opyt ispol'zovaniia tsvetnykh sintezirovannykh snimkov dlia deshifirovaniia sel'skokhoziaistvennykh ob'ektov).** T. P. Butivshchenko and N. I. Lesnichaiia. In: Space photography and thematic mapping - A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 57-62. In Russian.

**A80-32280 #** **The use of multispectral photographs for soil cover studies (Vozmozhnosti ispol'zovaniia mnogoazonal'nykh snimkov v issledovaniiakh pochvennogo pokrova).** V. I. Kravtsova and S. A. Nikolaeva. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 148-154. In Russian.

The paper examines the application of multispectral aerial or space photography to soil mapping; features of interpretation are discussed along with the suitability of multispectral photography for different soil types. The interpretation of Landsat photographs of the Danube River delta is considered as an example. B.J.

**A80-32281 #** **The use of microwave radiometry for the operational mapping of soil moisture (Primenenie metoda sverkhvysokochastotnoi radiometrii dlia operativnogo kartografirovaniia vlazhnosti pochv i gruntov).** A. E. Basharinov, I. M. Butenko, E. I. Reutov, and A. M. Shutko. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 154-159. 10 refs. In Russian.

**A80-32283 #** **Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs (Izuchenie sostoiianiia posevov khlopchatnika i osobennosti pochvennogo pokrova po mnogoazonal'nykh aerofotostimkam).** T. P. Butivshchenko, Iu. I. Kondratova, and I. A. Labutina. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 181-191. In Russian.

**A80-32284 #** **Crop identification using space photographs taken at different times /A study of the lower Volga Basin used as an example/ (Raspoznavanie sel'skokhoziaistvennykh kul'tur po razno-vremennym kosmicheskim snimkam /Na primere izucheniia Nizhnego Povolzh'ia/).** I. E. Ponomareva, V. I. Kravtsova, and L. F. Ianvareva. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 191-215. In Russian.

**A80-32518 \*** **Thermography for estimating near-surface soil moisture under developing crop canopies.** J. L. Heilman and D. G. Moore (South Dakota State University, Brookings, S. Dak.). *Journal of Applied Meteorology*, vol. 19, Mar. 1980, p. 324-328. 10 refs. Contract No. NAS5-24206.

Previous investigations of thermal infrared techniques using remote sensors (thermography) for estimating soil water content have been limited primarily to bare soil. Ground-based and aircraft investigations were conducted to evaluate the potential for extending the thermography approach to developing crop canopies. A significant exponential relationship was found between the volumetric soil

## 01 AGRICULTURE AND FORESTRY

water content in the 0-4 cm soil layer and the diurnal difference between surface soil temperature measured at 0230 and 1330 LST (satellite overpass times of NASA's Heat Capacity Mapping Mission - HCMM). Surface soil temperatures were estimated using minimum air temperature, percent cover of the canopy and remote measurements of canopy temperature. Results of the investigation demonstrated that thermography can potentially be used to estimate soil temperature and soil moisture throughout a complete growing season for a number of different crops and soils. (Author)

**N80-16391\*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

**DIGITAL PROCESSING OF LANDSAT MSS AND TOPOGRAPHIC DATA TO IMPROVE CAPABILITIES FOR COMPUTERIZED MAPPING OF FOREST COVER TYPES**  
Annual Report, 16 Dec. 1978 - 15 Jan. 1979

R. M. Hoffer, M. D. Fleming, L. A. Bartolucci, S. M. Davis, and R. F. Nelson, Principal Investigators 15 Jan. 1979 169 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS9-15508)

(E80-10041; NASA-CR-160379; LARS-TR-011579) Avail: NTIS HC A08/MF A01 CSCL 08B

**N80-16393\*#** Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

**COMPUTER-AIDED PROCESSING OF LANDSAT MSS DATA FOR CLASSIFICATION OF FORESTLANDS**

Ross F. Nelson and Roger M. Hoffer, Principal Investigators Oct. 1979 103 p refs ERTS

(Contract NAS9-15508)

(E80-10043; NASA-CR-160381; LARS-TR-102679) Avail: NTIS HC A06/MF A01 CSCL 02F

**N80-16394\*#** Lockheed Electronics Co., Houston, Tex.  
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). THE BOUNDARY PIXEL STUDY IN KANSAS AND NORTH DAKOTA**

D. T. Register, Principal Investigator and A. L. Ona Sep. 1979 34 p refs Sponsored by NASA, NOAA, and USDA ERTS (Contract NAS9-15800)

(E80-10044; NASA-CR-160365; JSC-14563; LEC-12826) Avail: NTIS HC A03/MF A01 CSCL 08B

The author has identified the following significant results. The statistical mapping approach to handling boundary pixels can be used as a standard for objectively comparing the cluster based technique, the maximum likelihood estimate based technique, and multicategory labeling.

**N80-16399\*#** Lockheed Electronics Co., Houston, Tex.  
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). DETAILED DESCRIPTION OF THE WHEAT ACREAGE ESTIMATION PROCEDURE USED IN THE LARGE AREA CROP INVENTORY EXPERIMENT**

Willa W. Austin, Principal Investigator Feb. 1978 43 p refs Sponsored by NASA, NOAA, and USDA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (Contract NAS9-15200)

(E80-10051; NASA-CR-160405; LEC-11497) Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-16400\*#** Lockheed Electronics Co., Houston, Tex.  
**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PROFILE SIMILARITY FEASIBILITY STUDY**

Charles V. Nazare, Principal Investigator Oct. 1979 44 p refs Sponsored by NASA, NOAA, and USDA ERTS

(Contract NAS9-15800)

(E80-10052; NASA-CR-160406; JSC-16246; LEC-14010) Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-16404\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**L-BAND RADAR SENSING OF SOIL MOISTURE**

A. T. C. Chang, S. Atwater (California Univ., Santa Barbara), V. V. Salomonson, J. E. Estes (California Univ., Santa Barbara), D. S. Simonett (California Univ., Santa Barbara), and M. L. Bryan (JPL) Jan. 1980 32 p refs Submitted for publication (NASA-TM-80628) Avail: NTIS HC A03/MF A01 CSCL 08M

The performance of an L-band, 25 cm wavelength imaging synthetic aperture radar was assessed for soil moisture determination, and the temporal variability of radar returns from a number of agricultural fields was studied. A series of three overflights was accomplished over an agricultural test site in Kern County, California. Soil moisture samples were collected from bare fields at nine sites at depths of 0-2, 2-5, 5-15, and 15-30 cm. These gravimetric measurements were converted to percent of field capacity for correlation to the radar return signal. The initial signal film was optically correlated and scanned to produce image data numbers. These numbers were then converted to relative return power by linear interpolation of the noise power wedge which was introduced in 5 dB steps into the original signal film before and after each data run. Results of correlations between the relative return power and percent of field capacity (FC) demonstrate that the relative return power from this imaging radar system is responsive to the amount of soil moisture in bare fields. The signal returned from dry (15% FC) and wet (130% FC) fields where furrowing is parallel to the radar beam differs by about 10 dB. A.R.H.

**N80-16600#** Tennessee Valley Authority, Chattanooga. Office of Natural Resources.

**REMOTE SENSING OF SULFUR DIOXIDE EFFECTS ON VEGETATION - PHOTOMETRIC ANALYSIS OF AERIAL PHOTOGRAPHS**

C. Daniel Sapp Jun. 1979 42 p refs (PB-300460/3; TVA/ONR-79/01; EPA-600/7-79-138) Avail: NTIS HC A03/MF A01 CSCL 13B

Spectral reflectances were measured by tri band densitometry of aerial color infrared photographs of soybean Glycine mass fields that had been affected by sulfur dioxide (SO<sub>2</sub>) emissions from large, coal fired power plants in northwestern Alabama and western Tennessee. The photographs were photometrically calibrated. Results indicate that, at very light levels of foliar injury, the infrared to red reflectance ratio decreased with increasing injury. This behavior was in accordance with theory. At moderate and severe levels of injury, the ratio increased with injury. The best indicator of crop yield was green band reflectance, but the red and infrared bands were nearly as good. The yield variable actually increased with the level of injury, apparently because of field to field variations in canopy density. GRA

**N80-18500** Oregon State Univ., Corvallis.  
**AN INVESTIGATION OF THE UTILITY OF LANDSAT 2 MSS DATA TO THE FIRE-DANGER RATING AREA, AND FOREST FUEL ANALYSIS WITHIN CRATER LAKE NATIONAL PARK, OREGON Ph.D. Thesis**

Hassan Alizadeh Rabii 1979 434 p Avail: Univ. Microfilms Order No. 8002679

Downed forest fuel tonnage/acre within Crater Lake National Park was inventoried and mapped using LANDSAT multispectral data in conjunction with National Cartographic Information Center (NCIC) digital topographic information. Interactive classification capability of a Nova 840 computer system and its video color display provided identification and mapping criteria for classification of various surface and cover types within the park. Ground truth information was utilized to correlate the MSS/topographic data set to color IR aerial photographic data. Dissert. Abstr.

**N80-18506** Utah State Univ., Logan.  
**FEATURE SELECTION AND CLASSIFIER DESIGN WITH APPLICATIONS TO REMOTE SENSING OF MULE DEER**  
 Ph.D. Thesis

Manmohan M. Trivedi 1980 134 p  
 Avail: Univ. Microfilms Order No. 8005119

The deer detection problem where the classification is performed in a multidimensional feature space. A generalized scene, of which the winter range may be considered typical is used in the classification. It includes the deer, evergreen trees, sagebrush, and dry brush against a snow background. A general interclass feature selection procedure, based upon clustering technique, was formulated and used to select best feature sets for the analysis. The classification performance was estimated by considering the a priori probabilities of 'not-deer' objects sufficiently high to eliminate the misclassification of not-deer objects into deer class. The three or four feature classifier was shown to be capable of providing useful deer census data in an operational system when combined with appropriate spatial classification techniques. Dissert. Abstr.

**N80-18506\***# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.  
**DEVELOPMENT OF LANDSAT-BASED TECHNOLOGY FOR CROP INVENTORIES** Final Report, 15 Nov. 1978 - 14 Nov. 1979

Q. A. Holmes, R. Horvath, R. C. Cicone, R. J. Kauth, and W. A. Malila, Principal Investigators Dec. 1979 217 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS (Contract NAS9-15476; Proj. AgRISTARS) (E80-10054; NASA-CR-160421; ERIM-132400-29-1F; SR-E9-00404) Avail: NTIS HC A10/MF A01 CSCL 02C

**N80-18507\***# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.  
**DEVELOPMENT OF LANDSAT-BASED TECHNOLOGY FOR CROP INVENTORIES: APPENDICES** Final Report, 15 Nov. 1978 - 14 Nov. 1979

Q. A. Holmes, R. Horvath, R. C. Cicone, R. J. Kauth, and W. A. Malila, Principal Investigators Dec. 1979 303 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS (Contract NAS9-15476; Proj. AgRISTARS) (E80-10055; NASA-CR-160422; ERIM-132400-29-2F; SR-E9-00404) Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-18509\***# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EVALUATION OF THREE-CATEGORY CLASSIFICATION**  
 K. A. Havens and K. M. Abotteen, Principal Investigators Aug. 1979 45 p refs Sponsored by NASA, NOAA, and USDA ERTS (Contract NAS9-15800) (E80-10058; NASA-CR-160436; JSC-16012; LEC-13498) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. Examination of both machine estimates and stratified areal estimates produced by clustering and classification reveal no significant differences between the proportion estimates and ground truth estimates. When testing the variances of the machine estimates, a significant reduction in the variances was found when the number of starting dots was increased from 30 to 45. The variances were again reduced, although not significantly, when the number of starting dots was increased from 45 to 60. From these results, 60 starting dots are recommended for a three-category classifier. When examining the variances of the estimates for the four estimation procedures (using 60 dots), no significant differences were found between procedures. Thus, only the machine clustering may be used to produce an estimate, and the stratified areal estimate computations and maximum likelihood classification can be deleted.

**N80-18510\***# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LACIE TRANSITION YEAR PLAN FOR THE DIRECT ESTIMATION OF WHEAT FROM LANDSAT IMAGERY**  
 R. K. Lennington, N. E. Marquina, D. T. Register, and M. C. Kinsler, Principal Investigators Mar. 1979 51 p Sponsored by NASA, NOAA, and USDA ERTS (Contract NAS9-15800) (E80-10059; NASA-CR-160426; JSC-14553; LEC-11861) Avail: NTIS HC A04/MF A01 CSCL 02C

**N80-18511\***# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

**IMPLEMENTATION OF BADHWAR CLASSIFICATION OF CORN/SOYBEAN SEGMENTS**  
 Willa W. Austin, Principal Investigator Oct. 1979 32 p refs ERTS (Contract NAS9-15800) (E80-10060; NASA-CR-160425; JSC-16274; LEC-14064) Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-18513\***# Texas A&M Univ., College Station. Remote Sensing Center.

**CORRELATION OF SPACECRAFT PASSIVE MICROWAVE SYSTEM DATA WITH SOIL MOISTURE INDICES (API)** Progress Report, Feb. - Aug. 1979  
 Bruce J. Blanchard, Principal Investigator Aug. 1979 66 p refs ERTS (Grant Nsg-5193) (E80-10063; NASA-CR-162585; RSC-3622-2) Avail: NTIS HC A04/MF A01 CSCL 08M

**N80-18514\***# Texas A&M Univ., College Station. Remote Sensing Center.

**MEASUREMENT OF SOIL MOISTURE TRENDS WITH AIRBORNE SCATTEROMETERS** Progress Report, 1 Jun. 1979 - 1 Jan. 1980  
 Bruce J. Blanchard, Principal Investigator 1 Jan. 1980 71 p ERTS (Grant Nsg-5134) (E80-10064; NASA-CR-162586; RSC-3458-4) Avail: NTIS HC A04/MF A01 CSCL 08M

The author has identified the following significant results. cursory examination of the data indicates that the listed row tillage practices at 90 deg to the radar beam are approximately 12.5db higher than other comparable agricultural land. The Seasat radar data show evidence that the high return occurs only at a narrow range in look direction near the 90 deg. Such a high increase in return compared to a 15db range in film response would indicate that rows seen crosswise would saturate optically processed data. This response to row direction will have an adverse effect on monitoring agricultural lands with L band radar systems. Preliminary examination indicates that there is no sensitivity to soil moisture at the 5 deg look angle when using a like-polarized L band system. Some sensitivity was evident at a look angle of 20 deg and only a weak sensitivity was indicated at 40 deg look angle. At both 20 deg and 40 deg there is a significant response to soil moisture and none to row direction. Steep angles or the 5 deg look angle using cross polarized (HB) L band system appear insensitive to row direction and soil moisture.

**N80-18515\***# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

**FOREST RESOURCE INFORMATION SYSTEM** Quarterly Report, 1 Jul. - 30 Sep. 1979  
 R. P. Mroczynski, Principal Investigator 30 Sep. 1979 56 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

## 01 AGRICULTURE AND FORESTRY

(Contract NAS9-15325)  
(E80-10065; NASA-CR-160435; LARS-093079) Avail: NTIS  
HC A04/MF A01 CSCL 02F

**N80-18518\*#** National Aeronautics and Space Administration,  
Lyndon B. Johnson Space Center, Houston, Tex.

**LACIE EVALUATION AND OUTLOOK PANEL TRANSCRIPT:  
THE LACIE SYMPOSIUM**

1978 22 p refs Symp. held at Houston, Tex., 23 Oct. 1978  
Sponsored by NASA, NOAA, and USDA ERTS  
(E80-10069; NASA-CR-162641; JSC-13769) Avail: NTIS  
HC A02/MF A01 CSCL 02C

**N80-18519\*#** Lockheed Electronics Co., Houston, Tex. Systems  
and Services Div.

**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE),  
BIBLIOGRAPHIC ADDENDA, TECHNICAL REPORTS,  
PAPERS, AND MEMORANDUMS PUBLISHED UNDER  
SUPPORTING RESEARCH AND TECHNOLOGY AND OTHER  
RESEARCH, TEST, AND EVALUATION CONTRACTS FOR  
THE EARTH OBSERVATIONS DIVISION**

J. B. Aumann, Principal Investigator May 1978 37 p ERTS  
(Contract NAS9-15200)  
(E80-10070; NASA-CR-160423; JSC-14278; LEC-11651)  
Avail: NTIS HC A03/MF A01 CSCL 05B

**N80-18521\*#** Department of Agriculture, Weslaco, Tex. Science  
and Education Administration.

**PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER  
STRESS, AND EVAPOTRANSPIRATION CONDITIONS  
Quarterly Progress Report, 1 Sep. - 1 Dec. 1979**

Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal  
Namken, Ross W. Leamer, and Arthur J. Richardson, Principal  
Investigators Dec. 1979 8 p HCMM  
(NASA Order S-4019-8B)

(E80-10072; NASA-CR-162643) Avail: NTIS  
HC A02/MF A01 CSCL 08M

The author has identified the following significant results.  
Procedures to edit cloud-contaminated pixels from those pixels  
representing Earth surface features were investigated. Because  
clouds are more reflective than Earth features and are colder  
than Earth surface features most of the year at 26 N latitude,  
either a raw digital count ratio or a ratio of reflectance percentage  
for the VIS band to the temperature works well. For this procedure,  
the two bands of data need to be registered to the ground  
scene.

**N80-18523\*#** Texas A&M Univ., College Station. Remote  
Sensing Center.

**DRYLAND PASTURE AND CROP CONDITONS AS SEEN  
BY HCMM Progress Report, Jul. - Oct. 1979**

W. D. Rosenthal, J. C. Harlan, and Bruce J. Blanchard, Principal  
Investigators Oct. 1979 13 p HCMM  
(Contract NAS5-24383)

(E80-10074; NASA-CR-162645; PR-3712-7) Avail: NTIS  
HC A02/MF A01 CSCL 02C

**N80-18525\*#** Lockheed Electronics Co., Houston, Tex. Systems  
and Services Div.

**LARGE AREA CROP INVENTORY EXPERIMENT (LACIE),  
COMPOSITION AND ASSEMBLY OF A SPECTRAL-MET  
DATA BASE FOR SPRING AND WINTER WHEAT,  
VOLUME 2**

M. H. Trenchard, M. L. Sestak, M. C. Kinsler, and D. E. Phinney,  
Principal Investigators Jun. 1979 194 p Sponsored by NASA,  
NOAA, and USDA ERTS  
(Contract NAS9-15800)

(E80-10076; NASA-CR-160437; JSC-14901-Vol-2;  
LEC-13393-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 02C

**N80-18526\*#** Texas A&M Univ., College Station. Dept. of  
Mathematics.

**AGRISTARS: A JOINT PROGRAM FOR AGRICULTURE  
AND RESOURCES INVENTORY SURVEYS THROUGH  
AEROSPACE REMOTE SENSING. DEVELOPMENT AND  
EVALUATION OF CLUSTERING PROCEDURES Final  
Report**

L. F. Guseman, Jr., Principal Investigator Nov. 1979 110 p  
refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of  
Interior and Agency for International Development ERTS  
(Contract NAS9-14689)

(E80-10079; NASA-CR-160427; SR-T9-00402) Avail: NTIS  
HC A06/MF A01 CSCL 02C

**N80-18528\*#** Texas A&M Univ., College Station. Dept. of  
Mathematics.

**THE EASY REMOTE SENSING PROBLEM Final Report**

L. F. Guseman, Jr., Principal Investigator and Jack Bryant *In  
its* AgRISTARS: A Joint Program for Agriculture and Resources  
Inventory Surveys Through Aerospace Remote Sensing Nov.  
1979 52 p refs ERTS

(Rept-20) Avail: NTIS HC A06/MF A01 CSCL 02C

**N80-18529\*#** Texas A&M Univ., College Station. Dept. of  
Mathematics.

**THE CRAMER-RAO LOWER BOUND AS A CRITERIA FOR  
EVALUATING A LARGE DATA REDUCTION SYSTEM SUCH  
AS LACIE Final Report**

L. F. Guseman, Jr., Principal Investigator and Patrick L. Odell  
(Texas Univ. at Dallas) *In its* AgRISTARS: A Joint Program  
for Agriculture and Resource Inventory Surveys Through Aerospace  
Remote Sensing Nov. 1979 24 p refs ERTS

(Rept-21) Avail: NTIS HC A06/MF A01 CSCL 02C

**N80-18530\*#** National Aeronautics and Space Administration,  
Goddard Space Flight Center, Greenbelt, Md.

**EFFECT OF SOIL TEXTURE ON THE MICROWAVE EMIS-  
SION FROM SOILS**

Thomas Schmutge Jan. 1980 32 p refs  
(NASA-TM-80632) Avail: NTIS HC A03/MF A01 CSCL  
08M

The intensity brightness temperature of the microwave  
emission from the soil is determined primarily by its dielectric  
properties. The large difference between the dielectric constant  
of water and that of dry soil produces a strong dependence of  
the soil's dielectric constant on its moisture content. This  
dependence is effected by the texture of the soil because the  
water molecules close to the particle surface are tightly bound  
and do not contribute significantly to the dielectric properties.  
Since this surface area is a function of the particle size  
distribution (soil texture), being larger for clay soils with small  
particles, and smaller for sandy soils with larger particles; the  
dielectric properties will depend on soil texture. Laboratory  
measurements of the dielectric constant for soils are sum-  
marized. The dependence of the microwave emission on texture  
is demonstrated by measurements of brightness temperature from  
an aircraft platform for a wide range of soil textures. It is concluded  
that the effect of soil texture differences on the observed values  
can be normalized by expressing the soil moisture values as a  
percent field capacity for the soil. A.R.H.

**N80-18531#** Instituto de Pesquisas Espaciais, Sao Jose dos  
Campos (Brazil).

**APPLICATION OF STATISTICAL CORRELATION IN THE  
STUDY OF AVAILABLE WATER IN LAYERS OF CERRADO  
SOIL [APLICACAO DE MODELOS DE ANALISE ESTATIS-**

**TICA COM ESTRUTURA CORRELAÇÃO EM ESTUDOS DE DISPONIBILIDADE DE AGUA EM SOLO DOS CERRADOS]**

Joel Neves Barreto Oct. 1979 206 p refs In PORTUGUESE; ENGLISH summary  
(INPE-1607-TDL/O14) Avail: NTIS HC A10/MF A01

The use and extension of the method of time series analysis, as illustrated by the application to studies of the influence of density of planting on the availability of water in different layers of 'Cerrado' soil, is proposed. Three models are elaborated, that take into account, isolated or jointly, the experimental errors correlated both serial and contemporaneously. It is concluded that, for the data analyzed, the averages of the densities, layers and interactions, differ in behavior when analyzed together. The use of this method of analysis, by the adoption of models with correlated errors, is an answer, in specific instances, to the convenience of developing alternate methods of analysis which take into consideration a more adequate correlation structure.

M.M.M.

**N80-18532#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**SIGNIFICANT RESULTS FROM A PROJECT ON AGRICULTURAL STATISTICS, 1975 - 1978 [RESULTADOS SIGNIFICANTES DO PROJETO ESTATISTICAS AGRICOLAS: 1975 - 1978]**

Francisco Jose Mendonca, David Chung Liang Lee, Antonio Tebaldi Tardin, Sherry Chou Chen, Rene Antonio Novaes, and Yosio Edemir Shimabukuro Oct. 1979 29 p refs In PORTUGUESE; ENGLISH summary

(INPE-1609-NTE/155) Avail: NTIS HC A03/MF A01

Results acquired by the staff of the Agricultural Statistics Project between 1975 and 1978 are presented. During this period color infrared images and LANDSAT data were interpreted in order to obtain crop identification and area estimates. M.M.M.

**N80-19587#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

**QUANTITATIVE ESTIMATION OF PLANT CHARACTERISTICS USING SPECTRAL MEASUREMENT: A SURVEY OF THE LITERATURE**

R. B. Cate, J. A. Artley, and D. E. Phinney, Principal Investigators Jan. 1980 43 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of Interior and Agency for International Development ERTS

(Contract NAS9-15800; Proj. AgRISTARS)

(E80-10078; NASA-CR-160460; LEMSCO-14077; JSC-16298; SR-LO-00408) Avail: NTIS HC A03/MF A01 CSCL 02C

**N80-19588#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**LANDSAT DIGITAL ANALYSIS OF THE INITIAL RECOVERY OF THE KOKOLIK RIVER TUNDRA FIRE AREA, ALASKA**

D. K. Hall, J. P. Ormsby, L. Johnson (Army Cold Regions Research and Engineering Lab., Fairbanks, Alaska), and J. Brown, Principal Investigators (Army Cold Regions Research and Engineering Lab., Hanover, N. H.) Dec. 1979 21 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(E80-10080; NASA-TM-80602) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Considerable regrowth of vegetation was observed between August 1977 and August 1978, both in the field and through analysis of LANDSAT near infrared digital data. The spectral reflectances in the burned areas were found to increase with the age of the burn in a one year period due to vegetation regrowth. Regrowth was particularly evident in the lightly burned portions of the burned area. Image analysis techniques using the AOIPS system permitted delineation of burn severity categories. The conditions and type of ground cover prior to the fire influenced the severity of burning, as did the direction of the winds while the burning was in progress as determined from field and LANDSAT observations. More severe burning was induced by winds blowing in the northeastern and southeastern portions of the burned area.

**N80-19590#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**A CRITICAL COMPARISON OF REMOTE SENSING AND OTHER METHODS FOR NONDESTRUCTIVE ESTIMATION OF STANDING CROP BIOMASS**

C. J. Tucker, Principal Investigator Dec. 1979 15 p refs Submitted for publication ERTS

(E80-10082; NASA-TM-80607) Avail: NTIS HC A02/MF A01

**N80-20763#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**REMOTE MONITORING OF FOREST COVER CONDITIONS**

D. Williams, S. Wharton, and R. Nelson, Principal Investigators *In its Earth Survey Appl. Div.:* Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 209-212 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 02F

**N80-20768#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**REMOTE SENSING OF LEAF WATER CONTENT IN THE NEAR INFRARED**

Compton J. Tucker, Principal Investigator *In its Earth Survey Appl. Div.:* Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 230-234 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 06C

The author has identified the following significant results. Simulated spectral reflectances using different leaf water contents resulted in different reflectance changes in the 0.7 to 2.5 micron region of the spectrum. Consideration of the solar spectral irradiance and atmospheric transmission characteristics shows that the 1.55 to 1.75 micron spectral interval is the best suited band in the 0.7 to 2.5 micron region for monitoring plant canopy water status from space platforms. The 1.48 to 1.75 micron spectral interval is the best suited band for ground-based monitoring of plant canopy water status. The 1.50 to 1.63 micron region shows the greatest spectral radiance changes with a simulated leaf dehydration.

**N80-20769#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**PLANT STRESS AND RELATIONSHIPS TO SPECTRAL RESPONSES**

J. B. Schutt, Principal Investigator *In its Earth Survey Appl. Div.:* Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 235-237 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 06C

The author has identified the following significant results. Comparison of the near infrared reflectance curves of cotton plants grown in a chamber, greenhouse, and in the field show that field cotton has the lowest reflectance over the regions from 0.8 to 1.3 microns and 1.92 to 2.5 microns, with greenhouse and growth chamber spectra with higher reflectances in respective order. The reflectance levels from 1.42 to 1.92 microns (1.55 to 1.75 microns) were independent of lighting conditions. Spectral response curves recorded in the near-UV and near-IR regions for tomato leaves subjected to O<sub>3</sub>, SO<sub>2</sub>, and their combination, show that greater consistency in detectability was found in the near-UV. Results show that visible damage first appeared at the upper surface of a leaf, while incipient damage was first detected at the under surface.

**N80-20770#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**MONITORING DROUGHT IN COLORADO WITH LANDSAT MSS**

## 01 AGRICULTURE AND FORESTRY

C. J. Tucker and D. W. Deering, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 238-241 ERTS

Avail: NTIS HC A14/MF A01 CSCL 08H

**N80-20771\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.  
**EFFECTS OF WHEAT IRRIGATION FREQUENCY ON REFLECTANCE IN SELECTED SPECTRAL BANDS**

E. W. Chappelle, F. W. Wood, and W. W. Newcomb, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 242-246 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20772\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.  
**OFF-NADIR VIEWING EFFECTS ON SPECTRAL ASSESSMENT OF GREEN BIOMASS**

D. W. Deering, Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 247-251 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

The author has identified the following significant results. Off-nadir pointing of remote sensors decreased the red radiance and increased the infrared radiance in a situation of sparse ground cover and low levels of green biomass by increasing the proportion of the measured spectral response that was affected by interaction with the plant material component of the vegetation scene. The magnitude of the spectral radiance value changes with changes in off-nadir viewing angle indicate that from 0 deg to 20 deg no significant radiometric adjustments are necessary, but at larger view angles, adjustment-to-nadir algorithms may be necessary for many applications. The infrared/red ratio vegetation index exhibited enhanced sensitivity to the green biomass in low biomass situations.

**N80-20773\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**THERMAL ANISOTROPY OF VEGETATION CANOPIES**  
D. S. Kimes, Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 252-256 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 02F

**N80-20774\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.  
**TIME OF DAY EFFECTS ON WHEAT REFLECTANCE IN FIFTEEN SELECTED BANDS**

E. W. Chappelle, F. W. Wood, and W. W. Newcomb, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 257-259 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20775\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.  
**ASSESSING SOYBEAN LEAF AREA AND LEAF BIOMASS BY SPECTRAL MEASUREMENTS**

B. N. Holben, C. J. Tucker, and C. Fan, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 260-263 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

The author has identified the following significant results. Red and photographic infrared spectral radiances were correlated with soybean total leaf area index, green leaf area index, chlorotic leaf area index, green leaf biomass, chlorotic leaf biomass, and total biomass. The most significant correlations were found to exist between the IR/red ratio data and green leaf index and/or green leaf biomass ( $r^2 = 0.85$  and  $0.86$  respectively).

**N80-20776\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.  
**RELATIVE SENSITIVITY OF FIFTEEN SPECTRAL BANDS TO CHANGES IN SOYBEAN CANOPY COVER FOR WET AND DRY SOILS**

E. W. Chappelle, R. Bell, F. W. Wood, D. W. Deering, and M. Labovitz, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 264-268 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20777\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.  
**RADIOMETRIC RESOLUTION FOR MONITORING VEGETATION: HOW MANY BITS ARE NEEDED?**

C. J. Tucker, Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 269-275 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

The author has identified the following significant results. The solar zenith angle has an effect on the noise equivalent change in reflectance. Two hundred fifty-six quantizing levels gave a 1% to 3% improvement per channel over 64 quantizing levels, and a 1% improvement per channel over 128 quantizing levels. No improvements were found for 256 vs 512 levels. Either 128 or 256 quantizing levels appear optimum for orbital monitoring of terrestrial vegetation for thematic mapper bands 3 and 4, or similar sensor bands. However, the data rate for 256 quantizing levels is 12.5% higher than the data rate for 128 levels, other parameters being equal. The thematic mapper was found to be closely matched to the scene dynamic radiance range for targets without incorporating variable gain control in the instrument.

**N80-20778\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**THEMATIC MAPPER VERSUS MULTISPECTRAL SCANNER FOR CROP MONITORING**

B. L. Markham, Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 276-280 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20779\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**SPECTRA OF ISOLATED VEGETATIONAL CONSTITUENTS**  
E. W. Chappelle and F. W. Wood, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 281-282 ERTS

Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-20780\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.  
**A SPECTRAL METHOD FOR DETERMINING THE PERCENTAGE OF GREEN HERBAGE MATERIAL IN CLIPPED SAMPLES**

C. J. Tucker, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 283-286 ERTS  
Avail: NTIS HC A14/MF A01 CSCL 02C

Insolation, soil moisture, precipitation, evapo-transpiration and canopy temperature (stress-degree-day concept) are analyzed for their importance in agromet models. The integration of data provided by meteorological and Earth observation satellites agricultural information systems is discussed. Author (ESA)

**N80-20781\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.  
**EVALUATION OF A SPECTRAL METHOD FOR PERCENTAGE GREEN DETERMINATION USING CLIPPED RANGE-LAND FORAGE SAMPLES**

D. W. Deering, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 287-290 ERTS  
Avail: NTIS HC A14/MF A01 CSCL 02C

**N80-21613#** National Bureau of Standards, Boulder, Colo.  
**HIGH RESOLUTION SENSING TECHNIQUES FOR SLOPE STABILITY STUDIES Final Report, Oct. 1976 - Sep. 1978**

Ramon L. Jesch, Robert B. Johnson, Donald R. Belsher, Arthur D. Yaghjian, and Michael C. Steppe Jan. 1979 142 p. refs (FHWA Order 7-3-0001)  
(PB80-124621; FHWA/RD-79/32) Avail: NTIS HC A07/MF A01 CSCL 13B

A four phase evaluation of high resolution remote sensing techniques for application to problems of determining slope stability is presented. The first two phases concentrated on documenting the subsurface features and associated characteristics which determine or influence slope stability. A variety of electromagnetic and acoustic remote sensing techniques which exhibited the greatest potential for detecting the subsurface features and characteristics were surveyed in phase three. Two techniques were chosen for further experimental and developmental pursuit: the existing FM-CW radar system, and the planar near field reconstruction approach. The existing FM-CW radar system was applied and analyzed in a series of field experiments to determine the subsurface structure at a designated test site in phase four. GRA

**N80-21817#** European Space Agency, Paris (France).  
**SATELLITE CONTRIBUTION TO THE STUDY OF THE PHYSICAL PROPERTIES OF SOILS. UTILIZATION IN THE WATER AND AGRICULTURAL DOMAINS [APPORT DES SATELLITES A L'ETUDE DES PROPRIETES PHYSIQUES DES SOLS. UTILISATION DANS LES DOMAINES DE L'EAU ET L'AGRICULTURE]**

Y. Vuillaume (Groupement pour le Develop. de la Teledetection Aerospatiale) *In its* Use of Data from Meteorol. Satellites Nov. 1979 p 183-189 refs In FRENCH

Avail: NTIS HC A12/MF A01

The utilization of satellite observation for improving the knowledge of renewable resources is examined. The physical properties of the soil which are accessible to remote detection are reviewed and the utilization of satellite data for evaluation of water and agricultural resources is analyzed. Author (ESA)

**N80-21818#** Joint Research Centre of the European Communities, Ispra (Italy).  
**AGROMETEOROLOGICAL APPLICATIONS [APPLICATIONS AGROMETEOROLOGIQUES]**

G. Frayesse *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 191-197 refs In FRENCH; ENGLISH summary

Avail: NTIS HC A12/MF A01

## ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis.

**A80-22138** Karhunen-Loève analysis of multispectral data from landscapes. J. Duvernoy (Franche-Compté, Université, Besançon, France) and J. Leger (California, University, La Jolla, Calif.). *Optics Communications*, vol. 32, Jan. 1980, p. 39-44. 6 refs. NSF-supported research.

Statistical properties of the chromatic spectrum of landscapes are studied by Karhunen-Loève (K.L.) transform. The information is found to be compressed into a few dominant eigenvectors of the covariance matrix of multispectral data. Natural and man-made objects are shown to differ by their covariance and therefore by the distribution of their eigenvalues. Feature selection is performed by using the first eigenvector as a chromatic filter. The respective influences of three elements of the landscapes considered (i.e. vegetation, sky, and cars in a parking lot) are assessed. Further applications to the automatic classification of the content of landscapes are discussed, and a hypothesis is proposed for the origin of the chromatic response of the human eye. (Author)

**A80-22400** # Remote sensing of regional air pollution from satellites. E. Friedman, J. Gupta, and E. Keitz (Mitre Corp., Metrek Div., McLean, Va.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 419-431.

It is noted that recent scientific interest in the processes of long-range transport of air pollutants has suggested the extensive application of remote sensing methods. Satellite remote sensing of pollutant gases in the troposphere is shown to have advantages in contributing to such studies. A model is developed for calculation of the data quality which might be achieved from such a satellite observation system. A nonsynchronous orbit is assumed, as would be the case for the Space Shuttle. Finally, the calculations include the effects of incomplete sampling, instrument response to a varying scene, cloudiness and instrument error. M.E.P.

**A80-22403** # Integration of remote sensing and geographic information systems. R. L. Shelton (Michigan State University, East Lansing, Mich.) and J. E. Estes (California, University, Santa Barbara, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 463-483. 11 refs.

Some specific, reasonably well established applications of remote sensing are reviewed. Technical and administrative issues related to remote sensing input into computer-based information systems are outlined, and some concepts appropriate to the design and implementation of integrated systems are discussed. V.P.

**A80-22422** # The use of remote sensing in the determination of beach sand parameters. C. F. Davis, R. A. Shuchman, and G. H. Suits (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 775-788. Contract No. N0014-74-C-0273.

Beach sands were analyzed with the intention of determining not only mineralogy but also moisture and grain size. These three parameters are of interest from a beach trafficability and sediment transport point of view. Using the information obtained from an AQUASAND model, the mineralogy, moisture, and grain size (MOGS) algorithm was developed using reflectance spectra measured on a Cary 14 spectrophotometer. The MOGS algorithm was

evaluated both on the reflectance spectra from which it was derived and on spectra collected following the algorithm development. In addition, digital images of grain size distribution and moisture distribution were developed from actual multispectral scanner data. V.T.

**A80-22426** # Terrain evaluation for environmental inventory and impact assessment. K. J. Lyons (Western Australian Institute of Technology, South Bentley, Australia). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 835-844.

Western Australia has a need for a rapid method of providing definitive information for the environmental impact assessment (EIA) process, without relying on extensive amounts of available data. The method considered in the present paper is based on small-scale aerotriangulated photography, coupled with terrain evaluation. The main approaches to terrestrial evaluation are compared against the requirements of the EIA process. V.P.

**A80-22431** # Land cover classification of Sagami River basin using Landsat data - An operational research. H. Shimoda, T. Sakata, T. Hosomura (Tokai University, Hiratsuka, Japan), S. Murai (Tokyo, University, Tokyo, Japan), M. Yanagisawa (National Land Agency, Tokyo, Japan), and K. Murano (Ken Research, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 891-901.

Results of land cover classification of the Sagami River (Japan) basin produced by remote sensing are presented. The Landsat image data showed high geometric and shadow-free classification accuracy achieved with precise geometric correction, intensive test area selection, and man-machine interactive iterative tree structure classification. A feasibility study of high-altitude airborne sensing utilizing a color infrared photograph showed its high potential for large-scale land use mapping. A.T.

**A80-22444** # Thematic adaptive spatial filtering of Landsat landuse classification results. K. I. Itten and F. Fasler (Zürich, Universität, Zurich, Switzerland). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1035-1042. 8 refs.

The paper examines the use of simple low-cost thematic adaptive filtering in the space domain to correct systematic as well as nonsystematic errors which appear in digital landuse classifications. It is shown that concurrently scale dependent generalization can be performed. The method is based on the use of individually formed classwise filters, consisting of two-dimensional specifically weighted arrays. Finally, the results of an application in northeastern Switzerland are presented and discussed. M.E.P.

**A80-22445** # Land use/cover changes in the Kainji Reservoir area /Nigeria/. D. Rodriguez Bejarano and F. E. Okoye (Michigan, University, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1043-1053.

The removal of tropical vegetative cover as a result of human activities (agriculture, livestock, and urban uses) can cause immediate socio-economic and ecological problems. Some of these problems are now being encountered in the Kainji Reservoir area in Nigeria, and may impair the ability of the reservoir to meet its intended purposes. The objectives of the study described in this paper were to determine the accuracy with which small-scale remote sensor data can be used to determine the location and extent of land cover/use changes in the areas surrounding the reservoir, and to determine the change in water

## 02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

surface area in the reservoir. Visual and machine-assisted interpretations of multi-date, multi-band Landsat and side-looking airborne radar (SLAR) imagery were utilized. (Author)

**A80-22452 # Measuring ecological changes in multitemporal Landsat data using principal components.** G. D. Lodwick (New South Wales, University, Sydney, Australia). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1131-1141. 19 refs.

It is shown that seasonal changes can be measured using the first two principal components by differencing the scores between successive images or by linear regression across a number of images. By devising a mathematical formula to model these changes, it is found that all seasonal variations in scores on the first principal component can be explained solely by variations in sun/slope/aspect geometry. On the other hand, changes in second principal component scores appear to be wholly related to changes in ecology due to seasonal climatic effects, or caused by living agencies, including man. V.P.

**A80-22462 # An evaluation of Michigan land cover/use inventories derived from remote sensing - Characteristics and costs.** R. Hill-Rowley and W. R. Enslin (Michigan State University, East Lansing, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1251-1259. 12 refs.

**A80-22468 # Urban environmental survey by remote sensing.** K. Narigasawa and M. Fuchimoto (Asia Air Survey Co., Ltd., Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1317-1335. Research sponsored by the Geographical Survey Institute of Japan.

The paper describes remote sensing techniques and experimental evaluation techniques being used in an urban environmental survey. Attention is given to six areas of urban environment which are evaluated or investigated: (1) vegetation cover, (2) effective duration of possible sunlight, (3) sky amount and open space, (4) tree damage, (5) ground temperature (during a summer day), and (6) stability of various ground conditions (rock, sand, etc.). Attention is given to the investigative procedures and it is reported that good results were produced. Some of these were compared with results produced by other methods and were found to agree. M.E.P.

**A80-22479 # Landsat applications to land use mapping of the Cul de Sac Plain of Haiti.** R. Lafortune, F. Seme (Department of Agriculture, Haiti), and R. Laurin (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1465-1477.

Satellite data collected in February 1975 were used to prepare a land use/land cover map of the Cul-de-Sac Plain in central Haiti - a 480 square kilometer area characterized by a wide range of ecological and cultural conditions. Manual interpretation of the tones and patterns of digitally-enhanced false color imagery resulted in a twenty category generalized land use map. Automatic scene classification of the Landsat data yielded seventeen detailed terrain/land cover categories. In this area of mixed environments, the combination of manual interpretation and automatic classification was found to be optimal for preparation of land use/land cover maps. Manual interpretation allowed delineation of broad areas of similar land use, while automatic processing was required for precise definition of detailed land cover boundaries and areal tabulation of the many small spatial units. (Author)

**A80-22492 # The elimination approach to monitoring urban growth from Landsat data.** P. Carter (Atomic Energy Research

Establishment, Harwell, Oxon, England) and M. J. Jackson (Department of Environment, London, England). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1609-1617. 6 refs. Research supported by the Department of Environment.

Research into the use of Landsat data for urban monitoring is described. Although the classification of a single Landsat scene, using only the multispectral data, can provide information about urban areas, the accuracy obtained is often too low for monitoring purposes. It is shown that by limiting the area of search for new growth to the periphery of the old urban boundary, by taking decisions on the basis of the data from more than one scene, and by including other procedures described, it is possible to achieve adequate accuracy. M.E.P.

**A80-22493 # National land use and settlement assessment - An areal data base model for Landsat information for Bangladesh.** M. I. Chowdhury and S. D. Shamsuddin (Jahangirnagar University, Bangladesh, India). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1619-1628. 7 refs.

There is a need in Bangladesh for an integrated system of data acquisition, storage, retrieval, and analysis, where existing techniques are suitably combined with Landsat technology. In the present paper, a hierarchical land use classification is proposed to achieve such an integrated system. It is suitable for qualitative and quantitative analysis in four scales - 1:1,000,000 for Landsat imagery, 1:50,000 for topographic maps, 1:30,000 for aerial photography, and 1:3960 for cadastral survey maps. V.P.

**A80-24074 New earth resource monitoring techniques (Nouvelles techniques pour la surveillance des ressources naturelles).** L. C. Goodfellow, F. E. Guertin (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and D. Robert (Intera Environmental Consultants, Ltd., Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings.

Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 241-250. 7 refs. In French.

The paper deals with the development of methods of correcting multispectral Landsat imagery for effects caused by changes in the atmosphere and illumination between two images. The detection of environmental changes by superposing two digital images and controlling color variations of IR aerial photography is discussed, along with methods of combining the four bands of digital Landsat MSS data to provide a means of improving color composites for visual interpretation. V.P.

**A80-25568 \* California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames.** N. A. Bryant, R. G. McLeod, A. L. Zobrist (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and H. B. Johnson (U.S. Bureau of Land Management, Riverside, Calif.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 69-79. 12 refs. Contract No. NAS7-100.

Procedures for adjustment of brightness values between frames and the digital mosaicking of Landsat frames to standard map projections are developed for providing a continuous data base for multispectral thematic classification. A combination of local terrain variations in the Californian deserts and a global sampling strategy based on transects provided the framework for accurate classification throughout the entire geographic region. C.F.W.

**A80-25572 \*** **A non-interactive approach to land use determination.** V. R. Algazi, G. E. Ford, and D. I. Meyer (California, University, Davis, Calif.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 122-131. 9 refs. Grant No. NSG-5092.

An operational procedure for use by the Corps of Engineers to acquire land use information for hydrologic planning purposes is described. The operational constraints preclude the use of dedicated, interactive image processing facilities. The procedure combines manual interpretation techniques and the batch-mode computer analysis of Landsat digital data. An example of the application of the procedure to an urban watershed is described. (Author)

**A80-25574** **A methodology for a national coverage land use study by computer.** J. A. Diez, S. A. Rivera, and M. Medina (Comisión del Plan Nacional Hidráulico, Mexico City, Mexico). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 142-148. 6 refs.

The methodology used with a computerized satellite imagery interpretation system in the development of a land use inventory for Mexico based on Landsat MSS computer compatible tapes is presented. The procedure consists of the identification and selection of sample zones, the location of the zones, the definition of representative subimages for analysis or verification, and the computer classification of the images. The computer processing involves the unsupervised classification of each subimage, the merging of subimage classes, and the supervised classification of the merged statistics. The results of the processing are then evaluated by comparison with peripheral information and printout features. Ground truth is obtained by means of aerial surveys and interpretation accuracy is determined by tests of classification hypotheses and a hit-error test. It is observed that the methodology is suitable for land use classification, and may be used, with appropriate modifications, for soil, water quality and crop estimation studies. A.L.W.

**A80-25575 \*** **The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants.** H. F. Fostel, J. E. Manley, and J. P. Ormsby (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Science, Greenbelt, Md.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 149-158.

**A80-25601** **Classification of areas using pixel-by-pixel and sample classifiers.** R. Kumar, M. Niero, A. P. Manso, L. A. M. Lucht, and M. S. Santiago Barros (Conselho Nacional de Desenvolvimento Científico e Tecnológico, Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 420-428. 15 refs.

A comparison of the area classification accuracy using pixel-by-pixel and sample classifiers is presented. The several options of image classification including a pixel-by-pixel maximum likelihood gaussian classifier, a sample classifier based on the generalized maximum likelihood approach, and the pixel-by-pixel single cell acquisition option of the Image-100 system are discussed. Landsat multispectral scanner data of three test sites in Brazil were classified, showing that the sample classifier yielded better classification accuracy than the maximum likelihood gaussian classifier or the single-cell signature acquisition option. A.T.

**A80-27430** **Settlement detection with radar imagery.** F. M. Henderson and M. A. Anuta (New York, State University, Albany, N.Y.). In: American Society of Photogrammetry and

American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 89-104. 7 refs.

The paper examines the detectability of settlements and factors influencing their visibility using imagery from two side-looking airborne radar systems. K-band and X-band imagery of diverse areas in the US are examined to discover the minimum population needed for a settlement to be consistently detected. Percent of settlements visible by size of population are calculated and results indicate that imagery at a scale of 1:200,000 or larger is requisite for settlement detection, so that 60-70 percent of settlements with 200-300 population can be identified with accuracies rising as population increases. Environmental characteristics were of little or no significance in explaining variation in settlement detection except for the effect of vegetation on selected settlements. A.T.

**A80-27457** **Effects of interpretation techniques on land-use mapping accuracy.** F. M. Henderson (New York, State University, Albany, N.Y.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Mar. 1980, p. 359-367. 5 refs.

Study areas in the southern U.S. were employed to examine the effects on land-use mapping accuracy of nine different interpretation methods based on a grid cell matrix. Specifically, the effects of grid placement or orientation, of cell size, and of method used to assign land use for each cell are considered in regard to the accuracy of land-use determination. Best results were not always obtained with the smallest grid cell; interpretation techniques less complex than stratified systematic unaligned sampling often produced more accurate data. In addition, the optimum interpretation technique was found to vary among sites and category but not in a consistent manner. J.P.B.

**A80-30925** **Urban residential ground cover using Landsat digital data.** B. C. Forster (New South Wales, University, Kensington, Australia). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Apr. 1980, p. 547-558. 21 refs.

The relationship between Landsat digital data and the percentage of various residential component covers sampled at the pixel level over the Sydney metropolitan area is examined using multiple regression analysis. It is found that linear equations (with correlations from 0.45 to 0.66) relating response in each band to changes in cover percentages are more explanatory than those using total cover percentages. Various response combinations are verified by computing the optimum combinations for predicting individual cover percentages, with correlations ranging from 0.33 for concrete percentage to 0.72 for grass and tree percentage combined. It is also found that by incorporating an average background effect more reliable estimates of the reflectance of cover types are obtained. L.M.

**A80-32273 #** **Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs (Opyt primeneniia avtomaticheskoi klassifikatsii dlia deshifirovaniia pustynnykh i polupustynnykh landshaftov Zapadnogo Kazakhstana po snimkam s kosmicheskogo korablia 'Soyuz-12').** M. B. Averintsev and V. I. Kravtsova. In: Space photography and thematic mapping - A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 72-76. In Russian.

**A80-32275 #** **Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment (Rezultaty predvaritel'noi kompleksnoi geograficheskoi interpretatsii materialov mnogoazonal'noi s'emki, poluchennykh s KK 'Soyuz-22' v sovmetstnom eksperimente SSSR i GDR 'Raduga').** K. A. Salishchev, S. S. Voskresenskii, E. V. Glushko, E. K. Kozlova, Iu. F. Knizhnikov, Iu. I. Kondratova, T. V. Kotova, V. I. Kravtsova, I. A. Labutina, and G. A. Saf'ianov. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow,

## 02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

Izdatel'stvo Moskovskogo Universiteta, 1979, p. 83-115. In Russian.

The present extensive analysis of space photographs of a great variety of landscapes reveals the superiority of photographs obtained (from a manned spacecraft) with a MKF 6 camera at orbit inclination angles of 65 degrees. The exclusive use of such photographs for scientific, economic, and geographic studies is suggested. V.P.

**A80-32278 #** Investigation of landscapes of the Turgay steppe using multispectral aerial photography (Izuchenie landshaftov Turgaiskoi stepi po materialam mnogozonal'noi aerofotos'emki). V. A. Nikolaev and T. G. Sharlai. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 129-139. In Russian.

**A80-32285 #** The use of ordinary and multispectral aerial and space photographs for the mapping of population centers (Ispol'zovanie obychnykh i mnogozonal'nykh aerokosmicheskikh snimkov dlia kartografirovaniia sistem naseleennykh punktov). E. M. Tsykina. (Vsesoiuznaia Konferentsiia po Kosmicheskim Lucham, Yerevan, Armenian SSR, June 1979.) Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaiia, vol. 43, Dec. 1979, p. 215-224. In Russian.

**N80-16575\*#** National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va. **SUMMARY OF AIRCRAFT RESULTS FOR 1978 SOUTH-EASTERN VIRGINIA URBAN PLUME MEASUREMENT STUDY OF OZONE, NITROGEN OXIDES, AND METHANE** Gerald L. Gregory, Dewey E. Wornom, Joe J. Mathis, Jr., and Daniel I. Sebacher Washington Feb. 1980 222 p refs (NASA-TM-80146; L-12981) Avail: NTIS HC A10/MF A01 CSDL 13B

Ozone production was determined from aircraft and surface in situ measurements, as well as from an airborne laser absorption spectrometer. Three aircraft and approximately 10 surface stations provided air-quality data. Extensive meteorological, mixing-layer-height, and ozone-precursor data were also measured. Approximately 50 hrs (9 flight days) of data from the aircraft equipped to monitor ozone, nitrogen oxides, dewpoint temperature, and temperature are presented. In addition, each experiment conducted is discussed. A.R.H.

**N80-16578\*#** Research Triangle Inst., Research Triangle Park, N. C.

**ALTITUDE CHARACTERISTICS OF SELECTED AIR QUALITY ANALYZERS Final Report** J. H. White, R. Strong, and J. B. Tommerdahl Nov. 1979 32 p (NASA Order L-96783-A; RTI Proj. 43U-1833) (NASA-CR-159165; RTI/1833/00-03F) Avail: NTIS HC A03/MF A01 CSDL 13B

The effects of altitude (pressure) on the operation and sensitivity of various air quality analyzers frequently flown on aircraft were analyzed. Two ozone analyzers were studied at altitudes from 600 to 7500 m and a nitrogen oxides chemiluminescence detector and a sulfur dioxide flame photometric detector were studied at altitudes from 600 to 3000 m. Calibration curves for altitude corrections to the sensitivity of the instruments are presented along with discussion of observed instrument behavior. K.L.

**N80-17120\*#** National Aeronautics and Space Administration, Washington, D. C. **RESEARCH PROJECT MAURETANIA: SATELLITES AS DEVELOPMENT AIDS**

Rupert Haydn, Helmut Bonarius, and Manfred Schramm Feb. 1980 18 p Transl. into ENGLISH from Bild Wiss. (West Germany), no. 11, 1979 p 151-161 Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASw-3198) (NASA-TM-76064) Avail: NTIS HC A02/MF A01 CSDL 22A

A general discussion is presented of how satellite images and ground surveys are used to define land use. Specifically it deals with the Tagant region in Mauretania, West Africa. R.C.T.

**N80-19592\*#** Michigan State Univ., East Lansing. **USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION Annual Progress Report, 1 Jun. 1978 - 31 May 1979**

Myles Boylan, Principal Investigator 1 Feb. 1980 113 p refs ERTS (Grant NGL-23-004-083) (E80-10085; NASA-CR-162783) Avail: NTIS HC A06/MF A01 CSDL 05B

**N80-19598#** Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div. **STATISTICAL ANALYSIS OF TERRAIN AND WATER (ICE) BACKGROUNDS IN A WINTER SCENE FROM NORTHERN MICHIGAN Final Report**

Anthony J. LaRocca Oct. 1979 299 p refs (Contract N60530-79-R-0036) (AD-A077554; ERIM-139900-2-F) Avail: NTIS HC A13/MF A01 CSDL 17/5

Data from infrared imagery on various terrain and water (ice, in this instance) backgrounds were collected and analyzed to present their statistical features. This report describes some of the characteristics in the form of histograms, ellipse 'pictures', and power spectra for the following infrared spectral bands: 3.5-3.9, 4.5-5.5, and 9.0-11.4 micrometers. Areas were chosen to show variability of results in a winter scene with respect to different times of the day and night. GRA

**N80-19599#** Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

**STATISTICAL ANALYSIS OF TERRAIN AND WATER BACKGROUNDS IN THE VICINITY OF PORT HUENEME, CALIFORNIA**

Anthony J. LaRocca Apr. 1979 156 p refs (Contract N60530-78-C-0009) (AD-A077025; ERIM-132300-3-T) Avail: NTIS HC A08/MF A01 CSDL 17/5

Data from infrared imagery on various terrain and water backgrounds have been collected by the Environmental Research Institute of Michigan and have been analyzed to present their statistical features. This work is being funded by the Optical Signatures Program to Support Navy Requirements. This report describes some of the characteristics in the form of histograms, ellipse 'pictures', and power spectra for the following infrared spectral bands: 2.0-2.6, 3.0-4.2, 4.5-5.5, and 9.0-11.4 microns. Special areas were chosen to demonstrate the variation in results with the selection of different backgrounds. GRA

**N80-20661#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE TOPOGRAPHIC SYNOPTIC MAP 1:200,000 [DIE TOPOGRAPHISCHE UEBERSICHTSKARTE 1:200,000 (TUEK 200)]**

Rolf Boehme *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 175-176 In GERMAN Original contains color illustrations

Avail: NTIS HC A11/MF A01

The page by page development of the 1:200,000 synoptic topographic map is briefly described. Samples of this highly informative document are reproduced. Author (ESA)

**N80-20662#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE SYNOPTIC MAP 1:500,000 (WORLD, SERIES 1404) [DIE UEBERSICHTSKARTE 1:500,000 (WORLD, SERIE 1404)]**

Rolf Boehme *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 177-178 In GERMAN Original contains color illustrations 11-42)

Avail: NTIS HC A11/MF A01

The 1:200,000 synoptic map is briefly described. A sample produced by IFAG is presented as well as a sample produced by the French National Geographic Institute. Author (ESA)

**N80-20663#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE INTERNATIONAL WORLD MAP 1:1,000,000 (IWK)  
[DIE INTERNATIONALE WELTKARTE 1:1,000,000 (IWK)]**

Wolfgang Weber *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 179-182 In GERMAN Original contains color illustrations

Avail: NTIS HC A11/MF A01

The development of the 1:1,000,000 world map requested by the United Nations is briefly described. Samples of the 1942 and 1977 editions of the same maps are presented.

Author (ESA)

**N80-20664#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**PHOTOGRAMMETRY IN IFAG FROM 1952 TO 1977 [DIE PHOTOGRAMMETRIE IM IFAG 1952-1977]**

Hans Belzner *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 187-192 In GERMAN

Avail: NTIS HC A11/MF A01

The development of photogrammetric studies in the IFAG is reviewed. Collaboration with other institutions, in particular, with the Organisation Europeene d Etudes Photogrammetriques Experimenteles (OEEPE) is examined. Work in orthophototechniques from aircraft and satellites is described. Contributions to development in the Middle East are mentioned. Author (ESA)

**N80-20668#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**OBTAINING SURFACE INFORMATION FOR TOPOGRAPHY AND TOWN AND COUNTRY PLANNING FROM REMOTE SENSING [DAS GEWINNEN VON FLAECHENNUTZUNGS INFORMATIONEN MITTELS FERNERKUNDUNGSVERFAHREN FUER AUFGABEN DGR TOPOGRAPHIE UND DER LANDESPLANUNG]**

Klaus Niemz *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 211-217 In GERMAN Original contains color illustrations

Avail: NTIS HC A11/MF A01

Methods developed for future Earth reconnaissance flights are described and discussed. Four test regions with different characteristics were selected: test region 1 (North Germany) for oceanic and coastal studies; test region 2 (Lower Main/Taunus/Wetterau) for town and country planning applications; test region 3 (Upper Rhine/Black Forest) for vegetation and forestry applications; test region 4 (Baltic region) for geological applications. Results obtained with a Bendix-11-channel scanner are presented and compared with LANDSAT 2 data. Different crops and land uses are characterized by color separation utilizing the DIBIAS system and the maximum likelihood method.

Author (ESA)

**N80-20721\*#** Commonwealth Scientific and Industrial Research Organization, Ryde (Australia).

**HEAT CAPACITY MAPPING MISSION (HCMM) Progress Report, 31 Aug. - 30 Nov. 1978**

K. G. McCracken, Principal Investigator 30 Nov. 1979 2 p Sponsored by NASA HCMM (E80-10066; NASA-CR-162587) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-20765\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**NASA-CENSUS APPLICATION PILOT TEST (APT) AND URBAN AREA DELINEATION STUDIES**

D. Toll and S. Wharton, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior

Jan. 1980 p 216-219 refs ERTS (For primary document see N80-20723 11-43)

Avail: NTIS HC A14/MF A01 CSCL 13B

**N80-20952#** New Mexico Univ., Albuquerque. Technology Application Center.

**REMOTE SENSING APPLIED TO POLLUTION MONITORING. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1976 - Jun. 1979**

Gerald F. Zollars Jul. 1979 51 p Sponsored in part by NTIS, Springfield, Va.

(NTIS/PS-79/0732/2) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 13B

Articles are cited from the international literature concerning the use of remote sensors to aid in the monitoring of air and water pollution. Use of lasers, optical radar systems, aerial photography, and satellite observations are included. (Contains 194 citations). GRA

## GEODESY AND CARTOGRAPHY

Includes mapping and topography.

**A80-22407 # Terrain modeling and geometric corrections using the Spot satellite.** A. Baudoin, D. Kirsner (Institut Géographique National, Saint-Mandé, Val-de-Marne, France), and J. C. Cazaux (Centre National d'Etudes Spatiales, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 537-556. 8 refs.

It is noted that the Spot satellite which is due to be launched in 1984 will have a capability to provide high resolution images and stereoscopic coverage of large areas. The paper describes the means by which the satellite will help to draw or to update topographic maps at scales from 1:200,000 down to 1:50,000. Attention is given to the HRV sensor and its pointing capability. In addition, the three types of preprocessed images are presented and the different steps to create planimetric maps and/or digital terrain modes are analyzed.

M.E.P.

**A80-22440 # Cartography with combined Landsat and navigational satellite data.** R. K. Vincent, R. A. Harrow, and D. K. Vincent (Geospectra Corp., Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 983-992.

Two methods for producing resampled computer tapes and photomap bases of high geometric accuracy from Landsat data were investigated. The first method, which simulated the use of a navigational satellite surveying instrument, can be utilized as an inexpensive two-dimensional surveying method for poorly mapped regions of the world. The second method is a map-matching method which utilizes geometrically accurate maps. Channel 5 photomap bases and map tapes were produced for the areas covered by the Ann Arbor East and Ann Arbor West 7.5 minute topo quad maps. Latitude and longitude for every resampled pixel on the map tape can be calculated by a simple linear equation. (Author)

**A80-22503 # Production of small-scale maps and inventories using Landsat data.** S. Braconne, J. C. Lummaux, and J. Poulain (Institut Géographique National, Paris, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1757-1764.

Landsat allows one to establish accurate cartography at small scales up to 1:250,000. An interactive image processing system enables one to reduce the time and costs involved. After one year of use the first operational results obtained with the TRIAS system of the French Institut Géographique National in the field of general and thematic cartography are discussed. Two processes are presented as examples of both themes: starting from Landsat imagery they use data processing sequences to produce cartographic plates in a short time, ready for printing. (Author)

**A80-22508 \* # An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy.** J. R. G. Townshend (Reading, University, Reading, Berks., England), D. F. Williams (Fairey Surveys, Ltd., Maidenhead, Berks., England), and C. D. Justice (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1839-1852. 8 refs.

Return Beam Videcon imagery from Landsat 3 was obtained in August, 1978 for part of Southern Italy in the regions of Basilicata and Apulia. The resolution of this imagery for medium contrast objects is approximately 40 meters and is shown to provide significant information concerning land cover and fluvial morphology. Because of the wide spectral band width which is sensed (0.505-0.750 microns) by the RBV cameras, discrimination is only possible for spectrally distinct cover types, especially oak woodland. Fluvial morphology can be readily described using the imagery. Because of the intense dissection of the area, the lowest order streams cannot be consistently mapped, but the rank order of the measured values of properties such as drainage density and link frequency for different lithologies corresponds closely to the actual ranking. (Author)

**A80-22509 # Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation.** E. M. El Shazly, M. A. Abdel Hady, M. A. El Ghawaby, I. A. El Kassas, M. M. El Shazly, A. B. Salman, and M. M. El Rakaiby (Remote Sensing Center; Nuclear Materials Authority, Cairo, Egypt). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1853-1860.

The paper discusses mapping of the Sinai Peninsula by Landsat-1 satellite imagery interpretation. Five basic maps were made including geological, structural lineation, drainage, petroleum and mineral potential and groundwater potential maps; the method showed particular usefulness for mountainous rugged areas which have been difficult to map due to lack of observation points. Mapping by spaceborne satellite imagery made it possible to identify petroleum, mineral, and groundwater sites, aiding in the rapid development of the Sinai Peninsula. A.T.

**A80-24810 # Free Doppler network adjustment.** E. Grafarend, A. Kleusberg, and B. Richter (München, Hochschule der Bundeswehr, Neubiberg, West Germany). In: International Geodetic Symposium on Satellite Doppler Positioning, 2nd, Austin, Tex., January 22-26, 1979, Proceedings. Volume 2. Austin, Tex., University of Texas, 1979, p. 1053-1069. 8 refs.

The paper analyzes rank deficiencies of datum-defects, configuration-defects, and of ill-conditionedness for a Doppler-satellite network. It is shown that a Doppler satellite network in the geometric mode has a datum defect of six due to the system insensitivity with respect to translation and rotation of the reference frame. The configuration deficiency can be avoided only through a sufficient number of simultaneous observations; for more general cases, inequalities between the number of ground stations, of satellite points, and of passes are constructed and tested, especially with respect to the ill-conditionedness of the system of observational equations. A.T.

**N80-19360\*# Massachusetts Inst. of Tech., Cambridge. THEORETICAL MODELLING AND EXPERIMENTAL DATA MATCHING FOR ACTIVE AND PASSIVE MICROWAVE REMOTE SENSING OF EARTH TERRAIN**

J. A. Kong, L. Tsang, M. Zuniga, R. Shin, J. C. Shiue, and A. T. C. Chang. In: AGARD Terrain Profiles and Contours in Electromagnetic Wave Propagation Dec. 1979 8 p refs Prepared in cooperation with NASA Goddard Space Flight Center Greenbelt, Md.

Avail: NTIS HC A17/MF A01 CSCL 20N

Two theoretical models were developed to characterize terrain media: a random medium with a variance, a horizontal correlation length; and a homogeneous dielectric containing discrete scatterers. The earth terrain is modelled as layers of such scattering media bounded by air above and half-space below. Matching the theoretical results with experimental data collected from vegetation and snow-ice fields shows that: (1) for observation angles near nadir, rough surface effects are important; (2) for snow-ice field the horizontal correlation length is greater than the vertical correlation length whereas for vegetation field their relative sizes depend on the types of vegetation; (3) the

### 03 GEODESY AND CARTOGRAPHY

vertically polarized backscattering cross-section is always larger than the horizontally polarized backscattering cross-section for half-space scattering media; (4) for snow field displaying diurnal change, a three-layer model including a thin top layer caused by sunlight illumination must be used; and (5) for a random medium with equal horizontal and vertical correlation lengths, the measured data can also be matched with a corresponding discrete scatterer model. K. L.

**N80-20638#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORT NO. 73 [NACHRICHTEN AUS DEM KARTEN UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE HEFT NR. 73]**  
1977 246 p refs In GERMAN Original contains color illustrations

(Rept-73) Avail: NTIS HC A11/MF A01

Papers describing the work of the Institute for the past 25 years include a description of the satellite observation station Wettzell. Geodetic data collection from Doppler and laser distance measurements, from altimeter and gravimetric evaluations, from the study of earth tides and photogrammetry are discussed, along with the cartographic representation of these data.

**N80-20639#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE 25 YEARS AT THE INSTITUTE FOR APPLIED GEODESY [25 JANRE INSTITUT FUER ANGEWANDTE GEODAESIE (1952-1977)]**

Rudolf Foerstner *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 7-37 refs In GERMAN

Avail: NTIS HC A11/MF A01

A chronological review of the important events since the foundation of the Institute 25 years ago is presented. The various phases of its organization and its relationship with other institutions are described. The goals fixed at the different stages of the IFAG's development in geodesy, mapping, and photogrammetry are examined. Author (ESA)

**N80-20640#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**A SURVEY OF THE GEODETICAL WORK OF THE IFAG FROM 1952-1977 [EIN UEBERBLICK UEBER DIE GEOD-AETISCHEN ARBEITEN DES IFAG (ABT. 2 DES DGFI) VON 1952-1977]**

Hermann Seeger, Rudolf Brein, Dieter Ehlert, Dieter Ielgemann, Klemens Nottarp, Bernd Richter, and Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 39-51 In GERMAN

Avail: NTIS HC A11/MF A01

Survey of the 25 years of geodetical research undertaken by the IFAG is presented. The improvement of the triangulation network and geoid determination, research on gravimetry and Earth tides, and the exploitation of data from geodetic satellites are described and future projects stated. Author (ESA)

**N80-20641#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE SATELLITE STATION WETZELL [DIE SATELLITENB-EOBACHTUNGSSTATION WETZELL]**

Hermann Seeger *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 53-62 refs In GERMAN

Avail: NTIS HC A11/MF A01

The observation station Wettzell was created in collaboration with other institutes to modernize the research techniques of the IFAG in geodesy and geodynamics. The conception, realization, and installation of the Institute are described, and the technical devices camera, and a third generation laser ranging system. Author (ESA)

**N80-20647#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**ELABORATING AN ASTRONOMICAL LONGITUDE SYSTEM [ARBEITEN AM ASTRONOMISCHEN LAENGENNETZ]**

Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 105-109 refs In GERMAN

Avail: NTIS HC A11/MF A01

The problem of astronomical longitude determination is examined. Systematic local variations in the astronomical longitude system are due to the consistency of the initial point. Relative longitude systems combination of these relative systems, comparing traditional geodetic and satellite methods eliminates errors and leads to a longitude systems homogeneous over Western Europe. Author (ESA)

**N80-20648#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**DETERMINATION OF AZIMUTH AND ASTRONOMICAL COORDINATES**

Gerhard Soltau *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 111-115 refs In GERMAN

Avail: NTIS HC A11/MF A01

The determination of astronomical coordinates and azimuth from Laplace stations is examined. Observations from stations examining the vertical variation are discussed. A precision of .5 min. of arc can be reached for each component. A greater density of points will contribute more to precision than will improvements in the measurement possibilities. Author (ESA)

**N80-20660#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE DATA BANK IN THE CARTOGRAPHIC AUTOMATION SYSTEM [DIE DATENBANK IM KARTOGRAPHISCHEN AUTOMATIONSSYSTEM]**

Wigand Weber *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 171-173 In GERMAN

in vertical photographs is discussed, and the effect of different Sun angles is shown in several photographs. Author (ESA)

**N80-20666#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**ORTHOPHOTO TECHNIQUES AND PHOTOMAPS [ORTHOPHOTOTECHNIK UND LUFTBILDKARTE]**

Rudolf Olach *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 199-201 refs In GERMAN

Avail: NTIS HC A11/MF A01

The orthophototechnique and the development of orthophotoplans and aerial photographic maps is examined. Precision in orthophotographic techniques, the applications of orthophotoplans and their structure are described. Author (ESA)

**N80-20667#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**AERIAL AND SPACE-BORNE PHOTOGRAPHIC MAPS [LUFTBILD UND WELTRAUMBILDKARTEN]**

Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 203-210 refs In GERMAN Original contains color illustrations

Avail: NTIS HC A11/MF A01

The production of topographic aerial photography and spaceborne photomaps is described. Aerial photomaps are produced from orthophotographs with additional cartographic information. Rapid execution of photomaps, and difficulties of scale reduction by classical or automatic means are mentioned as justification for aerial and spaceborne photographic mapping. Author (ESA)

**N80-20675#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**ON THE DISPLACEMENT PROBLEM AS PART OF A PROCESS IN GENERALIZING TOPOGRAPHICAL MAPS. PROPOSITION FOR HIERARCHICAL ORDER AND THE**

**SEARCH FOR EDP ASSISTED SOLUTIONS [ZUM PROBLEM DER VERDRAENGUNG ALS TEILVORGANG DER GENERALISIERUNG TOPOGRAPHISCHER KARTEN. HIERARCHIEVORSCHLAG UND VERSUCH EINER EDV-GESTUETZTEN LOESUNG]**

Roland Schittenhelm *In its Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 5-19 refs* In GERMAN; ENGLISH summary

Avail: NTIS HC A05/MF A01

Based on the results obtained from the investigation of practical cases of displacement on official maps of Germany, an order is proposed for map elements which could be observed during displacement. Solutions are given for three line element displacement cases (displacement by a compulsory point, displacement by a further element which is broadened or displaces itself, disentanglement of double hairpin bends of curved and broadened line elements). These have the advantage of freeing the cartographer from many routine tasks. Author (ESA)

**N80-20676#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**TWENTY-FIVE YEARS OF AERIAL PHOTOGRAPHY BY THE INSTITUTE OF APPLIED GEODESY [JAHRE LUFTBILDNACHWEIS DES INSTITUTS FUER ANGEWANDTE GEODAESIE]**

Heinz Schmidt-Falkenberg *In its Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. No. 74 1978 p 21-38 refs* In GERMAN; ENGLISH summary

Avail: NTIS HC A05/MF A01

After a short survey of aerial photography developments in Germany after the Second World War, some details are given about the aerial photography documentation which the institute possesses. Information is also given about the number and frequency of photo flights over a period of ten years. A detailed list of aerial photographs of the German estates is presented together with a list of aerial photography archives existing in Germany. Author (ESA)

**N80-20680#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**A PROGRAM FOR THE FULLY AUTOMATED DISPLACEMENT OF POINT AND LINE FEATURES IN CARTOGRAPHIC GENERALIZATION**

Fred Christ *In its Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 5-30 refs*

Avail: NTIS HC A07/MF A01

A program for the fully automated displacement of point and line features in cartographic generalization is described. The basic algorithm is a correlation of the displacement effects of the features when deriving a small scale map from a large scale map. Raster based processing is used. K.L.

**N80-20681#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**A DIGITAL TERRAIN MODEL FOR LARGE SURFACES AND DIRECT STORAGE ACCESS**

Rainer Detering *In its Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 31-34 refs*

Avail: NTIS HC A07/MF A01

A digital terrain model based on an equidistant grid structure which uses nonlinear interpolation while storing numerical values of elevations and slopes is proposed. The model, characterized by its high storage capacity and universality, is based on bicubic spline functions. The mathematically exact solution of a common adjustment in the total domain of definition is limited in favor of a pointed interactive change of input data. Author (ESA)

**N80-20682#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE PRODUCTION OF PHOTOMAPS FROM TIDAL FLAT AREAS**

Guenter Hake *In its Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 35-41 refs*

Avail: NTIS HC A07/MF A01

Clearly visible water lines from a series of infrared aerial photographs taken at the time of rising tides in tidal flat areas are digitized and transformed into contours by the allocation of individual elevation values. The cartographic combination of the contour representation and rectified aerial photographs from the time of the lowest water level leads to a photomap with a very high information content. Changes in elevation and volume can be calculated from subsequent photographs. Author (ESA)

**N80-20683#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**TESTING THE ACCURACY OF CARTOGRAPHIC EQUIPMENT: FIRST RESULTS**

Theodor Johannsen *In its Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 43054 refs*

Avail: NTIS HC A07/MF A01

Different methods of testing digitizers and plotters were developed and verified. Apart from simple tests (without the use of any additional equipment), profiles were measured with high precision using a laser interferometer. In addition, a technique was developed to establish the errors introduced by an operator when manually guiding the cursor for digitizing. It is concluded that absolute scale measurements and accurate local tests require equipment with resolution and accuracy exceeding those of the instrument to be measured by at least an order of magnitude. Author (ESA)

**N80-20685#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**LOCATIONAL CHARACTERISTICS AND THE SEQUENCE OF COMPUTER ASSISTED PROCESSES OF CARTOGRAPHIC GENERALIZATION**

Werner Lichtner *In its Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 65-75 refs*

Avail: NTIS HC A07/MF A01

A sequence of generalization processes for computer assisted operation is proposed which is intended to avoid both repetition of processes and frequent correction during batch compilation with the aid of interactive optical display systems. Particular attention is given to effects producing a lack or an excess of space and to locational changes in features and phenomena. Specific examples involving buildings and roads are discussed, as are displacement processes and the smoothing of contours and other linear phenomena. Good results are obtained with this method which has the advantage of homogeneity over manual methods. Author (ESA)

**N80-20686#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**COMPUTER-ASSISTED THEMATIC MAPPING FOR FEDERAL PLANNING**

Wolf-Dieter Rase *In its Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 77-83 refs*

Avail: NTIS HC A07/MF A01

To satisfy the needs for thematic maps on different levels of quality and quantity, computer assisted techniques were implemented in the map production process. Choropleth, graduated symbol, and other map types are plotted on an in-house minicomputer system with graphic peripherals. Remarks on the economic efficiency of computer assisted thematic cartography supplement the technical information. Author (ESA)

**N80-20688#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**EXPERIENCES GATHERED WITH A SYMBOL DISK WITH INTERCHANGEABLE SYMBOLS**

Helmut Uhrig *In its Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 93-106 refs*

### 03 GEODESY AND CARTOGRAPHY

Avail: NTIS HC A07/MF A01

A simple disk system that is both accurate and easily modifiable was sought. The system developed possesses 72 symbols which can be positioned by the user employing the cut and peel process or a technical method of reproduction. Specially positioned studs and holes assure that the disk is correctly centered, that the masks are in the right position, and that the unwanted part of the disk is correctly covered. A water distribution map is taken as an example. The maximum positioning error on the map itself resulting from the use of this technique is 32 microns. Author (ESA)

**N80-20690#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**MAP PROJECTION CHANGE: SOME PROGRAMS FOR THE TRANSFORMATION OF THE CONTENTS OF AVAILABLE MAPS ACCORDING TO DIFFERENT MAP PROJECTIONS**

Ingo Wilski *In its* Rept. on Cartography and Topographical Meas. Ser. 2: Transl. 1978 p 115-127 refs

Avail: NTIS HC A07/MF A01

Some FORTRAN programs are presented for the transformation of digitized map contents into geographical coordinates (Mercator and Lambert projections) and for the mass transformation of spherical geographical coordinates into rectangular map coordinates. Thirteen different map projections are considered, the graphical output being presented as a visual display and/or by a machine drawing. Author (ESA)

**N80-20702#** Bayerische Akademie der Wissenschaften, Munich (West Germany).

**THE RGST CHAIN PROGRAM FOR THE DETERMINATION OF POTENTIAL COEFFICIENTS AND STATION COORDINATES [DIE REST-PROGRAMMKETTE FUER DIE BESTIMMUNG VON POTENTIALKOEFFIZIENTEN UND STATIONS-KOORDINATEN]**

Christoph Reigber *In its* Res. Program 78, Satellite Geodesy Program 1978 p 111-119 refs In GERMAN

Avail: NTIS HC A09/MF A01

The dynamic method of satellite geodesy uses the numerical integration of the equations of motion to determine the temporal motion in relation to its reference orbit. A computer program REST is described which permits corrections to be performed for uncertainties introduced into the equations by the relief of the Earth and the elastic parameters of the Earth, Sun, and Moon. Author (ESA)

**N80-20704#** Bayerische Akademie der Wissenschaften, Munich (West Germany).

**STUDY FOR A PROJECT FOR A EUROPEAN HIGH PRECISION LASER NETWORK [PROJEKTSTUDIE FUER SATELLITEN-LASERNETZ HOECHSTER GENAUIGKEIT IN EUROPA]**

Walter Ehrnsperger and Martha Naebauer *In its* Res. Program 78, Satellite Geodesy Program 1978 p 139-158 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

Based upon simulated satellite transits of various heights, the attainable accuracy for a European network is investigated. The parameters are ranges as measured with third generation lasers or ranges in combination with optical directions. Numerical results for five stations and up to 100 satellite tracks are compared. Author (ESA)

**N80-20710#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**POSSIBILITIES OF APPLICATION OF LANDSAT AND SKYLAB DATA TO SMALL SCALE CARTOGRAPHY [VERWENDUNGSMOEGELICHKEITEN VON LANDSAT UND SKYLABAUFNAHMEN IN DER KLEIMASSTAEBIGEN KARTOGRAPHIES]**

Klaus Niemez *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 85-140 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

The possibility of producing small scale topographic maps from the 70 mm film taken from Skylab and multispectral scanner data from LANDSAT is discussed. Maps with scales from 1:100,000 to 1:2,800,000 are considered. The production equipment is described. Author (ESA)

**N80-20722\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**[EARTH SURVEY APPLICATIONS DIVISION: RESEARCH LEADING TO THE EFFECTIVE USE OF SPACE TECHNOLOGY IN APPLICATIONS RELATING TO THE EARTH'S SURFACE AND INTERIOR]**

Nov. 1979 298 p refs ERTS

(E80-10084; NASA-TM-80550)

HC A13/MF A01 CSCL 05B

Avail: NTIS

**N80-20723\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**[EARTH SURVEY APPLICATIONS DIVISION: RESEARCH LEADING TO THE EFFECTIVE USE OF SPACE TECHNOLOGY IN APPLICATIONS RELATING TO THE EARTH'S SURFACE AND INTERIOR] Annual Report, 1979**

Lloyd Carpenter, ed. Jan. 1980 322 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E80-10087; NASA-TM-80642; AR-2)

HC A14/MF A01 CSCL 05B

Accomplishments and future plans are described for the following areas: (1) geology - geobotanical indicators and geopotential data; (2) modeling magnetic fields; (3) modeling the structure, composition, and evolution of the Earth's crust; (4) global and regional motions of the Earth's crust and earthquake occurrence; (5) modeling geopotential from satellite tracking data; (6) modeling the Earth's gravity field; (7) global Earth dynamics; (8) sea surface topography, ocean dynamics; and geophysical interpretation; (9) land cover and land use; (10) physical and remote sensing attributes important in detecting, measuring, and monitoring agricultural crops; (11) prelaunch studies using LANDSAT D; (12) the multispectral linear array; (13) the aircraft linear array pushbroom radiometer; and (14) the spaceborne laser ranging system.

**N80-20726\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**MAGNETIC FIELD MODELING AND CRUSTAL STUDIES**  
P. T. Taylor and G. D. Mead, Principal Investigation *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 19-20 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20727\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**SPHERICAL HARMONIC MODELS OF THE CORE FIELD**  
R. A. Langel, G. D. Mead, and R. H. Estes, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 21-29 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20728\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**CRUSTAL ANOMALY REPRESENTATION**

R. A. Langel, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 30-38 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20729\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**ANOMALY VERIFICATION: COMPARISON OF POGO MAGNETIC DATA WITH AEROMAGNETIC MEASUREMENTS**

P. T. Taylor, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 39-52 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20731\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**REGIONAL MODELING: THE IVREA ZONE**

P. J. Wasilewski, M. A. Mayhew, and H. H. Thomas, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 61-62 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08F

**N80-20741\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**GSFC SITE STABILITY**

W. J. Webster, Jr. and R. J. Allenby, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 98 ERTS

Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20742\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**GEODETIC STABILITY OF THE GREEN BANK, WEST VIRGINIA VLBI SITE**

P. D. Lowman, W. J. Webster, Jr., and R. J. Allenby, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 99-102 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20747\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**GEODYN PROGRAM SYSTEMS DEVELOPMENT**

B. H. Putney, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 118-120 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08E

**N80-20748\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**GRAVITY MODEL DEVELOPMENT**

F. J. Lerch, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 121-127 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08N

**N80-20749\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**GRAVITY MODEL IMPROVEMENT FOR SEASAT**

F. J. Lerch, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in

Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 128-132 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20750\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**THE GRAVITY FIELD IN THE CENTRAL PACIFIC FROM SATELLITE-TO-SATELLITE TRACKING AND IMPLICATIONS FOR MANTLE CONVECTION**

J. G. Marsh, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 133-139 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A14/MF A01 CSCL 08N

**N80-20751\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**UNEXPLAINED LAGEOS PERTURBATION**

D. P. Rubincam, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 140-144 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08N

**N80-20752\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**MANTLE CONVECTION AND SUBCRUSTAL STRESS**

Han-Shou Liu, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 146-147 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20753\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**INFORMATION THEORY DENSITY DISTRIBUTION**

D. P. Rubincam, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 148-156 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20754\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**THE ENHANCED NODAL EQUILIBRIUM OCEAN TIDE AND POLAR MOTION**

B. V. Sanchez, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 157-164 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08H

**N80-20755\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.  
**POLAR MOTION RESEARCH**

M. A. Graber, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 165-166 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08H

### 03 GEODESY AND CARTOGRAPHY

**N80-20756\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.

**A DETERMINATION OF GM**

David E. Smith, Principal Investigator *In its Earth Survey Appl.*  
Div.: Res. Leading to the Effective Use of Space Technol. in  
Appl. Relating to the Earth's Surface and Interior Jan. 1980  
p 167-170 ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20757\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.

**POLAR MOTION AND EARTH ROTATION RESULTS FROM LAGEOS**

David E. Smith, Principal Investigator *In its Earth Survey Appl.*  
Div.: Res. Leading to the Effective Use of Space Technol. in  
Appl. Relating to the Earth's Surface and Interior Jan. 1980  
p 171-173 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20758\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.

**THE SEASAT ALTIMETER HEIGHT BIAS USING FOUR BERMUDA OVERFLIGHTS**

R. Kolenkiewicz, Principal Investigator *In its Earth Survey Appl.*  
Div.: Res. Leading to the Effective Use of Space Technol. in  
Appl. Relating to the Earth's Surface and Interior Jan. 1980  
p 176-186 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 14B

**N80-20785\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.

**THE SPACEBORNE LASER RANGING SYSTEM**

W. D. Kahn, Principal Investigator *In its Earth Survey Appl.*  
Div.: Res. Leading to the Effective Use of Space Technol. in  
Appl. Relating to the Earth's Surface and Interior Jan. 1980  
p 303-308 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 20E

## GEOLOGY AND MINERAL RESOURCES

Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology.

**A80-21839** Digital processing of Landsat data of ice and snow areas at Vatnajökull, Iceland - A possibility for improved morphological tectonic interpretation (Digitale Verarbeitung von Landsat-Daten über Eis- und Schneegebieten des Vatnajökulls /Island/ - Eine Möglichkeit verbesserter morphologischer tektonischer Interpretation). U. Münzer and J. Bodechtel (Zentralstelle für Geo-Photogrammetrie und Fernerkundung, Munich, West Germany). *Bildmessung und Luftbildwesen*, vol. 48, Jan. 1, 1980, p. 21-28. 12 refs. In German.

Multitemporal Landsat scenes acquired over the Vatnajökull area in Iceland have been digitally enhanced. By applying simple enhancement techniques and linear combinations of MSS bands the known geotectonic pattern could be interpreted through the overlying icecover. This referred especially to NE-SW and NW-SE striking lineaments and to ringstructures associated to subglacial volcanos. (Author)

**A80-22433 #** Some application of Landsat imagery interpretation for petroleum targeting in India. D. Venkataramanan (Oil and Natural Gas Commission, Madras, India). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 911-923. 13 refs.

An assessment of the utility of space imageries in targeting for petroleum traps is presented. Interpretations of plotted lineaments in conjunction with geological, geomorphological, and geophysical data show that petroleum entrapment is more likely near the main boundary fault in the sub-Himalayan foothills which separate the fresh-water Siwalik sedimentary belt from the Pre-Tertiaries. It is concluded that in the southwestern West Bengal basin, a new geological model is proposed on imagery interpretation, and evidence is observed of the build-up in the basin of east-flowing rivers. A.T.

**A80-22435 #** An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands. P. W. Mause, L. H. Alger, and P. J. Madison (Indiana State University, Terre Haute, Ind.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 939-949. 10 refs.

July, 1975 Landsat data acquired from coal strip mine lands in western Indiana were analyzed using parametric and nonparametric clustering algorithms. A parametric minimum Euclidean distance and two nonparametric multidimensional histogram-oriented cluster programs were used in an unsupervised classification mode to identify strip mine features. The cluster classes developed from each one of the processors provided information of potential value for monitoring coal strip mine features. This information can be especially useful between periods of more intensive analysis. All the cluster programs tested identified basic strip mine features such as ungraded spoil, graded spoil, strip mine water, and various categories of reclaimed land. However, the nonparametric approach to cluster analysis of large areas requires 4-20 times less CPU time than the minimum Euclidean distance processor. The cost characteristics of the nonparametric cluster program used at the Indiana State University Remote Sensing Laboratory (ISURSL) make it more economically feasible to use than parametric clustering techniques for acquiring important information from large coal strip mine areas. (Author)

**A80-22441 #** Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults. R. Peterson (Nebraska, University, Lincoln, Neb.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 993-1014. 33 refs.

The system for exploration of oil and gas, described in the present paper, is based on the delineation of lineaments on remotely sensed images. By recognition of certain lineament patterns associated with bends in wrench faults, potential petroleum-bearing structures can be located. V.P.

**A80-22443 #** CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite. M. Viellefosse and J.-C. Favard (Centre National d'Etudes Spatiales, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1025-1033. 9 refs.

The study of ground thermal behavior can give useful information about subsoil characteristics and soil moisture. Interest in this field has led to the definition of the CITHARE project, the aim of which is to determine the feasibility of elaborating significant products for geological and hydrological purposes. The basis for such a study is to use many successive IR and visible pictures in order to assess thermal inertia over a given area. For that reason a meteorological geosynchronous satellite, such as SMS, GOES or METEOSAT, with its high temporal and stable coverage appears as a first choice data source. (Author)

**A80-22458 #** Optimum Landsat sun angles for extreme contrasts of terrain. C. A. Kitcho (Woodward-Clyde Consultants, San Francisco, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1213-1221.

12 refs.

Very low sun angles can hinder geologic interpretation of Landsat imagery because of the obscuring shadows caused by high relief contrast of terrain. Based on this observation during geologic interpretation of Landsat imagery of Alaska, this study was extended to include mountain ranges of various orientations and at different latitudes in the U.S. Optimum sun angles were derived, and guidelines for ordering correct Landsat images with minimal shadowing effect are presented. (Author)

**A80-22489 #** Application of Landsat in evaluation of selected earthquake prone areas. R. S. Punongbayan, E. G. Ramos, J. B. R. Lim, E. S. Bate, E. S. Elefan, and D. R. Guerrero (Ministry of Natural Resources, Natural Resources Management Center, Quezon City, Philippines). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1579-1590.

9 refs.

Preprocessing of Landsat scenes covering the Central Luzon Basin enhanced several lineaments believed to be alluvium-covered faults. The presence of these subsurface structural controls were evidenced by tonal variations, peculiar stream alignments and offsets, abrupt textural difference, and selective vegetation growths. The site is an extensive alluvium filled basin in northern Philippines. Its proximity to two earthquake-generating Benioff zones and the relative rarity of existing structural data within the basin, initiated re-analysis using Landsat MSS data. Preprocessing of the Landsat data such as band ratioing, transformation and contrast stretching were extensively used and the extracted lineament map was checked against cultural and structural data. This was coupled with earthquake recurrence maps to delineate areas where future surface dislocations may occur. (Author)

## 04 GEOLOGY AND MINERAL RESOURCES

**A80-22491 #** The applicability of remote sensing technique for geological and mineral exploration in Nepal. K. D. Bhattarai (Department of Mines and Geology, Kathmandu, Nepal). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1603-1608. 6 refs.

The applicability of remote sensing techniques for geological and mineralogical exploration in Nepal is discussed. Mineralization sites deduced from the fracture density contour map and lineament map are proposed, which include 182 sites from five regions, 18 of which are located around Katmandu. It is concluded that a possible relationship exists between linear features and drainage patterns.

C.F.W.

**A80-22510 #** Larger perspective for geomorphic studies on Landsat imagery - A case study: Andhra Pradesh, India. N. Bedi (National Remote Sensing Agency, Secunderabad, India). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1861-1870. 10 refs.

**A80-25152 #** The role of navigation satellites in oil exploration. J. G. Morgan (Chevron Geophysical Co., Houston, Tex.). In: Navigation satellite users; Proceedings of the National Aerospace Symposium, Springfield, Va., March 6-8, 1979.

Washington, D.C., Institute of Navigation, 1979, p. 119-126. 9 refs.

The paper examines the requirements of the oil and gas exploration communities for navigation and positioning (with particular reference to seismic surveys, well site surveys, and drilling vessel positioning) and describes the role played by the Transit satellite system in oil and gas exploration. Emphasis is placed on some problems facing the civil user of Transit, particularly the problem of the time gap between some satellite fixes.

B.J.

**A80-25159 #** GPS application to seismic oil exploration. C. Johnson and P. Ward (Texas Instruments, Inc., Dallas, Tex.). In: Navigation satellite users; Proceedings of the National Aerospace Symposium, Springfield, Va., March 6-8, 1979.

Washington, D.C., Institute of Navigation, 1979, p. 163-169.

The NAVSTAR Global Positioning System (GPS) is considered in terms of the requirements of the geophysical oil exploration industry. The suitability of the GPS for both marine and land surveys is discussed, as are receiver requirements in terms of C/A-code and P-code. It is noted that the space vehicles of the GPS provide a three-dimensional estimate of the user's position to 10 m and velocity to 0.01 m/s, as well as absolute GPS time to a few nanoseconds.

J.P.B.

**A80-25577** Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data. L. H. Alger, P. W. Mausel (Indiana State University, Terre Haute, Ind.), and R. R. Herner. In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 172-182. 9 refs.

The Indiana State University Remote Sensing Laboratory (ISURSL) has initiated a research program applied to evaluation of coal strip mine features in Indiana, Illinois, and Ohio using machine-assisted processing of Landsat MSS data. Specifically, two large strip mines in western Indiana were analyzed implementing both supervised and unsupervised non-parametric classification algorithms which were partially or totally developed at ISURSL. Nine classes of strip mine features were identified which included bare mine spoil, revegetated mine spoil, and water features in various physical states. An estimation of accuracy was made through comparison of the Landsat classification results with 1/30,000 scale

aerial photographs taken the same day as the Landsat pass. Class accuracies ranged from 73% to 96% with an overall accuracy of 85%. The non-parametric approaches to classification used at ISURSL provide coal strip mine feature information of comparable quality to that generated by commonly used parametric classification systems, but they require as little as one-fourth the computer time for analysis.

(Author)

**A80-26316 \*** Remote sensing data of SP mountain and SP lava flow in north-central Arizona. G. G. Schaber (U.S. Geological Survey, Branch of Astrogeologic Studies, Flagstaff, Ariz.), C. Elachi, and T. G. Farr (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing of Environment*, vol. 9, Mar. 1980, p. 149-170. 21 refs. Contract No. NAS7-100. NASA Order W-08619; NASA Order W-13130.

Multifrequency airborne radar image data of SP Mountain and SP flow in north-central Arizona were obtained in diverse viewing directions and direct and cross-polarization and compared with surface and aerial photography, Landsat multispectral scanner data, airborne thermal infrared imagery, surface geology, and surface roughness statistics. The extremely blocky, basaltic andesite of SP flow is brighter on direct-polarization K-band images than on cross-polarized images taken simultaneously. This effect is explained by multiple scattering and the strong wavelength dependence of polarization effects caused by the rectilinear basaltic andesite scatters. Two distinct types of surface relief on SP flow, one extremely blocky, the other subdued, are clearly discriminated on the visible and thermal wavelength images but are separable only on the longer wavelength L-band radar image data.

(Author)

**A80-26727 #** Study of geological and geophysical manifestations of horizontal stresses in the crust based on satellite imagery (Izucheniye geologo-geofizicheskikh proiavlennii gorizonta'nykh napriazhenii v kore s pomoshch'iu kosmicheskikh snimkov). G. Ia. Golizdra (Dnepropetrovskii Gornyi Institut, Dnepropetrovsk, Ukrainian SSR). *Geofizicheskii Sbornik*, no. 86, 1978, p. 83-88. 26 refs. In Russian.

Active longitudinal tectonic seams were detected in the region of the Don-Dnieper trough by analyzing small-scale satellite imagery. It is suggested that the asymmetric arrangement of the seams is due to long-time horizontal stresses directed from the south and the southwest. The tectonic-lines distribution is shown to be related to the structure of the Precambrian basement. The data obtained prove the importance of the greenstone belts in the crustal neotectonics.

V.L.

**A80-27456** An evaluation of landscape units. V. B. Ackerson and E. B. Fish (Texas Tech University, Lubbock, Tex.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Mar. 1980, p. 347-358. 19 refs. U.S. Department of the Interior Contract No. CX702960143. DI Project B-206-TEX.

Land system delineation based on photographic image tone, texture, and pattern was investigated as a technique for obtaining land classification entities for the Guadalupe Mountains National Park of west Texas. It was shown that the boundaries of the delineated units were real in terms of slope, vegetative, and geologic variables. In addition, research indicates that the delineated landscape units are distinct entities which display a greater degree of internal homogeneity than would a series of randomly configured units of similar size; furthermore, homogeneity involved the physical and biological composition of sites as well as the number of sites.

J.P.B.

**A80-32276 #** The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas (Primeneniye raznomasshtabnykh mnogozonal'nykh kosmicheskikh snimkov zemli pri geologicheskoi izuchenii neftegazonosnykh territorii). S. V. Atanasian and V. D. Skariatin. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 115-122. In Russian.

The paper considers the application of photogeological interpretation methods to the exploration of areas with oil and natural gas reserves; the use of multispectral (including IR scanner) satellite photographs of different scales is examined. Geological interpretations of the Persian Gulf area and of the Caucasus Mountains area are considered as examples. B.J.

**A80-32277 #** Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region (Kompleksnoe geologicheskoe deshifirovanie mnogoazonal'nykh skaner-nykh snimkov raiona oz. Il'men'). V. D. Skariatin, V. B. Sokolova, and E. A. Shuleshkina. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 122-128. In Russian.

Landsat 1 photographs of the Ilmen Lake region, taken on June 4, 1973, are interpreted. A geological map of the region is presented, and structures of the foundation of the Ilmen lowland are examined. B.J.

**N80-16398\*#** Geological Survey, Denver, Colo. **GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE** Progress Report, Sep. - Nov. 1979

Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Nov. 1979 20 p Sponsored by NASA ERTS (E80-10050; NASA-CR-162522) Avail: NTIS HC A02/MF A01 CSCL 08B

**N80-16410#** Department of Energy, Morgantown, W. Va. Energy Technology Center.

**GAS PRODUCTION OF DEVONIAN SHALE WELLS RELATIVE TO PHOTO LINEAMENT LOCATIONS: A STATISTICAL ANALYSIS**

J. F. Howard (Howard and Associates, Owensboro, Ky.), S. J. Lahoda (West Virginia Univ., Morgantown), W. E. Zirk (West Virginia Univ., Morgantown), and C. A. Komar Apr. 1979 19 p refs

(METC/CR-79/28) Avail: NTIS HC A02/MF A01

A pilot study was made to relate Devonian shale gas well production to distance from photo lineaments that were mapped at two different scales, namely low altitude (1:24,000) and intermediate altitude (1:62,500). Cumulative production after 5 years for 41 wells located in the Vicco quadrangle of Perry Co., Kentucky, was used in the study. A statistical two-way analysis of variance design was used to group the data into four classes depending on whether the producing wells were within or beyond 300 feet of a photo lineament derived from both scales. Results indicate that cumulative 5 year production is higher for wells sited within 300 feet of a low-altitude photo lineament. The correlations indicate a narrow zone of influence or effect for the geologic feature represented by the photo lineament. Moreover, the most consistently effective features are derived from low-altitude (1:24,000) scale photography, well below the detail commonly utilized in studies to date. DOE

**N80-16429#** Geological Survey, Reston, Va. **U.S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: YELLOWSTONE NATIONAL PARK**

Janet Bonner 1979 117 p refs (PB-301333/1) Avail: NTIS HC A06/MF A01 CSCL 08B

Computer listings of material available in photographic form showing scenes filmed by Skylab, LANDSAT, NASA aircraft, or on USGS mapping missions are presented. In the case of LANDSAT imagery, computer-compatible magnetic tapes are also available. A.R.H.

**N80-16430#** Geological Survey, Reston, Va. **U.S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS**

**AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: ROCKY MOUNTAIN NATIONAL PARK**

Janet Bonner comp. 1979 74 p (PB-301334/9) Avail: NTIS HC A04/MF A01 CSCL 08B

Photographs and images of biosphere reserves taken from spacecraft and aircraft provide a significant data base showing broad views and details of the landscape and are invaluable in searching for changes and trends in forest cover, water area, and other diagnostic landscape features. Each data report in this series lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

**N80-16651\*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**PROCESSING OF MULTISPECTRAL THERMAL IR DATA FOR GEOLOGIC APPLICATIONS**

Anne B. Kahle, Daryl P. Madura, and James M. Soha 15 Nov. 1979 43 p refs Original contains color illustrations

(Contract NAS7-100) (NASA-CR-162682; JPL-PUB-79-89) Avail: NTIS HC A03/MF A01 CSCL 08G

Multispectral thermal IR data were acquired with a 24-channel scanner flown in an aircraft over the E. Tintic Utah mining district. These digital image data required extensive computer processing in order to put the information into a format useful for a geologic photointerpreter. Simple enhancement procedures were not sufficient to reveal the total information content because the data were highly correlated in all channels. The data were shown to be dominated by temperature variations across the scene, while the much more subtle spectral variations between the different rock types were of interest. The image processing techniques employed to analyze these data are described. J.M.S.

**N80-18516\*#** Stanford Univ., Calif. Dept. of Geology. **HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA** Ernest I. Rich, Principal Investigator 21 Jan. 1980 2 p HCMM

(Contract NAS5-24479) (E80-10067; NASA-CR-162588) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. Detailed examination of Nite-IR images of intermontane basins in arid and/or semiarid areas of California discloses a ring or halo of relatively lighter greytone around the edges of each basin. Intermontane basins in the Northern Coast Range, however, do not show this thermal haloing. The topographic elevation of the haloes in arid basins shows seasonal variation, but it is present on nearly all images. A similar halo encircles many of the volcanoes on the Modoc Plateau and Southern Cascade Range. Although the halo around the arid intermontane basins can possibly be explained in relation to the location of alluvial fans (and perhaps water content of the rocks), a similar explanation cannot be made for the haloes around volcanoes or for the lack of haloes around basins in the Coast Range. Atmospheric thermal layering may be an alternative explanation; however, this explanation is also riddled with inconsistencies.

**N80-19603#** Wyoming Univ., Laramie. Dept. of Geology. **VIDEO PROCESSING OF REMOTE SENSOR DATA APPLIED TO URANIUM EXPLORATION IN WYOMING** Final Report Richard A. Levinson, Ronald W. Marrs, and Fred Crockett 30 Jun. 1979 223 p refs

(Contracts EY-76-C-13-1648; F(05-1)-1648) (GJBX-171(79)) Avail: NTIS HC A10/MF A01

LANDSAT satellite imagery and aerial photography, used to map areas of altered sandstone associated with roll-front uranium deposits, must be enhanced so that alteration spectral contrasts can be seen. Video image processing is a fast, low-cost, and

## 04 GEOLOGY AND MINERAL RESOURCES

efficient tool. For LANDSAT data, the 7/4 ratio produces the best enhancement of altered sandstone. The 6/4 ratio is most effective for color infrared aerial photography. Samples from Pumpkin Buttes show that iron is the primary coloring agent which makes alteration visually detectable. Eh and pH changes associated with passage of a roll front cause oxidation of magnetic and pyrite to hematite, goethite, and limonite in the host sandstone, thereby producing the alteration. Statistical analysis show that the detectability of geochemical and color zonation in host sands is weakened by soil-forming processes. Alteration can only be mapped in areas of thin soil cover and moderate to sparse vegetative cover. DOE

**N80-20301#** Army Electronics Research and Development Command, White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

### **SATELLITE CALIBRATION DATA, ANNUAL DATA REPORT Progress Report, Jan. - Dec. 1977**

L. I. Murillo and L. Edwin Williamson Aug. 1979 406 p (DA Proj. 1L1-62111-AH-71)  
(AD-A075602; ERADCOM/ASL-DR-79-0001) Avail: NTIS HC A18/MF A01 CSCL 22/2

This report contains data from observations of meteorological and radiative parameters at selected satellite calibration target sites. These sites include the highly reflective gypsum field in southcentral New Mexico, a dark lava surface, a nearby fresh water reservoir and over desert terrain. The report also contains narrative descriptions of the instruments in use at the target sites. GRA

**N80-20724\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **GEOBOTANICAL EXPLORATION**

M. Labovitz, E. Masuoka, and A. Siegrist, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 2-4 refs ERTS*

Avail: NTIS HC A14/MF A01 CSCL 06C

**N80-20725\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **GEOLOGICAL/GEOPHYSICAL RESOURCE ASSESSMENT**

R. C. Belcher, V. Gornitz, E. J. Masuoka, and K. T. Meehan, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 5-17 ERTS*

Avail: NTIS HC A14/MF A01 CSCL 08F

**N80-20730\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **REGIONAL MODELING: THE KENTUCKY ANOMALY**

M. A. Mayhew, H. H. Thomas, and P. J. Wasilewski, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 54-60 ref ERTS*

Avail: NTIS HC A14/MF A01 CSCL 08F

**N80-20732\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **INTERPRETATION OF GEOID ANOMALIES IN THE VICINITY OF SUBDUCTION ZONES**

D. C. McAdoo, Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 63-67 refs ERTS*

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20733\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **GLOBAL GEOLOGY AND GEOPHYSICS USING SATELLITE-DERIVED DATA**

Herbert Frey, Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in*

*Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 68-69 ref ERTS 11-43)*

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20734\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **GEOPHYSICAL ATLAS**

P. D. Lowman, Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 70-72 refs ERTS*

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20735\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **COMPARATIVE PLANETOLOGY/CRUSTAL EVOLUTION**

Herbert Frey, Principal Investigator and P. D. Lowman, Jr. *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 73-74 refs ERTS*

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20736\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **CRUSTAL DEFORMATION: CRUSTAL DYNAMICS PROJECT**

H. Frey, R. J. Allenby, and P. D. Lowman, Jr., Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 77-80 ref ERTS*

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20737\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **INVESTIGATION OF CRUSTAL DYNAMICS USING VLBI**

Chopo Ma and James W. Ryan, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 81-83 ERTS*

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20738\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **CRUSTAL STRUCTURE AND DYNAMICS OF SOUTHEASTERN US**

R. J. Allenby and M. A. Mayhew, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 84-85 refs ERTS*

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20739\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **PLATE BOUNDARY DEFORMATION IN CALIFORNIA**

P. D. Lowman, Jr., Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 86-95 Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS*

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20740\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

### **ON THE SELECTION OF STATION SITES FOR OBSERVING STRAIN STREPS AND EARTHQUAKE FORERUNNERS IN CALIFORNIA**

H. S. Liu, Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl.*

Relating to the Earth's Surface and Interior Jan. 1980 p 96-97  
 refs ERTS  
 Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20743\*#** National Aeronautics and Space Administration.  
 Goddard Space Flight Center, Greenbelt, Md.  
**EARTHQUAKE AND CRUSTAL DEFORMATION STUDIES**  
 S. C. Cohen, Principal Investigator *In its Earth Survey Appl.*  
 Div.: Res. Leading to the Effective Use of Space Technol. in  
 Appl. Relating to the Earth's Surface and Interior Jan. 1980  
 p 103-108 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20744\*#** National Aeronautics and Space Administration.  
 Goddard Space Flight Center, Greenbelt, Md.

**GLOBAL INTRA-PLATE VOLCANISM**  
 Han-Shou Liu, Principal Investigator *In its Earth Survey Appl.*  
 Div.: Res. Leading to the Effective Use of Space Technol. in  
 Appl. Relating to the Earth's Surface and Interior Jan. 1980  
 p 109-110 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 08G

**N80-20745\*#** National Aeronautics and Space Administration.  
 Goddard Space Flight Center, Greenbelt, Md.

**DEVELOPMENT OF A SEISMIC DATA COLLECTION PLATFORM**  
 W. J. Webster, Jr. and R. J. Allenby, Principal Investigators *In its Earth Survey Appl.* Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 111-113 ref ERTS

Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20746\*#** National Aeronautics and Space Administration.  
 Goddard Space Flight Center, Greenbelt, Md.

**CRUSTAL MOTION MEASUREMENTS IN CALIFORNIA (SAFE)**  
 D. E. Smith, Principal Investigator *In its Earth Survey Appl.*  
 Div.: Res. Leading to the Effective Use of Space Technol. in  
 Appl. Relating to the Earth's Surface and Interior Jan. 1980  
 p 114-115 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08K

**N80-20764\*#** National Aeronautics and Space Administration.  
 Goddard Space Flight Center, Greenbelt, Md.

**SURFACE MINE MONITORING**  
 J. R. Irons, Principal Investigator *In its Earth Survey Appl.* Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 213-215 ERTS

Avail: NTIS HC A14/MF A01 CSCL 08I

**N80-20787\*#** National Aeronautics and Space Administration.  
 Lewis Research Center, Cleveland, Ohio.

**ASSESSMENT OF SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA FOR STRIP-MINE MONITORING**

Ernie W. Spisz and Joyce T. Dooley Washington Mar. 1980  
 39 p Original contains color illustrations  
 (NASA-TM-79268; E-187) Avail: NTIS HC A03/MF A01 CSCL 08I

The application of LANDSAT multispectral scanner data to describe the mining and reclamation changes of a hilltop surface coal mine in the rugged, mountainous area of eastern Kentucky is presented. Original single band satellite imagery, computer enhanced single band imagery, and computer classified imagery are presented for four different data sets in order to demonstrate the land cover changes that can be detected. Data obtained with an 11 band multispectral scanner on board a C-47 aircraft at an altitude of 3000 meters are also presented. Comparing the satellite data with color, infrared aerial photography, and

ground survey data shows that significant changes in the disrupted area can be detected from LANDSAT band 5 satellite imagery for mines with more than 100 acres of disturbed area. However, band-ratio (bands 5/6) imagery provides greater contrast than single band imagery and can provide a qualitative level 1 classification of the land cover that may be useful for monitoring either the disturbed mining area or the revegetation progress. However, if a quantitative, accurate classification of the barren or revegetated classes is required, it is necessary to perform a detailed, four band computer classification of the data. J.M.S.

**N80-20803#** Lockheed Electronics Co., Inc., Las Vegas, Nev. Remote Sensing Lab.

**COMPUTER PROCESSING OF MULTISPECTRAL SCANNER DATA OVER COAL STRIP MINES Final Report, 1 Jan. - 30 Jun. 1978**

Charles E. Tanner Mar. 1979 62 p refs  
 (Contract EPA-68-03-2636)

(PB80-111677; EPA-600/7-79-080) Avail: NTIS HC A04/MF A01 CSCL 08I

Aircraft multispectral scanner data acquired over six coal strip mines in the states of Wyoming, Montana, Colorado, and Arizona were processed on the Data Analysis System (DAS) using a clustering approach to automatic pattern recognition. The classification results demonstrated that a level one hierarchy of vegetation features, manmade features, and disturbed areas could be easily obtained with a minimum amount of time. GRA

**N80-21925#** National Technical Information Service, Springfield, Va.

**TECTONICS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1975 - Feb. 1980**

Audrey S. Hundemann Feb. 1980 273 p Supersedes NTIS/PS-79/0089; NTIS/PS-78/0082; NTIS/PS-77/0088 (PB80-804529; NTIS/PS-79/0089; NTIS/PS-78/0082;

NTIS/PS-77/0088) Avail: NTIS HC \$30.00/MF \$30.00 CSCL 08G

Abstracts dealing with plate tectonics, remote sensing of terrain features, geologic faults, ocean bottom spreading, geomagnetic anomalies, paleomagnetism, and geomorphology are cited. This updated bibliography contains 266 abstracts, 26 of which are new entries to the previous edition. GRA

## OCEANOGRAPHY AND MARINE RESOURCES

Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

**A80-21454** # **Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data.** F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King (Research Triangle Institute, Research Triangle Park, N.C.). *Journal of Geophysical Research*, vol. 84, Dec. 20, 1979, p. 7749-7768. 21 refs. Contract No. EG-77-C-05-5444.

Satellite infrared data and in situ data were combined to study synoptic-scale and mesoscale fronts in the Gulf of Mexico in the period 1973-1977. Deep northward penetrations of the Loop Current were noted in the winter, and a major warm gyre developed in the winter, 1974. Other major warm gyres were seen to develop in the early spring (1974 and 1977). In all cases, a very large meander developed off the southern part of the west Florida shelf prior to the development of the major warm gyre. Smaller meanders were seen to move along the Loop Current boundary at an average speed of 28 km/day and with an average wavelength of 210 km. (Author)

**A80-21963** # **The ocean observed with microwaves (El oceano observado con microondas).** C. Romeu Nedwed (Instituto de Investigaciones Pesqueras, Barcelona, Spain). *Ibérica*, vol. 57, Feb. 1979, p. 44-50. In Spanish.

Satellite microwave observation, is discussed, including active (radar) and passive (radiation) systems, microwave radiometers, and scatterometer teledetection. Although microwave systems allow day and night observation independent of meteorologic conditions, as well as 3-dimensional information, they suffer from low resolution and high cost. J.P.B.

**A80-22383** # **Remote sensing of ocean circulation using a satellite-borne radar altimeter.** B. C. Douglas and P. D. Gaboriski (NOAA, National Ocean Survey, Rockville, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 81-91. 6 refs.

Altimeter data from collinear passes of GEOS-3 and Seasat satellites in the western Atlantic are reviewed, with particular attention given to the elimination of satellite ephemeris error and gravimetric geoids and other reference surfaces. It is found that, in general, repeated passes of satellite altimeter data provide a good means for investigating changes in the sea surface topography and hence the underlying circulation that produces the topography. In some areas where gravimetric data are plentiful a gravimetric geoid can be used directly as the reference surface. In addition, infrared observations of the ocean surface are an important source of data for the verification of features. B.J.

**A80-22384** # **The feasibility of measurement of ocean surface currents using synthetic aperture radar.** R. A. Shuchman, A. Klooster (Michigan, Environmental Research Institute, Ann Arbor, Mich.), C. L. Rufenach (NOAA, Wave Propagation Laboratory, Boulder, Colo.), and F. I. Gonzalez (NOAA, Pacific Marine Environmental Laboratory, Seattle, Wash.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 93-102. 8 refs. Grant No. NOAA-A01-78-00-4822.

The paper discusses a technique which involves the measurement of ocean surface current velocity by the use of SAR Doppler signal history; radial (line of sight) velocities of currents shift the Doppler history, and it is this shift that is measured and exploited to obtain the horizontal current velocity. X- and L-band SAR data from

near-shore and Gulf Stream ocean surfaces have been obtained on the basis of the Doppler shift of moving ocean scatterers relative to stationary scatterers. Currents deduced from these Doppler shift calculations were found to be consistent with available sea truth gathered during the Marineland Experiment. Furthermore, SAT-Seasat data of the Columbia River, Oregon is being evaluated to assess the potential of using SAR to map ocean surface currents. B.J.

**A80-22385** # **Radar and ship observations of coastal sea surface roughness patterns in the Gulf of Georgia.** J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada) and B. A. Hughes (Defence Research Establishment Pacific Esquimalt, British Columbia, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute, 1979, p. 103-115.

High resolution sea surface height and slope measuring equipment was deployed in the Gulf of Georgia, British Columbia, Canada, in the period July 12 to 30, 1978 at the times of SEASAT overpasses. In simultaneous overflights, the ERIM X and L band radar gave images, some of which showed extensive surface roughness modulation patterns caused by internal waves. This paper presents a comparison of the radiometric intensities observed on radar imagery with the measurements made along the ship's track and discusses the analysis techniques involved. (Author)

**A80-22406** # **Geostationary and orbiting satellites applied to remote ocean buoy data acquisition.** E. G. Kerut (NOAA, Data Buoy Office, Bay St. Louis, Miss.) and G. Haas (Sperry Rand Corp., Bay St. Louis, Miss.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 519-533. 17 refs.

The paper examines the need for evolutionary development and implementation of a global environmental measurement/monitoring system for the understanding and study of climate processes. It is noted that with the advent of geostationary and polar-orbiting satellites, the technology is now available to collect environmental data on a global basis from surface stations. It is shown that remote sensing of oceanographic and meteorological data by space-derived measurements will provide descriptions of planetary scale phenomena. In addition, moored and drifting buoy systems, in conjunction with space measurement systems, will enhance and complement the data products available from individual systems. M.E.P.

**A80-22410** # **Shallow-water reflectance modeling with applications to remote sensing of the ocean floor.** D. R. Lyzenga (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 583-602. 12 refs. Contract No. N00014-78-C-0458.

**A80-22411** # **Synthetic aperture radar modeling of surface ocean waves.** R. A. Shuchman, A. Klooster (Michigan, Environmental Research Institute, Ann Arbor, Mich.), and A. L. Maffett (Michigan, University, Dearborn, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 603-627. 20 refs. Contract No. N00014-76-C-1048.

The study draws together analytical and experimental results based on a combination of static and dynamic models explaining wave imagery obtained with a synthetic aperture radar (SAR). The observation of moving ocean, imaged by a SAR and studied in a SAR optical correlator supports a theory that the ocean surface appears relatively stationary in the absence of currents. The reflecting surface is most likely moving slowly (i.e., capillaries, wave, phase velocity, and orbital wave velocities) relative to the phase velocity of the large gravity waves. V.T.

## 05 OCEANOGRAPHY AND MARINE RESOURCES

**A80-22416 #** Assessment of tidal wetland habitat and productivity. D. S. Bartlett and V. Klemas (Delaware, University, Newark, Del.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 693-701. 19 refs.

The use of remote sensing in the quantitative assessment of wetland habitats is reviewed. Attention is given to the processes and difficulties associated with the spectral mapping of emergent plant species composition, the evaluation of plant biomass production, and problems associated with the use of aerial photography, radiometers and Landsat MSS data. It is concluded that remote sensing has established its utility in the delineation of wetland boundaries and the identification of species composition to infer tidal and salinity regimes and animal habitats. Further research on the spectral characteristics of wetlands and an improvement in the reliability and availability of atmospheric correction methodologies is needed, however, to enable the widespread spectral estimation of wetland biomass production. A.L.W.

**A80-22417 #** A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances. S. Tassan, B. Sturm, and E. Diana (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 713-727. 11 refs.

A specific feature of remote sensing of water bodies is the low value of typical water upwelling radiances. Only a minor part of the radiance measured by satellite or airborne sensors contains information about the water itself and substances in the water. The major part, originating from atmospheric scattering, as well as sun and sky glitter (in the following called atmospheric effects), must be determined and subtracted from the total signal. This correction is, however, difficult to make with adequate accuracy. The paper reports the results from a sensitivity study of atmospheric effects on remote sensing of chlorophyll in water. (Author)

**A80-22418 #** Remote sensing of living marine resources. A. J. Kemmerer (NOAA, National Fisheries Engineering Laboratory, Bay St. Louis, Miss.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 729-738. 26 refs.

A review of direct and indirect forms of remote sensing for living marine resources is provided. Direct forms range from visual spotting of marine animals from aircraft to satellite tracking of individual animals, and monitoring of fishing activities. Four satellite investigations are reviewed which relied on indirect forms of remote sensing to infer distribution patterns of coastal fish and to infer surface circulation patterns for estimates of fish yields. Satellite systems emphasized include Landsat, Skylab, Nimbus-6, Seasat-A, and Tiros. (Author)

**A80-22434 #** The use of models for predicting ice floes in Baffin Bay. B. Dey and A. F. Gregory (Gregory Geoscience, Ltd., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 933-937. 9 refs.

In this study, geometrically corrected and enlarged NOAA-VHRR images for July 1977 have been used for observing ice motion in Baffin Bay. The observed velocities and directions of forty-four ice floes were compared with predicted values from the existing model by Zubov (1943). Floe predictions with other models, such as Skiles

and Neralla et al., are underway. The observed values of velocity and direction of ice floes show large deviations from predictions by Zubov's model. The deviation may result from several variables that affect the floe drift and which were not included in Zubov's model. (Author)

**A80-22447 #** IR enhancement techniques to delineate surface temperature and sea-ice distributions. K. Ahlmas (Alaska, University, Fairbanks, Alaska). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1067-1076. Contract No. NOAA-03-5-022-56.

The theories behind different types of enhancements, like the single scale, multiple scale and some modifications to obtain special identity, are explained with graphs and examples. To show the usefulness of various kinds of enhancements, some applications for special fields such as (1) water masses and coastlines, (2) oceanic eddies, and (3) sea ice are treated. Within each field specific cases are analyzed in detail. (Author)

**A80-22448 #** Verification of synthetic aperture radar focusing algorithms on ocean waves. E. S. Kasischke, A. Klooster, and R. A. Shuchman (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1077-1092. 10 refs. Contract No. NOAA-7-35328.

A method is presented where radar backscatter signals from ocean waves can be measured and quantified (this methodology is referred to as modulation depth calculations). A brief discussion of the theoretical algorithms needed to correct for the velocity induced defocusing in SAR imagery of ocean waves is presented. A statistical analysis of modulation depth calculations showed X-Band (3.2 cm) data to be relatively insensitive to azimuth focusing attempts. The analysis showed L-band (23.5 cm) data to be sensitive to both azimuth and range focusing attempts. (Author)

**A80-22449 #** Enhancement of Landsat imagery for the monitoring of coastal waters - Application to the southern part of the North Sea. M. Viollier and N. Baussart (Lille I, Université, Villeneuve-d'Ascq, Nord, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1093-1105. 10 refs. Research supported by the Centre National de la Recherche Scientifique and Centre National d'Etudes Spatiales.

The paper examines how Landsat products have been improved by specific data processing, in order to monitor the quality of coastal waters. The methods of treatment covered are: (1) improvement of the signal-to-noise ratio, (2) atmospheric correction which takes into account Rayleigh scattering, and (3) the differences between the reflectances in MSS 5 and 6 bands. M.E.P.

**A80-22464 #** Landsat bathymetric mapping by multi-temporal processing. F. C. Polcyn and D. R. Lyzenga (Michigan, Environmental Research Institute, Ann Arbor, Mich.). (*Symposium on Measurement, Mapping, and Management in the Coastal Zone, New York, N.Y., May 21-23, 1979.*) In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1269-1276. 6 refs.

A recent test of modern methodology was made for selected portions of the Chagos Archipelago. A corrected chart of this area, based on photographic interpretation of Landsat-2 data, is presented, showing a new reef that was detected approximately 9 miles east of Speaker's Bank (named Colvocoresses Reef). Using techniques tested in the Bahamian Photobathymetric Calibration Range, computer depth charts were prepared, making use of basic physical parameters. V.P.

**A80-22466 #** Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries. R. T. Biña and E. R. Ombac (Ministry of Natural Resources, Natural Resources Management Center, Quezon City, Philippines). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1293-1308. 5 refs.

Effects of tidal fluctuation on the spectral characteristics of submerged reef areas were investigated through digital analysis of Landsat temporal images. Statistical comparisons and analyses were made on selected training areas as well as on different classification categories regarding differences in radiometric characteristics and area measurements. Results indicate the various spectral pattern changes in relation to tidal level variations. (Author)

**A80-22495 #** Spatial and temporal variations in lagoon and coastal processes of the southern Brazilian Coast. R. Herz (São Paulo, Universidade; Conselho Nacional de Pesquisas, Instituto de Pesquisas Espaciais, São Paulo, Brazil). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1643-1656. 18 refs.

**A80-22496 #** Marine pollution analysis in Tokyo Bay by Landsat 1 and 2. S.-I. Saitoh (Hokkaido University, Hakodate, Japan), J. Iisaka (IBM Japan, Ltd., Tokyo, Japan), and O. Asaoka (Meteorological Agency, Meteorological Research Institute, Tokyo, Japan). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1657-1679. 21 refs.

In the present study, marine pollution in Tokyo Bay has been analyzed by using multi-temporal Landsat MSS data from 1972 to 1976. Oceanographic conditions and pollution distributions were able to be interpreted by generating various kinds of imageries. Moreover, it was possible to determine quantitatively the change of marine pollution over a four year period by using chronological Landsat data in combination with other environmental information. As a result of this study, the recent report that marine pollution has improved since 1972 was supported. (Author)

**A80-22506 #** Remote sensing of the sea around Singapore. Y. J. Chong, T. Y. Liang, A. C. Yeo, and V. K. Vong (University of Singapore, Singapore). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1807-1814. 9 refs.

Knowledge of the condition of the sea around Singapore is of great importance to Singapore. Remote sensing offers a synoptic view of a very large area and would be very useful in supplementing ground level studies. To determine the usefulness of remote sensing methods an analysis is carried out of Landsat multispectral scanner data on computer compatible tapes. The investigation covers areas in the coastal regions as well as in the open sea. Examples are given to show how Landsat imagery may be used to obtain information on changes in shoreline, dispersal patterns of pollution discharged by rivers, submerged coral reefs, and depth in clear shallow waters. (Author)

**A80-22941 \*** Gulf stream ground truth project - Results of the NRL airborne sensors. C. R. McClain (NASA, Goddard Space Flight Center, Applications Directorate, Greenbelt, Md.; U.S. Navy, Naval Research Laboratory, Washington, D.C.), D. T. Chen, and D. L. Hammond (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Ocean Engineering*, vol. 7, no. 1, 1980, p. 55-97. 15 refs. NASA Order P-62257-G; NAVAIR Task A370/370C/058B.

Results of an airborne study of the waves in the Gulf Stream are presented. These results show that the active microwave sensors (high-flight radar and wind-wave radar) provide consistent and accurate estimates of significant wave height and surface wind speed, respectively. The correlation between the wave height measurements of the high-flight radar and a laser profilometer is excellent. (Author)

**A80-22942 \*** Spectral distortion inherent in airborne profilometer measurements of ocean wave heights. D. L. Hammond (U.S. Navy, Naval Research Laboratory, Washington, D.C.) and C. R. McClain (NASA, Goddard Space Flight Center, Sensor Development Branch, Greenbelt, Md.). *Ocean Engineering*, vol. 7, no. 1, 1980, p. 99-108. 13 refs. NASA Order P-62257-G; NAVAIR Task A370/370C/058B.

A theoretical analysis of the performance characteristics of an airborne profilometer is presented. The analytical characteristics are shown to agree with those of the prototype. Results show that both the wave spectra and the dominant wave heading can be determined using the airborne profilometer. (Author)

**A80-23286** Spatial Gauss-Markov models of ocean currents. S. K. Jordan (Geospace Systems Corp., Brookline, Mass.) and G. N. Sherman (Analytic Sciences Corp., Reading, Mass.). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-15, Nov. 1979, p. 874-881. 18 refs.

Ocean currents are an important error source in marine inertial navigation systems (INS). Satellite radar altimeter data are used to construct self-consistent Gauss-Markov models of ocean currents. These models are useful for INS error analysis and optimal (Kalman) filtering of INS outputs. (Author)

**A80-24546** Gulf stream ring trajectories. P. L. Richardson. *Journal of Physical Oceanography*, vol. 10, Jan. 1980, p. 90-104. 21 refs. NSF Grants No. OCE-75-08765; No. OCE-76-82059; Contract No. N00014-74-C-0262. NR Project 083-004.

The movement of 2 anticyclonic and 12 cyclonic Gulf Stream (GS) rings was measured with satellite-tracked free-drifting buoys, revealing frequency strong interactions between rings and the GS. Rings that were not touching the Stream generally moved westward with typical speeds of 5 cm/s, and rings that were attached to the Stream generally moved downstream with speeds up to 75 cm/s. Frequently rings coalesced with the GS and either turned into open meanders, were advected downstream, or interacted with the GS, exchanged water and energy, and reformed as modified rings. J.P.B.

**A80-25153 #** Use of satellite navigation by tuna seiners. J. D. Luse (Navigation Communication Systems, Inc., Chatsworth, Calif.) and L. Chicami. In: Navigation satellite users; Proceedings of the National Aerospace Symposium, Springfield, Va., March 6-8, 1979. Washington, D.C., Institute of Navigation, 1979, p. 127-132. 5 refs.

The paper deals with the use of satellite navigation by tuna purse-seiners. The satellite navigation equipment includes one NCS Model 2900N1 and one NCS Model 2800, both utilizing single-channel transit satellite tracking receivers and a microprocessor-based computer. It is noted that about 800 satellite navigation equipments are used in the tuna fleet for the following purposes: (1) enroute navigation, (2) searching for tuna schools, (3) returning precisely to logs or other locations, (4) estimating drift or current in fishing area, and (5) staying out of other countries' territorial waters. It is found that up to 2% of distance run can be saved by the use of satellite navigation. The other benefits include the determination of log positions with an accuracy of 0.5 miles or better, and the determination of set and drift with an accuracy of a few tenths of a knot. The use of satellite navigation equipment can result in cost reductions and/or increased production up to \$120,000 per year.

L.M.

## 05 OCEANOGRAPHY AND MARINE RESOURCES

**A80-25327** Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978, Proceedings. Parts 1, 2 & 3. Colloquium sponsored by the Inter Union Commission on Radio Meteorology. Edited by J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada). *Boundary-Layer Meteorology*, vol. 18, Feb.-May, 1980. Feb., 190 p.; Mar., 102 p.; May, 124 p.

Topics presented include passive radiometry of the ocean from space, atmospheric corrections to passive microwave observations of the ocean, and arctic sea-ice variation from time-lapse passive microwave imagery. Also discussed are oceanographic implications of features in NOAA satellite visible imagery, applications of a two-flow model for remote sensing of substances in water, and atmospheric effects in the remote sensing of phytoplankton pigments. C.F.W.

**A80-25328** Passive radiometry of the ocean from space - An overview. E. P. McClain (NOAA, National Environmental Satellite Service, Washington, D.C.). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Feb. 1980, p. 7-24. 35 refs.

A brief description of unmanned earth-observation platforms in space, and their ocean-related radiometric instrumentation, is given. Both operational and research-type spacecraft, current and near-future, are discussed. Some recent oceanographic studies and applications are reviewed, including the following topics: sea surface temperature, sea ice, ocean surface roughness and near-surface wind, and ocean color. (Author)

**A80-25329 \*** Passive microwave remote sensing of the ocean - A review. C. T. Swift (NASA, Langley Research Center, Hampton, Va.). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Feb. 1980, p. 25-54. 29 refs.

This paper reviews the current status of passive microwave remote sensing of the ocean. The physics of emission and instrumentation are highlighted in order to establish a relationship between the thermal emission and retrieved geophysical parameters. A discussion then follows on measurements of temperature, salinity, windspeed, etc. using passive microwave systems. These measurements are related to the accuracy and spatial resolution required by the users. The status of passive microwave remote sensing is summarized and recommendations for future research are presented. (Author)

**A80-25330** Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry. A. E. Basharinov and A. M. Shutko (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Feb. 1980, p. 55-64. 15 refs.

**A80-25333 \*** Arctic sea-ice variations from time-lapse passive microwave imagery. W. J. Campbell (U.S. Geological Survey, Reston, Va.), R. O. Ramseier (Department of the Environment, Ottawa, Canada), H. J. Zwally, and P. Gloersen (NASA, Goddard Space Flight Center, Greenbelt, Md.). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Feb. 1980, p. 99-106. 19 refs. NOAA-supported research.

This paper presents: (1) a short historical review of the passive microwave research on sea ice, which established the observational and theoretical base permitting the interpretation of the first passive microwave images of earth obtained by the Nimbus-5 ESMR; (2) the construction of a time-lapse motion picture film of a 16-month set of serial ESMR images to aid in the formidable data analysis task; and

(3) a few of the most significant findings resulting from an early analysis of these data, using selected ESMR images to illustrate these findings. (Author)

**A80-25334** The aqueous thermal boundary layer. K. B. Katsaros (Washington, University, Seattle, Wash.). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Feb. 1980, p. 107-127. 105 refs. Contract No. N00014-75-C-0502.

This article reviews the available data, measurement techniques, and present understanding of the millimeter thick aqueous thermal boundary layer. A temperature difference between the surface and lower strata of the order of a few tenths to -1 C have been observed. Techniques ranging from miniature mercury thermometers and electrical point sensors to optical interferometry and infrared radiometry have been employed. Many processes influence the temperature structure in this thin boundary layer. Among them are: the net upward heat flux due to evaporation and sensible heat transfer; infrared and solar radiation; and the turbulence near the interface due to wind mixing, wave breaking and current shear. Presence of solute and surface-active materials stimulate or dampen these mixing processes thereby influencing boundary-layer thickness and temperature structure. (Author)

**A80-25336** Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations. O. B. Brown and R. H. Evans (Miami, University, Coral Gables, Fla.). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Mar. 1980, p. 145-157. 17 refs. NSF Grant No. OCD-73-00214; Contract No. N00014-75-00173.

**A80-25337** Oceanographic implications of features in NOAA satellite visible imagery. P. E. La Violette (U.S. Navy, Bay Saint Louis, Miss.), S. Peteherych (Department of the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada), and J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Mar. 1980, p. 159-175. 29 refs.

The paper examines the ocean-related samples of NOAA visible imagery and the geometric patterns in the infrared imagery. Data from the Grand Banks Experiment show that the sunglint features of this imagery are related to strong frontal processes in the area; although some features may be associated with fog or mist, the side-looking airborne radar imagery confirms the presence of surface roughness variations. The observations suggest that these roughness variations are due to changes in the stability of the atmospheric boundary layer caused by the different surface water temperatures in the area. A.T.

**A80-25338** In-water and remote measurements of ocean color. A. Morel (Laboratoire de Physique et Chimie Marines, Villefranche-sur-Mer, Alpes-Maritimes, France). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Mar. 1980, p. 177-201. 26 refs. Centre National d'Exploitation des Océans Contract No. 77/1695; Centre National de la Recherche Scientifique Contracts No. RCP-247; No. ERA-278.

The paper discusses the in-water and remote measurements of ocean color obtained from the spectral measurements of downwelling and upwelling irradiance above and below the surface. Typical results for water of various turbidities and phytoplankton content are presented; the magnitudes of the useful signal emerging from the water, and of the additional signals due to special reflection at the interface and to atmospheric scattering are compared on the basis of the spectroradiometric measurements performed within and above the sea from various altitudes. A.T.

**A80-25340** Applications of a two-flow model for remote sensing of substances in water. R. Doerffer (Hamburg, Universität, Hamburg, West Germany). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Mar. 1980, p. 221-232. 12 refs. Research supported by the Deutsche Forschungsgemeinschaft.

A two-flow radiative transfer model is presented for a study of the relationship between substances in water and the backscattered radiation field. It is shown that assuming a diffuse radiative input into a water body, the irradiance attenuation coefficient can be considered as an inherent property. A cuvette system is presented which can determine the attenuation coefficient, the absorption coefficient, and the backscattering coefficient of various substances. The model can check the applicability of a remote sensing technique for specific parameters; the inversion of the model can estimate concentrations in water from the backscattered radiation. A.T.

**A80-25342** An algorithm for remote sensing of water color from space. M. Viollier, D. Tanré, and P. Y. Deschamps (Lille I, Université, Villeneuve-d'Ascq, Nord, France). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, May 1980, p. 247-267. 21 refs. Research supported by the Centre National de la Recherche Scientifique and Centre National d'Etudes Spatiales.

The ocean color algorithm proposed in this paper takes into account the effects of Rayleigh and aerosol scattering. The inherent reflectance and the diffuse transmittance of the Rayleigh atmosphere are expressed as functions of optical thickness and satellite measurement geometry with the aid of simple and accurate formulas. In the case of a turbid atmosphere, from which the aerosol optical thickness is unknown, the aerosol contribution is estimated with the aid of a measurement in a channel where the ocean is a blackbody (in the red or near infrared). If the relationship between the ocean color and the chlorophyll-like pigment concentration is assumed to be known at sea level, it is shown that the chlorophyll-like pigment concentration at an open ocean site can be determined from space to within a factor of 1.5 to 3 (uncertainty equal to 0.2 to 0.5 log interval), depending on the atmospheric turbidity. (Author)

**A80-25343** Gulf of Mexico, ocean-color surface-truth measurements. R. W. Austin (California, University, La Jolla, Calif.). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, May 1980, p. 269-285. 7 refs. Grant No. NOAA-04-6-158-44033.

In October 1977, a major remote sensing experiment was conducted in the Gulf of Mexico, in preparation for the launch of NIMBUS-7 which carried the Coastal Zone Color Scanner. Two major vessels obtained surface-truth measurements, while two jet aircraft at altitudes of 12.5 and 19.5 km obtained images of the surrounding ocean in 10 spectral bands. Measurements obtained in the surface water from the NOAA vessel *Researcher* of the spectral downwelling irradiances, upwelling radiances, attenuation and scattering properties are described. (Author)

**A80-25345 \*** Atmospheric effects in the remote sensing of phytoplankton pigments. H. R. Gordon and D. K. Clark (NOAA, National Environment Satellite Service, Washington, D.C.). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Mar. 1980, p. 299-313. 22 refs. Contract No. NAS5-22963.

The accuracy with which relevant atmospheric parameters must be estimated to derive phytoplankton pigment concentrations of a given accuracy, from measurements of the ocean's apparent spectral radiance at satellite altitudes, is examined. A phytoplankton pigment algorithm is developed which relates the pigment concentration (c)

to the three ratios of upwelling radiance just beneath the sea surface which can be formed from wavelengths ( $\lambda$ ) 440, 520 and 550 nm. C.F.W.

**A80-25346 \*** A design study for an advanced ocean color scanner system. H. H. Kim, R. S. Fraser, L. L. Thompson (NASA, Goddard Space Flight Center, Greenbelt, Md.), and O. Bahethi (Science Applications and Systems, Inc., Lanham, Md.). (*Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.*) *Boundary-Layer Meteorology*, vol. 18, Mar. 1980, p. 315-327. 10 refs.

Along with a colorimetric data analysis scheme, the instrumental parameters which need to be optimized in future spaceborne ocean color scanner systems are outlined. With regard to assessing atmospheric effects from ocean colorimetry, attention is given to computing size parameters of the aerosols in the atmosphere, total optical depth measurement, and the aerosol optical thickness. It is suggested that sensors based on the use of linear array technology will meet hardware objectives. J.P.B.

**A80-26751 #** Scales oceanic parameters as monitored from space. K.-H. Szeikielda (Hamburg, Universität, Hamburg, West Germany). *Remote Sensing Quarterly*, vol. 2, Jan. 1980, p. 16-35. 15 refs.

The development of spacecraft technology to monitor earth surface features has led to the application of remote sensing technology in oceanography to investigate the patchiness in the distribution of certain parameters. However, application over the oceans is restricted with regard to the size of the structures to be detected, their life span and the gradients created by concentration and temperature differences. For certain size scales, remote sensing from aircraft and remote sensing from satellites complement each other. Although finer structures can not yet be detected fully from satellite altitudes, larger oceanic systems from about 100-3000 km can be sufficiently monitored from space. (Author)

**A80-27331** Field performance of a laser fluorosensor for the detection of oil spills. R. A. O'Neil, L. Buja-Bijunas (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and D. M. Rayner (National Research Council, Ottawa, Canada). *Applied Optics*, vol. 19, Mar. 15, 1980, p. 863-870. 10 refs. Research supported by the Department of the Environment.

An airborne laser fluorosensor is described that was designed to detect and identify targets by means of the characteristic fluorescence emission spectrum. The first field trials of the sensor over marine oil and dye spills are reported. A correlation technique has been developed that, when applied to the data collected during these field trials, clearly differentiated among dye, the two crude oils, and the general fluorescence background of ocean water. (Author)

**A80-28251** OCEANS '79: Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979. Conference sponsored by the Institute of Electrical and Electronics Engineers and Marine Technology Society. New York, Institute of Electrical and Electronics Engineers, Inc., 1979. 815 p. \$33.75.

Topics included in this work are on advanced surface craft, electromagnetic systems for ocean surface monitoring, and communications, ocean energy, Space Shuttle support. Individual subjects such as the use of semi-submerged ships to support new technology at sea, buoyant module VHF antenna design for submerged systems/aircraft communications, a system for undersea storage of thermal energy, ocean wave concepts as well as the solid rocket booster dewatering set, and the SRB retrieval support craft are presented. C.F.W.

**A80-28256 \*** The relationship between ocean surface structure and the synthetic aperture radar imagery of ocean waves. D. D. Evans (California Institute of Technology, Jet Propulsion Labora-

tory, Pasadena, Calif.). In: OCEANS '79; Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 385-390. 23 refs. Contract No. NAS7-100.

The relationship between synthetic aperture radar (SAR) imagery of ocean waves and the ocean surface structure is discussed. The effects of ocean surface motion on SAR images is given. A generalization of conventional SAR correlation techniques is developed to provide imagery with the minimum possible degradation and distortion. The modeling of such imagery is discussed and an analytically tractable example given. Ongoing work towards the determination of the relevant components of surface microstructure is described. The future use of SAR phase information to supplement information obtainable from SAR imagery is suggested. (Author)

**A80-28263** Field study of pollutant migration in the vicinity of a coastal front. E. Waddell, J. Karpen, and P. Debrule (Science Applications, Inc., Raleigh, N.C.). In: OCEANS '79; Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 635-641. 9 refs. U.S. Bureau of Land Management Contract No. AA550-CT-759.

Discharge of estuarine water onto the shelf can create plumes with limits defined by fronts. The associated density field can produce a circulation with flow toward the front and back down along a density interface. In a field study, surface and dispersed pollutant simulators were released in the vicinity of such a front and traced using aerial photographic techniques. Tracers tended to converge to the front at only a small portion (10%) of the front's migration velocity. Most fixed-frame tracer velocities resulted from tidal currents and plume growth. Wind effects caused divergence between aluminum chips and dyes. At times, wind shear moved aluminum across the front and against the convergent surface currents. When shear was weaker, aluminum accumulated on a moving front. Dyes were subducted along the density interface. Within the plume, vertical mixing and resultant dispersion were probably due to stronger vertical gradients in horizontal velocity than found in the ambient velocity field. Exchange between plume and ambient water was often inhibited by the strong stable pycnocline. (Author)

**A80-29389** Remote sensing of ocean waters. H. van der Piepen, V. Amann, R. Stätter, and M. Schroeder (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Optoelektronik, Oberpfaffenhofen, West Germany). In: Laser 79 opto-electronics; Proceedings of the Fourth Conference, Munich, West Germany, July 2-6, 1979.

Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1979, p. 508-513. 6 refs.

The remote sensing of ocean waters is examined with attention given to user requirements, the passive and active techniques currently in use, the incorporation of these techniques into major satellite projects, and the application of these techniques to the measurement of water parameters. Both optical and microwave methods are examined. B.J.

**A80-31989** Analysis of remote sensing data in oceanography and climatology (Analyse des données de télédétection en océanographie et en climatologie). J. M. Monget (Paris, Ecole Nationale Supérieure des Mines, Valbonne, Alpes-Maritimes, France). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings.

Paris, Editions Technip, 1979, p. 338-347. 6 refs. In French.

The digital processing of remotely sensed data for oceanographic and climatological applications is examined, using NOAA satellite VHRR sensor data as an example. Particular attention is given to the transformation of thermal IR images into sea-surface temperature maps. The advantages of multispectral scanners for climatological applications are emphasized. B.J.

**N80-16407\*#** City Univ. of New York, N. Y. Inst. of Marine and Atmospheric Sciences.

**VERIFICATION PROCEDURES FOR THE SEASAT MEASUREMENTS OF THE VECTOR WIND WITH THE SASS** Willard J. Pierson Jan. 1978 39 p refs Sponsored by NASA Prepared for JPL

(Contracts JPL-954411: N00014-77-C-0206) (NASA-CR-162469; AD-A073644) Avail: NTIS HC A03/MF A01

Various relationships between the friction velocity and the roughness length in boundary layer models are studied in terms of the verification of the SASS on SEASAT. It is shown that verification against a measured wind at a known anemometer height is preferable to verification against a theoretical value of the friction velocity. The effect of the different models is small when they are used to refer all measured winds to one elevation. A model is proposed that has the features of two quite different models and the height of the anemometer for verification purposes is recommended to be 19.5 meters. GRA

**N80-18512\*#** Department of Industry, London (England). **SATELLITE MONITORING OF SEA SURFACE POLLUTION Progress Report, 1 Sep. - 31 Dec. 1979**

Gilbert Fielder and Duncan John Telfer, Principal Investigators 31 Dec. 1979 27 p Sponsored by NASA Original contains color imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md 20771. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM (E80-10062; NASA-CR-162584; PR-2-14/P6; PR-2) Avail: NTIS HC A03/MF A01 CSCL 13B

The author has identified the following significant results. Image processing techniques developed are well adapted to the exploration and isolation of local areas which exhibit small temperature differences between themselves and their surroundings. In the worst case of imagery of small areal extent of sea surface having no coastal boundary in the area, there is yet no method of distinguishing unambiguously an oil spill from fog, cloud, the effect produced by shallow sediments, or the effects of naturally occurring thermal fronts. In the case of uniform slicks of liquid North Sea oil in still air, laboratory simulation experiments show that, for oil thicknesses in excess of 1 or 2 mm, there is, under equilibrium conditions, little dependence of oil surface temperature on the thickness of the oil layer. The surface temperature of oil is consistently higher than that of water, the difference being about 1 K at low values of relative humidity, but tending to increase as the relative humidity increases.

**N80-18542#** Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

**BACKSCATTER MEASUREMENTS OF SEA ICE WITH A HELICOPTER-BORNE SCATTEROMETER**

J. S. Patel, R. G. Onstott, C. V. Delker, and R. K. Moore Jul. 1979 132 p refs

(Contract N00014-76-C-1105) (AD-A077614; RSL-TR-331-13) Avail: NTIS HC A07/MF A01 CSCL 08/12

The purpose of this paper is to describe the design and development of the University of Kansas helicopter-borne scatterometer system, HELOSCAT. The experiments performed to measure the radar backscatter from sea ice with this system along with the results are also described. Backscatter measurements were made at 1-2 GHz and 8-18 GHz frequencies, HH-polarization, and three incidence angles (20, 40, and 60 deg). Different types of ice ranging from thin ice to multiyear ice were observed; however, most data were collected from thick first-year and multiyear ice. A comparison of 1-2 GHz results for thick first-year and multiyear ice shows that the scattering coefficient values for multiyear ice at 60 deg are slightly lower than the value for thick first-year ice. The 8-18 GHz results show that the backscatter from multiyear ice at these frequencies is higher than the backscatter return from thick first-year ice by at least 3-4 dB. The frequency response of backscatter return is an upward sloping straight line on a dB-vs-frequency plot. For

the multiyear ice, only the 60 deg data was found usable; the data at 20 deg and 40 deg were determined to be erroneous because of a malfunctioning frequency counter. GRA

**N80-18549\*** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**SEASAT GULF OF ALASKA WORKSHOP REPORT**

George H. Born (NOAA), John C. Wilkerson (NOAA), John W. Sherman, III, and David B. Lame May 1979 42 p Prepared in cooperation with DOD, Washington, D.C.

(NASA-CR-162463; PB-301417/2; JPL-662-101; NOAA-79090406) Avail: NTIS HC A03/MF A01 CSCL 08J

Results are presented of an initial evaluation of part of the 105-day Seasat mission, focusing on data obtained from a 30 day experiment conducted in the Gulf of Alaska during August-September 1978. The Gulf of Alaska Seasat Experiment (GOASEX) was the only dedicated surface observation program conducted to validate the satellite data. Initial quantitative Seasat results produced during a Workshop held on January 22-26, 1979 are reported. Based on an early evaluation of these results, it is concluded that some of the original objectives of sensor performance were met. GRA

**N80-18671#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**COASTAL WATER TEMPERATURES IN THE SOUTHEASTERN PORTION OF BRAZIL FROM OCEANOGRAPHIC DATA AND NOAA SATELLITE OBSERVATIONS, VOLUME 1 [TEMPERATURAS DAS AGUAS DA COSTA SUDESTE DO BRASIL, OBTIDAS ATRAVES DE DADOS OCEANOGRAFICOS E DE DADOS DE SATELITES DA SERIE NOAA, VOLUME 1]**

Hector Manuel Inostroza Villagra and Jose Luiz Stech Sep. 1979 101 p refs In PORTUGUESE; ENGLISH abstract (INPE-1569-RPE/070) Avail: NTIS HC A06/MF A01

Sub surface temperature charts in the southeastern coast of Brazil, utilizing oceanographic data and thermal sensor data of NOAA's satellites are presented. A detailed analysis of 350 oceanographic stations resulted in the finding of a marked seasonal tendency in the vertical temperature structure of the waters. A correlation was established between the surface and vertical thermal structure. The analysis was done on a weekly time basis with the year 1970 as the reference year. Temperature charts at the depth of 50 m were done for the four seasons of the year, as an example of the applicability of the model, with results considered as satisfactory in a first approach. M.M.M.

**N80-18673#** Smithsonian Astrophysical Observatory, Cambridge, Mass.

**STUDY OF OCEANIC LITHOSPHERE USING GEOS-3 RADAR ALTIMETER DATA Final Report, 1 Oct. 1977 -- 30 Sep. 1979**

M. C. Roufousse Jul. 1979 29 p refs (Contract F19628-78-C-0003; AF Proj. 2309) (AD-A077344; AFGL-TR-79-0181) Avail: NTIS HC A03/MF A01 CSCL 08/7

The aim of this work is to study the mechanical properties and time evolution of the lithosphere. For that purpose, geoid heights derived from the Geos 3 radar altimeter were used. The study of the correlation existing between bathymetry and free-air anomalies or geoid heights gives information on the mechanical properties of the lithosphere and its thickness. The lithospheric thickness is related to the age of the lithospheric plate, and by probing several locations spanning varied temporal situations, one is able to retrace the time evolution of the lithospheric plates. Toward that aim, several seamount chains, islands, and ridges have been investigated in the Pacific, Atlantic, and Indian Oceans. In the regions studied so far, the age of the lithosphere at the time of loading is the primary parameter. In this work, the author attempts a systematic study of all the parameters influencing the observed mechanical properties of the lithosphere. GRA

**N80-18678#** Research Inst. of National Defence, Stockholm (Sweden).

**TESTS OF LASER INDUCED FLUORESCENCE FROM ALGAE AT SEA [LASERINDUCERAD FLUORESCENS FRAAN ALGER. RESULTAT FRAAN ETT BAATBURET FAELTFOER-SOEK]**

Brit Hartmann, Ove Steinvall, and Anders Widen Jul. 1979 52 p refs In SWEDISH

(FOA-C-30171-E1) Avail: NTIS HC A04/MF A01

Fluorescence from algae illuminated by a boat mounted laser was measured to see if the technique is feasible for airborne ocean surveillance of algae concentrations and oil or chemical spills. Good agreement was found between the laser data and manually gathered data, but uncertainty about chlorophyll concentrations requires that the airborne system be complemented with a ground truth calculation method in some parts of the area surveyed. Author (ESA)

**N80-19332\*#** Naval Research Lab., Washington, D. C. **A UNIQUE RADIO OCEANOGRAPHIC RADAR Final Report**

James E. Kenney (NASA, Langley Research Center) and Edward J. Walsh (NASA, Wallops Station) Nov. 1979 24 p (Contract NASA Order L-17098-A)

(AD-A077364; NRL-MR-4086) Avail: NTIS HC A02/MF A01 CSCL 17/9

A 36 GHz computer controlled airborne radar has been developed by NRL and NASA WFC which generates a false-color coded elevation map of the sea surface below the aircraft in realtime and can routinely produce ocean directional wave spectra with off-line data processing. GRA

**N80-19585\*#** Lille Univ. (France). **SEA SURFACE TEMPERATURE OF THE COASTAL ZONES OF FRANCE. HEAT CAPACITY MAPPING MISSION (HCMM) Progress Report**

P. Y. Deschamps, R. Frouin, G. Cassanet, and F. Verger, Principal Investigators Dec. 1979 53 p refs Sponsored by NASA Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20711. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM

(E80-10057; NASA-CR-162753; PR-2) Avail: NTIS HC A04/MF A01 CSCL 08C

The author has identified the following significant results. HCMM data analysis shows some mesoscale features which were previously expected to occur: summer coastal upwellings in the Gulf of Lions, tidal fronts bordering the English Channel, and cooler surface waters at the continental shelf break. The analysis of the spectral variance density spectra show that the interpretation of the data usually is limited by the HCMM radiometric performance (noise levels) at wavenumbers below 5 km in the oceanic areas; from this analysis it may also be concluded that a decrease of the radiometric noise level down to 0.1 k against an increase of the ground resolution up to 2 km would give a better optimum of the radiometric performances in the oceanic areas. HCMM data appear to be useful for analysis of the sea surface temperature field, particularly in the very coastal area by profiting from the ground resolution of 500 m.

**N80-20760\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**MEAN SEA SURFACE COMPUTATION USING GEOS-3 ALTIMETER DATA**

J. G. Marsh, Principal Investigator *In its Earth Survey Appl. Div.:* Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 190-197 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08C

**N80-20761\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**OCEAN CIRCULATION**

R. E. Cheney, Principal Investigator *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 198-202 refs ERTS 11-43)  
 Avail: NTIS HC A14/MF A01 CSCL 08C

**N80-20762\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**STARLETTE ORBIT ANALYSES FOR OCEAN TIDAL STUDIES**

T. L. Felsentreger and J. G. Marsh, Principal Investigators *In its Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior* Jan. 1980 p 203-206 refs ERTS

**N80-20786#** Electrotechnical Lab., Ibaraki (Japan).

**MICROWAVE REMOTE SENSING TECHNOLOGY FOR THE MARINE OIL POLLUTION SURVEILLANCE**

Toshio Nenoto, Ichiro Yokoshima, Yoshihiko Kato, Takehiko Hidaka, Yutaka Kurioka, Minoru Yokota, Shinobu Hashimoto, Hiroshi Nakano, and Masahiko Yamaguchi Aug. 1979 166 p refs *In JAPANESE; ENGLISH summary* (Rept-202) Avail: NTIS HC A08/MF A01

The existing state of oil pollution in the adjacent seas of the Japanese Archipelago, the techniques used in the oil detection and monitoring, and technical problems to be met in carrying out the patrol mission concerned with the enforcement of marine environment protection law are outlined. Functional requirements of a practical surveillance system useful for facilitating the activities to prevent the marine oil pollution are given. Basic mechanisms of interactions of microwaves at the air-sea water and air-oil-sea water interfaces are described. Reflection coefficients and emissivities of clean sea and polluted sea are exemplified under a number of different conditions of the temperature and salinity of sea water, observing frequency, and polarization of electromagnetic wave. The mechanisms of interaction between microwave signals and the atmospheric component gases and water droplets of various sizes are described, and examples of parameters useful for calculations of practical atmospheric attenuation and emission of microwaves are given. J.M.S.

**N80-20790#** Naval Ocean Research and Development Activity, Bay St. Louis, Miss. Remote Sensing Branch.

**INTERACTIVE DIGITAL SATELLITE IMAGE PROCESSING SYSTEM FOR OCEANOGRAPHIC APPLICATIONS Final Report**

Albert E. Pressman and Ronald J. Holyer Apr. 1978 18 p (AD-A079697; NORDA-TN-23) Avail: NTIS HC A02/MF A01 CSCL 08/10

The NORDA oceanographic satellite remote sensing program will emphasize data exploitation as opposed to data collection. This emphasis is because the collection technology has already far outstripped our ability to utilize the data for oceanographic purposes. The satellite data system described herein is an essential component for development and demonstration of processing, analysis, and interpretation methodology. The NORDA system includes a near real-time capability to receive GOES and limited VHRR data for screening purposes. GRA

**N80-21010#** National Ocean Survey, Rockville, Md. Test and Evaluation Lab.

**WAVE SENSOR SURVEY**

Richard L. Ribe Jul. 1979 48 p (PB80-118581; NOAA-TR-NOS-78; NOAA-79101102) Avail: NTIS HC A03/MF A01 CSCL 08C

A study of selected scientific and engineering literature was conducted to survey the state-of-the-art of wave measurement technology. Brief descriptions of representative wave sensors and their principles of operation are given. GRA

**N80-21406#** British Aerospace Dynamics Group, Bristol (England). Electronic and Space Systems.

**COASTAL OCEANS MONITORING SATELLITE SYSTEM (COMSS). VOLUME 1: EXECUTIVE SUMMARY Final Report**

Mar. 1979 81 p Prepared in cooperation with Engins Matra Velizy, France; Technical Univ. of Denmark, Copenhagen; Logica Ltd. and Sira Inst. Ltd. Original contains color illustrations (Contract ESA-3632/78-F-CG) (ESS/SS-930; ESA-CR(P)-1281) Avail: NTIS HC A05/MF A01

A study of the major systems aspects associated with the Coastal Ocean Monitoring Satellite System (COMSS) and design studies of principal payload elements in the space segment are presented. The COMSS concept envisages a large 3-axis stabilized satellite incorporating several Earth observation sensors operating in the visible, infrared, and microwave regions of the spectrum. This satellite and the system of which it forms a part would be used for monitoring the economically and environmentally important coastal oceans regions of Europe and the World.

Author (ESA)

**N80-21819#** European Space Agency, Paris (France).

**SEA SURFACE TEMPERATURE ANOMALY MAPPING USING THE NOAA SATELLITES**

M. Albuissou (Ecole des Mines, Valbonne, France), J. M. Monget (Ecole des Mines, Valbonne, France), and G. Nihous (Ecole des Mines, Valbonne, France) *In its Use of Data from Meteorol. Satellites* Nov. 1979 p 201-204 refs Sponsored by Centre Natl. d'Exploitation des Oceans

Avail: NTIS HC A12/MF A01

A method for processing NOAA very high resolution radiometers data is described. The method eliminates various types of noise and produces surface temperature maps with an accuracy suitable for oceanographic applications. An example of a climatology study based on data gathered from 1975 to 1978 on the Ligurian Sea is presented. Author (ESA)

**N80-21820#** Institute of Oceanographic Sciences, Wormley (England).

**MONITORING THE SEA SURFACE**

T. D. Allan *In ESA Use of Data from Meteorol. Satellites* Nov. 1979 p 205-215

Avail: NTIS HC A12/MF A01

The application of current satellite technology to the scientific study of the oceans is reviewed with emphasis on the performance of the microwave sensors carried on Seasat-1. A brief resume of the future plans of NASA and ESA in the field of oceanographic satellite is provided. Author (ESA)

**N80-21821#** Joint Research Centre of the European Communities, Ispra (Italy).

**BIOLOGICAL APPLICATIONS INCLUDING POLLUTION MONITORING**

B. Sturn *In ESA Use of Data from Meteorol. Satellites* Nov. 1979 p 217-222 refs

Avail: NTIS HC A12/MF A01

The coastal zone color scanner (CZCS) on board the Nimbus-7 satellite is described. The CZCS measures upwelling spectral radiances from the ocean in five visible and one thermal IR band. The use of the CZCS to determine chlorophyll-a concentrations in the water is discussed. Author (ESA)

## HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

**A80-22398 # Impacts of land use on estuarine water quality.** J. M. Hill (Louisiana State University, Baton Rouge, La.) and K. Stout (Trident Engineering Associates, Inc., Warrenton, Va.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 385-395. 13 refs.

The paper stresses the need for establishment of a large scale coastal monitoring and management program, noting that such a program cannot be accomplished under present traditional sampling procedures and current funding and staffing levels. Attention is given to the application of existing remote sensing techniques (both aircraft and satellite), by the Environmental Protection Agency, to monitoring and management schemes in the nation's coastal zone. Emphasis is placed on the use of remotely acquired data to help establish land-use/water quality relationships in estuarine systems.

M.E.P.

**A80-22399 # A laser-fluorosensor technique for water quality assessment.** M. Bristow, D. Nielsen, and R. Furtek (U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, Nev.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 397-417. 26 refs.

A profiling airborne laser-fluorosensor has been used to monitor changes in surface water chlorophyll a fluorescence for concentrations down to 1 microgram/liter at a minimum aircraft elevation of 200 m above the water surface under clear-sky day-light conditions. Sensitivity of the original system is about 0.4 microgram/liter with a minimum signal-to-background noise ratio of 3. With implementation of measures to increase the laser peak power and reduce the background signal and noise, detection of chlorophyll a levels will be possible down to 0.1 microgram/liter with a minimum signal-to-background noise ratio of 20. Comparisons between chlorophyll a ground truth data and the airborne chlorophyll a fluorescence signal produced linear correlation coefficients in the range from 0.77 to 0.95.

(Author)

**A80-22451 # Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan.** J. G. Lyon (Michigan University, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1117-1129. 12 refs. Grant No. NOAA-04-8-M01-134.

Two approaches to wetland quantity and quality analysis were examined. In the first approach, the coastal wetlands of the St. Clair River delta were delineated with aerial photography, and described with two wetland classification systems. The second approach examined the capability of computer classification of Landsat digital data to provide coastal land use and vegetation community information. The value of these approaches for wetland inventory and utility of the classifications is addressed.

(Author)

**A80-22454 # Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing.** F. Becker, D. Blumenroeder, E. Hechinger, A. Hourani, B. Ramey, J. Trautmann (Strasbourg I, Université, Strasbourg, France), C. Dechambenois, and A. Pellegrin (Ecole Polytechnique, Palaiseau,

Essonne, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1151-1166. Research supported by the Centre National d'Etudes Spatiales, Délégation Générale à la Recherche Scientifique et Technique, and Electricité de France.

An airborne remote measurement of the surface temperature of the Rhine has been performed in the 10.5-12.5 micron window with the French 4-channel scanning radiometer ARIES which gives well calibrated digitized radiometric temperatures of the ground due to accurate calibrations performed both during the flight and at the laboratory. Using a simple, fast, approximative radiative transfer model, it has been possible to correct the radiometric data to obtain, with the LAE 980 image processing system of the laboratory, encoded coloured images of the absolute surface temperature with an error less than or equal to 0.4 C. A mapping of these images has been made on a topographic map allowing comparisons of the surface temperature at different times and seasons in order to monitor the thermal pollution, as well as the dynamics of the water flows or its interaction with the underground water table. This procedure has been employed successfully over the Atlantic Ocean and the Mediterranean Sea.

(Author)

**A80-22461 # On the penetration of microwaves in snow and soil.** C. Matzler, R. Hofer, D. Wyssen, and E. Schanda (Bern, Universität, Berne, Switzerland). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1243-1249.

The potentiality of relating classical ground truth data to microwave signature for remote sensing purposes depends very critically on the penetration depth, p. The paper reports on the measurement of p by passive microwave remote sensing in the 1.8 to 94 GHz range. The method is applied to soil and snow. In order to estimate the uncertainty of p due to the model dependence the results of two extreme situations are compared, the results of which vary by less than a factor 2. The penetration depth of a humid loam soil was found to decrease from about 5 cm at 1.8 GHz to 1.5 cm at 36 GHz. On the other hand the penetration depth of snow was found to change drastically, according to the content of liquid water.

(Author)

**A80-22467 \* # The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah.** C. J. Merry (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1309-1316. 7 refs. Grant No. NSG-5014.

A water sampling program was accomplished at Lake Powell, Utah, during June 1975 for correlation to multispectral data obtained with a 500-channel airborne spectroradiometer. Field measurements were taken of percentage of light transmittance, surface temperature, pH and Secchi disk depth. Percentage of light transmittance was also measured in the laboratory for the water samples. Analyses of electron micrographs and suspended sediment concentration data for four water samples located at Hite Bridge, Mile 168, Mile 150 and Bullfrog Bay indicated differences in the composition and concentration of the particulate matter. Airborne spectroradiometer multispectral data were analyzed for the four sampling locations. The results showed that: (1) as the percentage of light transmittance of the water samples decreased, the reflected radiance increased; and (2) as the suspended sediment concentration (mg/l) increased, the reflected radiance increased in the 1-80 mg/l range. In conclusion, valuable qualitative information was obtained on surface turbidity for the Lake Powell water spectra. Also, the reflected radiance measured at a wavelength of 0.58 micron was directly correlated to the suspended sediment concentration.

(Author)

**A80-22470 \* #** A regression technique for evaluation and quantification for water quality parameters from remote sensing data. C. H. Whitlock (NASA, Langley Research Center, Marine Environments Branch, Hampton, Va.) and C. Y. Kuo (Old Dominion University, Norfolk, Va.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1351-1365. 19 refs.

The paper attempts to define optical physics and/or environmental conditions under which the linear multiple-regression should be applicable. It is reported that investigation of the signal response shows that the exact solution for a number of optical physics conditions is of the same form as a linearized multiple-regression equation, even if nonlinear contributions from surface reflections, atmospheric constituents, or other water pollutants are included. Limitations on achieving this type of solution are defined. Laboratory data are used to demonstrate that the technique is applicable to water mixtures which contain constituents with both linear and nonlinear radiance gradients. Finally, it is concluded that instrument noise, ground-truth placement, and time lapse between remote sensor overpass and water sample operations are serious barriers to successful use of the technique. M.E.P.

**A80-22478 #** Study of the Argentine Pampa's lowland by means of interpretation of Landsat satellite information. N. Marlenko (Comisión Nacional de Investigación del Espacio, Buenos Aires, Argentina). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1455-1463.

**A80-22490 \* #** Remote sensing analysis of water quality in the San Francisco Bay-delta. S. Khorram (California, University, Berkeley, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1591-1601. 15 refs. Research supported by the University of California; Grant No. NsG-5256.

Water quality parameters in the San Francisco Bay-delta area using remotely sensed data combined with in situ data are investigated. The parameters included suspended solids, chlorophyll, turbidity, and electrical conductivity; the ocean color scanner (OCS) data were acquired from a NASA U-2 aircraft, and water quality samples were obtained from boats. It was concluded that areas with high biological activity were clearly discernible on enhanced imagery from OCS data, and it was impossible to locate such areas on aerial photography taken with conventional or infrared sensitive color films. A.T.

**A80-24054** Remote sensing and water resources in Quebec (Télétection et ressources en eau au Québec). G. Rochon (Université Laval, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télétection, 1979, p. 33-42. 12 refs. In French.

The applicability of remote sensing activities to the management of water resources in Quebec is reviewed. The ways in which remote sensing can be applied to the localization of water, measurement of its motions and physicochemical characteristics, and the determination of its relationships with the terrestrial ecosystem in Quebec are examined, and the possible roles of remote sensing in the monitoring of changes in lake or marine environments are indicated. The management of water resource information in Quebec and Canada as a whole is discussed, and it is suggested that environmental data be allowed to circulate to all concerned provincial and local agencies in

order to achieve the full potential of remote sensing and other forms of water resource investigations. A.L.W.

**A80-24058** A comparative study of various remote sensing techniques applied to geomorphology (Etude comparée de différents techniques de télédétection appliquées à la géomorphologie). P. Clément and F. Bonn (Sherbrooke, Université, Sherbrooke, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télétection, 1979, p. 85-96. 7 refs. In French.

Remote sensing imagery of the Eaton river basin in Quebec obtained in the visible, near-infrared, and thermal-infrared ranges and by synthetic aperture radar is compared. Color infrared is shown to be the most appropriate technique for identifying mineral deposits, although daytime thermal imagery may reveal deposit boundaries if they are accompanied by modifications in drainage patterns. L-band synthetic aperture radar with HH polarization is found to be capable of localizing lines of rock outcroppings and tectonic accidents, along with daytime thermal, while erosion channels under wooded areas can be visualized using X-band synthetic aperture radar with HV polarization. It is concluded, however, that conventional photo-interpretation of remote sensing data provides information superior to that obtained by panchromatic stereophotography only in a few instances, and further work in determining the relationships between geomorphological parameters and the properties measured by remote sensing techniques is necessary. A.L.W.

**A80-24059** Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis. A. Ichikawa, N. Tamai (Tokyo, University, Tokyo, Japan), H. Kanda (Ministry of Construction, River Environmental Div., Kawasaki, Japan), and S. Tanaka (Remote Sensing Technology Center of Japan, Tokyo, Japan). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télétection, 1979, p. 101-118. 11 refs.

An aerial MSS study of the water quality under typical hydraulic conditions of the Tama River in the Tokyo metropolitan area is presented. Data were obtained by an airborne digital multispectral scanner at an altitude of 1000 m with a resolution of 2 m during winter and summer, and processed using multispectral image analyzers. The production of false-color images allows the identification of bars, flood plains, falls, pools, confluences of tributaries, sewage effluent outfalls, and pollutant mixing zones in eight color slices, which are confirmed by ground truth data. From this two-dimensional display, river hydrodynamics are investigated, with the use of isotherms and isoconcentration contours, and self-purification coefficients are derived which suggest that purification is intensified by settling in the backwater zone of weirs. It is concluded that, although the application of remote sensing to hydro-environmental problems has been shown to be worthwhile, detailed and precise quantitative investigation is necessary for deriving pollution control strategies. A.L.W.

**A80-24060** The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources (Mesure des variations horaires de température et de l'albedo terrestre par satellite - Application à la télédétection des ressources en eau). M. Vieillefosse and J.-C. Favard (Centre National d'Etudes Spatiales, Toulouse, France). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télétection, 1979, p. 119-128. In French.

The use of satellite observations of the visible reflectance of the earth and its thermal emission in order to determine soil moisture is

discussed. It is shown that geostationary or polar orbiting satellites such as SMS, Meteosat and HCMM can measure hourly or semi-diurnal changes in temperature and albedo and thus determine the thermal inertia of the surface, a function of its moisture content. Measurements of the terrestrial radiation balance are also presented as a promising means of determining the moisture content of soils covered by vegetation and evapotranspiration through them. A.L.W.

**A80-24061** **Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images (Remplissage du réservoir de LG 2 - Surveillance à l'aide des images Landsat).** P. Laframboise (Société de Développement de la Baie James, Canada), A. Bachand (Société d'Énergie de la Baie James, Montreal, Canada), and H. Audet (Ministère des Terres et Forêts, Centre Québécois de Coopération en Télédétection, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 129-133. In French.

Landsat images used for the surveillance of the LG 2 reservoir in France during the filling-up period, as part of a global ecological surveillance program, are considered. Also discussed are observations of the ice-covered period, the ice break-up and rising of the water, and periods of mixing (sediment and suspended organic material, water dynamics, floating bogs), and stratification. J.P.B.

**A80-24827** **Investigations on snow parameters by radiometry in the 3- to 60-mm wavelength region.** R. Hofer and C. Mätzler (Bern, Universität, Berne, Switzerland). *Journal of Geophysical Research*, vol. 85, Jan. 20, 1980, p. 453-460. 30 refs.

A report on a 2-year period of monitoring parameters of a natural snowpack by ground-based microwave radiometry on a high-altitude Alpine test site is presented. The microwave brightness temperatures are compared to a large set of ground-truth data. Three stages in the seasonal development of the snow cover are easily distinguishable which allow the prediction of the beginning of the snow melting. The moisture content of the melting surface layer is estimated by the aid of the typical daily variations of microwave brightness temperatures in spring. The test site was composed of two snow fields. The first one was lying on slightly reflecting soil, and the second one was lying on a completely reflecting metal foil. By measuring on both fields some microwave snow parameters can be determined. The damping coefficients for microwaves between 5 and 100 GHz were estimated by comparing the results of two extreme theories. Both theories gave results from less than 1 dB/m to more than 30 dB/m depending on the snow state, especially its liquid water content. (Author)

**A80-26787** **An assessment of electromagnetic remote sensing systems for the detection of perched water tables.** L. Tinney, C. E. Ezra, and J. E. Estes (California, University, Santa Barbara, Calif.). In: EASCON '79; Electronics and Aerospace Systems Conference, Arlington, Va., October 9-11, 1979, Conference Record. Volume 1. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 87-96. 37 refs.

Research efforts conducted by the Geography Remote Sensing Unit (GRSU) have investigated the study of multispectral capabilities for detecting surface soil moisture as related to the presence of shallow or 'perched' water tables at a southern San Joaquin Valley, California test site. This study focuses upon remote sensing techniques within the spectral range 0.4 micron and 23 cm of the electromagnetic spectrum. Basic physics and components of remote sensing systems applicable to the detection of shallow perched water tables for the sensor systems operating within this spectral region are presented in this study. Additionally, imagery from the visible and reflective infrared (aerial camera and Landsat scanner), thermal infrared (aircraft scanner) and microwave (both active L-band and passive 35 GHz micrad) are analyzed to determine their respective utilities and limitation in detecting perched water table regions. (Author)

**A80-27431 \*** **Wetland flow resistance determination using Landsat data.** J. C. Gervin (NASA, Goddard Space Flight Center, Eastern Regional Remote Sensing Applications Center, Greenbelt, Md.) and S. F. Shih (Florida, University, Belle Glade, Fla.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 105-116. 9 refs. NASA-supported research.

In the past, one value of the roughness coefficient has frequently been used to represent the flow resistance characteristics of an entire natural wetland throughout the year. To improve the simulation of water flow through these natural vegetation communities, Landsat imagery and in situ flow measurements were combined to produce a more detailed representation of flow resistance. The vegetation in a typical marshland drainage basin in south Florida was classified into five categories using Landsat data. Flow measurements were then performed at characteristic sites in the basin. The measurements were taken at various depths during months of significant flow to examine the effect of seasonal growth. This information was then combined with the areal distribution of the vegetation as measured by satellite to more accurately simulate resistance to water flow in a natural marshland drainage basin. (Author)

**A80-27433 \*** **Remote sensing inputs to National Model Implementation Program for water resources quality improvement.** J. C. Eidenshink and F. A. Schmer (South Dakota State University, Brookings, S. Dak.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 165-179. 6 refs. Research supported by the U.S. Department of Agriculture; Grant No. NGL-42-003-007.

The Lake Herman watershed in southeastern South Dakota has been selected as one of seven water resources systems in the United States for involvement in the National Model Implementation Program (MIP). MIP is a pilot program initiated to illustrate the effectiveness of existing water resources quality improvement programs. The Remote Sensing Institute (RSI) at South Dakota State University has produced a computerized geographic information system for the Lake Herman watershed. All components necessary for the monitoring and evaluation process were included in the data base. The computerized data were used to produce thematic maps and tabular data for the land cover and soil classes within the watershed. These data are being utilized operationally by SCS resource personnel for planning and management purposes. (Author)

**A80-27434 \*** **Improvements in lake water budget computations using Landsat data.** J. C. Gervin (NASA, Goddard Space Flight Center, Eastern Regional Remote Sensing Applications Center, Greenbelt, Md.) and S. F. Shih (Florida, University, Belle Glade, Fla.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1979, p. 206-218. 8 refs.

A supervised multispectral classification was performed on Landsat data for Lake Okeechobee's extensive littoral zone to provide two types of information. First, the acreage of a given plant species as measured by satellite was combined with a more accurate transpiration rate to give a better estimate of evapotranspiration from the littoral zone. Second, the surface area coupled by plant communities was used to develop a better estimate of the water surface as a function of lake stage. Based on this information, more detailed representations of evapotranspiration and total water surface (and hence total lake volume) were provided to the water balance budget model for lake volume predictions. The model results based on information derived from satellite demonstrated a 94 percent reduction in cumulative lake stage error and a 70 percent reduction in the maximum deviation of the lake stage. (Author)

**A80-27436** Monitoring man's impact in the coastal zone. A. R. Benton, Jr., W. W. Snell (Texas A & M University, College Station, Tex.), and C. A. Clark (Lockheed Electronics Co., Inc., Houston, Tex.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 237-250. 7 refs.

The paper examines the monitoring of man's impact in the coastal zone. Color infrared photography shows destroyed or degraded wetlands or beaches, and makes possible relevant linear or areal measurements with aerial photography; it can also categorize the environmental impacts which have accrued as the result of completion of water development projects. Aerial photography of the Texas coastal zone illustrates the nature and degree of damage likely to occur as a result of construction or maintenance projects. It is concluded that the method of assigning realistic values to unit areas of wetlands and beaches will make it feasible to incorporate the cost of estuarine damages into the cost estimates of water development schemes.  
A.T.

**A80-27438** Near-surface bathymetry system. G. Schwarz (U.S. Army, Engineer Topographic Laboratories, Fort Belvoir, Va.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 261-266.

The paper considers the near-surface bathymeter system which will enable Landsat multispectral images to be projected in a color additive viewer to form a color composite image. The system which consists of a viewer/projector and a Zoom Transfer Scope is described, noting that the operator views the Landsat images and superimposes them on an image of a hydrographic chart. The system operation is described which allows the operator to determine whether any underwater changes have occurred since the last survey, and make possible shoreline changes or corrections. The depth to which the system can penetrate is limited by turbidity, wave action, and the sun angle, but depth penetration of 10 fathoms and greater is possible.  
A.T.

**A80-30920\*** Microwave approaches in hydrology. T. J. Schmutge (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Apr. 1980, p. 495-507. 38 refs.

The microwave approaches for remote sensing of soil moisture content, snowpack properties, surface water area, and the detection of precipitation over land are discussed. Both active (radar) and passive (radiometry) approaches are considered, and the advantages of microwave sensing are pointed out, including all-weather capability, especially at the longer wavelengths, and greater penetration depth with optical or infrared sensors. Results obtained from ground-based, aircraft, and spacecraft platforms show that microwave systems can monitor the moisture content in the surface soil layer (5 cm thick), and that passive microwave systems can discriminate between light and heavy snowcover, detect the presence of liquid water in the snow, and qualitatively estimate snow water equivalent.  
L.M.

**N80-16396\*#** Maryland Univ., College Park. Dept. of Civil Engineering.  
**RELATIONSHIP OF PHYSIOGRAPHY AND SNOW AREA TO STREAM DISCHARGE Final Report, 1 Nov. 1976 - 31 May 1979**  
Richard H. McCuen, Principal Investigator Oct. 1979 146 p refs ERTS  
(Grant NGR-21-002-399)  
(E80-10046; NASA-CR-162506) Avail: NTIS HC A07/MF A01 CSCL 08L

The author has identified the following significant results. A comparison of snowmelt runoff models shows that the accuracy of the Tangborn model and regression models is greater if the test data falls within the range of calibration than if the test data lies outside the range of calibration data. The regression models are significantly more accurate for forecasts of 60 days or more than for shorter prediction periods. The Tangborn model is more accurate for forecasts of 90 days or more than for shorter prediction periods. The Martinec model is more accurate for forecasts of one or two days than for periods of 3, 5, 10, or 15 days. Accuracy of the long-term models seems to be independent of forecast data. The sufficiency of the calibration data base is a function not only of the number of years of record but also of the accuracy with which the calibration years represent the total population of data years. Twelve years appears to be a sufficient length of record for each of the models considered, as long as the twelve years are representative of the population.

**N80-16397\*#** Environmental Research and Technology, Inc., Concord, Mass.

**INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, Oct. - Dec. 1979**

James C. Barnes, Principal Investigator 7 Jan. 1980 7 p Sponsored by NASA ERTS  
(E80-10049; NASA-CR-162521; QPR-9) Avail: NTIS HC A02/MF A01 CSCL 08L

**N80-18498\*** National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.

**RADAR TARGET FOR REMOTELY SENSING HYDROLOGICAL PHENOMENA Patent**

Wilford E. Sivertson, Jr., inventor (to NASA) Issued 15 Jan. 1980 6 p Filed 22 Sep. 1978 Supersedes N78-33511 (16 - 24, p 3231)

(NASA-Case-LAR-12344-1; US-Patent-4,184,155; US-Patent-Appl-SN-945041; US-Patent-Class-343-5CM; US-Patent-Class-343-5W; US-Patent-Class-343-18B; US-Patent-Class-343-18D) Avail: U.S. Patent and Trademark Office CSCL 08H

An apparatus for remotely measuring and accessing water status relative to snow and glacial melt, surface runoff, rainfall, evaporation, flow rate, and soil moisture is described. A radar target located at a selected location on the surface of the Earth is designed to collect water and render its cross sectional area variable as a function of the height of the water level within the target. The target is remotely monitored by an orbiting or airborne synthetic aperture radar. The target appears as a bright spot embedded within the radar image. The target brightness is indicative of the height of the water level within the ground located target.

Official Gazette of the U.S. Patent and Trademark Office

**N80-18517\*#** National Oceanic and Atmospheric Administration, Washington, D. C.

**APPLICATION OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report**

Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 18 Jan. 1980 4 p Sponsored by NASA HCMM  
(E80-10068; NASA-CR-162639) Avail: NTIS HC A02/MF A01 CSCL 08L

**N80-18520\*#** Calspan Advanced Technology Center, Buffalo, N.Y.

**APPLICATIONS OF HCMM SATELLITE DATA Quarterly Report, 23 Aug. - 23 Nov. 1979**

23 Nov. 1979 4 p HCMM  
(Contract NAS5-24263)  
(E80-10071; NASA-CR-162642; QR-9) Avail: NTIS HC A02/MF A01 CSCL 05B

**N80-18522\*#** Texas A&M Univ., College Station. Remote Sensing Center.

**CONTINUATION OF MEASUREMENT OF HYDROLOGIC SOIL-COVER COMPLEX WITH AIRBORNE SCATTEROMETERS Final Report**

Bruce J. Blanchard, John L. Nieber, and Andrew J. Blanchard, Principal Investigators [1979] 48 p refs ERTS (Grant NsG-5156) (E80-10073; NASA-CR-162644; FR-3496) Avail: NTIS HC A03/MF A01 CSCL 08M

The author has identified the following significant results. Analysis of radar scatterometry data obtained over five flight lines in Texas by NASA C-130 aircraft demonstrated that multivariant radar data can be used to distinguish difference in land use, and hence be an indicator of surface runoff characteristics. The capability of using microwave sensors to detect flood inundation of timbered land was also determined.

**N80-18524\*#** South Dakota State Univ., Brookings. Remote Sensing Inst.

**HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Oct. - Dec. 1979**

Donald G. Moore, Principal Investigator and J. L. Heilman Dec. 1979 59 p refs Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, MD 20771. Domestic users send orders to 'Attn: National Space Science Data Center', non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM (Contract NAS5-24206)

(E80-10075; NASA-CR-162646; SDSU-RSI-80-01) Avail: NTIS HC A04/MF A01 CSCL 13B

The author has identified the following significant results. Evidence of a heat sink produced by perched water tables was detected with HCMM night thermal data. The region of shallow water was not visible on HCMM visible or day IR imagery. The results are consistent with previous aircraft investigations.

**N80-18545#** Consiglio Nazionale delle Ricerche, Padua (Italy). **USE OF SATELLITE IMAGERY FOR THE DERIVATION OF THE HYDROGEOLOGIC CHARACTERISTICS OF A TEST AREA IN SEMIARID CLIMATES**

Carlo Vaccari (Italeco SpA) and Bruno Marcolongo 29 May 1979 12 p Presented at COSPAR Water Resources Symp., Bangalore, India, 30 May - 1 Jun. 1979 Avail: NTIS HC A02/MF A01

The ability to identify locations of underwater storage is especially important in semiarid areas. To this effect, the application of remote sensing by LANDSAT can lead to the identification of potential sites suitable for further ground exploration, thus curtailing the time, labor, and expense of alternative prospecting procedures. The method described utilizes the radiometric information supplied by LANDSAT, together with existing and readily available ground information, to reconstruct the major hydrogeologic features of a semiarid area and to assess in semiquantitative fashion its potential subsurface water content. Author (ESA)

**N80-19591\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md. **MULTISENSOR ANALYSIS OF HYDROLOGIC FEATURES IN THE WIND RIVER RANGE, WYOMING WITH EMPHASIS ON THE SEASAT SAR**

James L. Foster and Dorothy K. Hall, Principal Investigators Oct. 1979 26 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E80-10083; NASA-TM-80582) Avail: NTIS HC A03/MF A01 CSCL 08H

The author has identified the following significant results. Analysis of imagery obtained over west-central Wyoming indicates that Seasat SAR has capability for hydrologic mapping. Both the L-Band (Seasat) and the X-Band (aircraft) SAR imagery were useful for observing drainage detail. Streams have bright signatures on the SAR imagery because the riparian vegetation produces a rough surface and thus high radar returns. Lakes appear relatively bright on the Seasat image presumably in response to surface ripples and waves induced by wind action. SAR imagery did not reveal snow at either the 23.5 cm (L-Band) or 2.8 cm

(X-Band) wavelengths. Comparing Seasat and X-Band aircraft SAR imagery to LANDSAT RBV imagery, U-2 photography, and topographic maps of the Wind River Range, it appears that the SAR data do not seem to provide as much hydrologic information as do the other sensors in the visible and near infrared portions of the spectrum.

**N80-19594#** National Environmental Satellite Service, Washington, D. C.

**NOAA SATELLITE MONITORING OF SNOW COVER IN THE NORTHERN HEMISPHERE DURING THE WINTER OF 1977**

Donald R. Wiesnet, Michael Matson, and David F. McGinnis [1977] 18 p refs Avail: NTIS HC A02/MF A01

Weekly snow and ice charts were used to prepare mean monthly data on snowcover for both North America and Eurasia. These data were then utilized to prepare simple regressions of antecedent snowcover vs. January, February, February and January-through March snowcover figures, demonstrating a number of statistically significant relationships for Eurasia and the Northern Hemisphere (land surface only). These relationships, despite the limited data sample (10 years of record), indicate that higher-than-average December snowcover tends to preage a winter of more-than-average snowcover. A.R.H.

**N80-20797#** Environmental Monitoring and Support Lab., Las Vegas, Nev.

**AIRBORNE LASER FLUORENSING OF SURFACE WATER CHLOROPHYLL a Interim Report, Jan. 1976 - Aug. 1978**

M. Bristow, F. Nielsen, R. Furtek, and J. Baker Aug. 1979 79 p refs Prepared in cooperation with Nev. Univ., Las Vegas (PB80-113400; EPA-600/4-79-048) Avail: NTIS HC A05/MF A01 CSCL 14B

A prototype airborne laser fluorosensor for monitoring surface water chlorophyll 'a' was tested over Lake Mead, Nevada. Trends in the remotely sensed data are in close correspondence with ground truth data. It is suggested that system performance can be improved by concurrently gauging the water optical attenuation coefficient and by implementing chlorophyll 'a' analyses on ground truth samples. GRA

**N80-21816#** Norwegian Water Resources and Electricity Board, Oslo.

**SNOW AND ICE MAPPING: NORWEGIAN EXAMPLES FOR RUN-OFF PREDICTION**

G. Oestrem, T. Andersen, H. Odegaard (IBM, Oslo), and R. delLlano (IBM, Oslo) In ESA Use of Data from Meteorol. Satellites Nov. 1979 p 177-181 refs

Avail: NTIS HC A12/MF A01

A method which relies on NOAA and TIROS data to evaluate the snow residue and to predict the corresponding melt water volume in a number of Norwegian high mountain basins is described. The method is to be used by hydroelectric power plant managers in order to plan production rates during the melt season. Author (ESA)

## DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

**A80-22382 \* #** The suitability of the ILLIAC IV architecture for image processing. D. K. Stevenson and R. M. Hord (NASA, Ames Research Center, Moffett Field, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 61-71. 10 refs.

The major architectural features of the ILLIAC IV large scale, array processor are summarized along with their applicability to image processing. Several image processing algorithms are considered, including multispectral classification, texture feature extraction, two-dimensional Fourier transform, and synthetic aperture radar processing. The basic parallelism of the ILLIAC IV (64 processing elements acting in lock-step) is usually fully utilized by the image processing applications. The major architectural aspect of the system with respect to image processing is the relatively small local scratch-pad memory and the long latency time to access the main storage device. The major precision used for the image processing applications is the 32-bit floating point, given a choice of 8-bit integers and 64-bit floating point. B.J.

**A80-22392 \* #** Integration of Landsat, Seasat, and other geo-data sources. A. L. Zobrist, R. J. Blackwell, and W. D. Stromberg (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 271-289. 7 refs. Contract No. NAS7-100.

The paper discusses integration of Landsat, Seasat, and other geographic information sources. Mosaicking of radar data and registration of radar to Landsat digital imagery are described, and six types of geophysical data, including gravity and magnetic measurements, are integrated and analyzed using image processing techniques. A.T.

**A80-22401 #** Digital image processing techniques of integrated images and non-image data sets. P. S. Chavez, Jr., D. K. McMacken, E. Eliason (U.S. Geological Survey, Flagstaff, Ariz.), and J. T. O'Connor (U.S. Geological Survey, Reston, Va.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 439-454. 5 refs.

The present paper deals with several techniques for processing images and for comparing image and nonimage data, which appear to be applicable as aids in the resource planning and management area. The discussion is centered on techniques used to accomplish the major stages of processing: digitize, clean up, and reproduce color images; digitize and create spatial data arrays from contour maps; geometrically correct the image and nonimage data so that they all could be overlaid on a pixel-by-pixel basis; and score the different data sets so they could be directly compared with each other automatically. V.P.

**A80-22404 #** Operational data collection and platform location by satellite. J. L. Bessis (Centre National d'Etudes Spatiales, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 485-504.

The paper surveys the Argos data collection and platform location system onboard the Tiros-N satellite, noting that the system is particularly suitable for gathering environmental data in the areas of meteorology, oceanography and earth science. It is noted that unlike conventional data collection and transmission systems using cable and radio links, the Argos system is worldwide. Discussion covers the following areas: user platforms, orbit characteristics, data collection, platform location, operational data processing, interval between data collection and availability and distribution of results. Finally, applications of the Argos system are examined. M.E.P.

**A80-22430 #** A study of digitized radar images. A. Shahin and T. Le Toan (Centre d'Etude Spatiale des Rayonnements, Toulouse, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 879-889. 5 refs.

Radar images acquired by the JPL L Band radar over the Northern Toulouse, France are studied. Geometric and radiometric correction techniques are applied on digitized data and the study of sample responses allows estimation of the classification ability of HH and HV L band images for some surface types. Comparison with Visible and IR aerial data is presented. (Author)

**A80-22471 #** Applying contrast, filtering and smoothing techniques to Landsat images. M. Hernández (IBM-México, Centro Científico, Mexico City, Mexico) and J. L. del Rio (Instituto Mexicano del Petróleo, Mexico City, Mexico). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1367-1375. 5 refs.

The design and implementation of enhancement, smoothing, and filtering digital techniques for Landsat images are described. The gradient technique is shown to be the technique most indicated for satellite image enhancement. It is concluded that there is a prominent future in the use of contrast, smoothing, and filtering techniques applied to satellite images. V.T.

**A80-22481 \* #** Classification results using spatially correlated Landsat data. J. D. Tubbs (Arkansas, University, Fayetteville, Ark.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1499-1505. Contract No. NAS13-1608.

Tubbs and Coberly (1978) demonstrated that Landsat multi-spectral scanner data are not independent random observations, but, are in fact highly correlated. They also demonstrated that the correlation structure for the data is similar to that of a stationary autoregressive process of order one. This paper investigates the effect that serially correlated training data have upon both the estimation of parameters and the classification problem. Results are included for both the Bayesian and maximum likelihood classification procedures. (Author)

**A80-22483 \* #** Autocorrelation in Landsat data. R. G. Craig (Kent State University, Kent, Ohio). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1517-1524. 12 refs. Contract No. NAS9-13406.

Many computer algorithms for the analysis of Landsat data have a statistical basis which requires that the observations comprise independent samples. Four distinct methods are employed to show that this assumption commonly is not fulfilled for these data. Each leads to a similar conclusion; the data must be sampled no closer than every 10th pixel in order to yield independent estimators. The implications of this are illustrated with a simple example. (Author)

**A80-22484 #** A low cost classification algorithm for developing countries. H. L. Wagner and G. H. Suits (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1525-1529.

A simple multispectral classification algorithm has been developed which provides good classification accuracy while significantly reducing processing costs. The algorithm offers the user options which minimize the impact of a striped or otherwise corrupted channel; the user also has the option of allowing conflicts in signature recognition to be resolved automatically by a likelihood decision rule, or to provide the program with a priority scheme for the input signatures. A.T.

**A80-22488 #** Integrated survey of natural resources of the low lands of Bolivia using Landsat images. J. A. Michel. In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1567-1577. 9 refs.

**A80-22498 \* #** Quadratic image destriping. J. T. Dalton and G. E. Winkert (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1697-1705. 5 refs.

An algorithm for removing second-order detector banding effects (striping) from digital imagery is described. This quadratic destriping method is basically an extension of a linear method to one higher degree. It provides a nonlinear alternative between the two-parameter linear correction and a multilinear histogram equalization approach. The application of the proposed technique to GOES visible imagery is discussed, and its effectiveness is compared to existing methods. V.T.

**A80-22511 #** Computation of a data structure for a topographic map using multispectral Landsat scenes. P. Haberäcker, W. Kirchhof, E. Krauth, G. Kritikos, and R. Winter (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Nachrichtentechnik, Wessling, West Germany). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1871-1882.

A data structure from Landsat image data containing the land-use information is evaluated. Multivariable classification has been implemented in digital image processing. Verification of the classification results is presented along with reproduction of the results as pictures. Consideration is given to a tree structure and its evaluation. V.T.

**A80-22744 \* #** Stereosat - A new astrodynamics challenge. J. M. Driver (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 18th, Pasadena, Calif., Jan. 14-16, 1980, Paper 80-0237.* 10 p. 7 refs. Contract No. NAS7-100.

The paper investigates the astrodynamics requirements for a spacecraft which produces stereo images of the land masses of the earth for use in geoscience investigations, cartography and earth resource exploration. It describes a candidate Stereosat imaging product, presents criteria for evaluating potential image quality and usability, and assesses the impact of various spacecraft and astrodynamics factors on image quality. Several challenges are identified and discussed, namely (1) securing adequate image quality for pixel level elevation measurements, (2) determining absolute location of imaged phenomena in remote regions, (3) satisfying the long-term orbit prediction requirements, and (4) transmitting accurate orbit

data along with the image data stream. Meeting these challenges will greatly enhance operational facility. (Author)

**A80-24073** Analysis of numerical data handling systems in remote sensing (Analyse de systèmes de traitement numérique en télédétection). A. Grenon (Ministère des Terres et Forêts, Centre Québécois de Coordination de la Télédétection, Sainte-Foy, Quebec, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 233-239. 6 refs. In French.

One of the reasons for the increased interest of Landsat data is their easy adaptability to digital computers. In the present paper, some numerical data handling systems are reviewed. B.J.

**A80-25561 \*** Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, Purdue University, West Lafayette, Ind., June 27-29, 1979. Symposium sponsored by the American Association of Petroleum Geologists, American Society of Agronomy, Crop Science Society of America, ASP, IEEE, NASA, et al. Edited by I. M. Tendam and D. B. Morrison. New York, Institute of Electrical and Electronics Engineers, Inc., 1979. 480 p. \$25.

Papers are presented on techniques and applications for the machine processing of remotely sensed data. Specific topics include the Landsat-D mission and thematic mapper, data preprocessing to account for atmospheric and solar illumination effects, sampling in crop area estimation, the LACIE program, the assessment of revegetation on surface mine land using color infrared aerial photography, the identification of surface-disturbed features through a nonparametric analysis of Landsat MSS data, the extraction of soil data in vegetated areas, and the transfer of remote sensing computer technology to developing nations. Attention is also given to the classification of multispectral remote sensing data using context, the use of guided clustering techniques for Landsat data analysis in forest land cover mapping, crop classification using an interactive color display, and future trends in image processing software and hardware. A.L.W.

**A80-25563 \* #** Landsat-D data acquisition and processing. P. L. Smith, Jr. and W. C. Webb (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 13-20.

The Landsat-D system, in which S-band and X-band data links will provide real-time direct transmission of sensor data, is described. System performance objectives include input data quantity of 200 MSS scenes/day and 100 TM scenes/day by the Domestic Communication Satellite, and processing capability, in a pipeline mode, of 2.6 x 10 to the 11th input bits of sensor data per 16-hour day. Data processing techniques, including automated cloudcover assessment, control point library build system, radiometric calibration, and geometric correction are discussed. J.P.B.

**A80-25579** Analyzing accuracy attributes of Landsat and digital terrain tape data in the context of a digital geobase information system. D. A. Stow and J. E. Estes (California, University, Santa Barbara, Calif.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 193-201. 13 refs.

**A80-25580** An image registration algorithm using sampled binary correlation. E. W. Cordan, Jr. (Martin Marietta Aerospace, Orlando, Fla.) and B. W. Patz (Central Florida, University, Orlando, Fla.). In: Machine processing of remotely sensed data; Proceedings of

the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 202-212. 6 refs.

One of the problems associated with the automatic image processing of satellite photographs such as weather maps is the need for image registration; that is, the fitting of a map that has some translational and rotational bias to a known data base. This paper investigates a least squares method of image registration using an image that has been converted into a boundary map with a pixel representation of 1 for land, -1 for water and zero for cloud pixels. A sampled correlation array is constructed about the correlation peak of the binary cross-correlation for the coded satellite map against its data base by shifting the satellite map to locations on a given grid, and performing an accumulation of the pixel-by-pixel comparisons between the satellite image and its data base over the whole map or a smaller search window. A least squares approximation of the translational and rotational bias can then be performed using the data from this sampled correlation array, fitted against a shape such as an elliptical cone. (Author)

**A80-25587 #** **Transfer of remote sensing computer technology to the developing world - Case examples.** C. K. Paul (Agency for International Development, Washington, D.C.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 278-283.

The problems that the Agency for International Development has had to face in transferring remote sensing computer technology for image processing to less developed countries (LDCs) that utilize Landsat data are reviewed. These include the necessity to first develop visual analysis skills, variations in computer compatible tape formats, and the capital-intensive technology involved. Attention is also given to actual case examples of the useful development in LDCs of computer facilities, including the advanced digital processing, display and recording techniques used in Egypt, the GEOBOL remote sensing center in Bolivia, deforestation studies in Thailand, and crop identification and measurement in Sri Lanka. J.P.B.

**A80-25588** **IMAGENET - An image analysis network.** P. R. Pearl (DPIX Systems, Ltd., Ottawa, Canada). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 286-293.

An image analysis network called IMAGENET which incorporates the implementation of public access packet switching networks, reduced cost of high speed digital memory, and advances in microcomputer power, is described. Emphasis is given to a number of microprocessor-controlled remote entry analyzing color terminals, particularly with regard to the time required to transmit an image through the network. J.P.B.

**A80-25589 \* #** **A system for processing Landsat and other georeferenced data for resource management applications.** S. L. Whitley (NASA, National Space Technology Laboratories, Earth Resources Laboratory, Slidell, La.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 294-303. 7 refs.

The NASA Earth Resources Laboratory has developed a transferrable system for processing Landsat and disparate data with capabilities for digital data classification, georeferencing, overlaying, and data base management. This system is known as the Earth Resources Data Analysis System. The versatility of the system has been demonstrated with applications in several disciplines. A description is given of a low-cost data system concept that is suitable for transfer to one's available in-house minicomputer or to a low-cost computer purchased for this purpose. Software packages are

described that process Landsat data to produce surface cover classifications and that geographically reference the data to the UTM projection. Programs are also described that incorporate several sets of Landsat derived information, topographic information, soils information, rainfall information, etc., into a data base. Selected application algorithms are discussed and sample products are presented. The types of computers on which the low-cost data system concept has been implemented are identified, typical implementation costs are given, and the source where the software may be obtained is identified. (Author)

**A80-25590** **Georgia's operational Landsat processing system.** N. L. Faust, L. E. Jordan (Georgia Institute of Technology, Atlanta, Ga.), and B. O. Rado (Georgia Department of Natural Resources, Atlanta, Ga.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 304-310. 9 refs.

**A80-25594 \*** **A method for classifying multispectral remote sensing data using context.** P. H. Swain, H. J. Siegel, and B. W. Smith (Purdue University, West Lafayette, Ind.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 343-353. 15 refs. Contract No. NAS9-15466.

The paper describes a method of classifying multispectral remote sensing data using a context classifier. Because the computational requirements of the context classifier are very large, its implementation on parallel/pipelined multiprocessor systems is being investigated, so that the types of computations can be efficiently implemented. Special considerations necessary for such implementations are discussed, with particular reference to implementation on an array of Control Data Corporation Flexible Processors. A.T.

**A80-26311 #** **The geometric correction of Landsat images at the Canada Centre for Remote Sensing (La correction géométrique des images Landsat au Centre Canadien de Télédétection).** F. E. Guertin, T. J. Butlin, and R. G. Jones (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). (*Groupement pour le Développement de la Télédétection Aérospatiale, Colloque International, 3rd, Toulouse, France, June 19-22, 1979.*) *Canadian Journal of Remote Sensing*, vol. 5, Dec. 1979, p. 118-127. 6 refs. In French.

To facilitate the integration of Landsat multi-spectral imagery with other geobase information systems, the Canada Centre for Remote Sensing has developed a precision processed image product in the Universal Transverse Mercator (UTM) projection, offered to the users on computer compatible tapes. The images are geometrically corrected and rotated in order to align the pixels on the UTM metric grid. Pixels are resampled to 50 sq m. To be compatible with the National Topographic System, the Landsat images are divided into 0.5 deg latitude by 1.0 deg longitude quadrangles corresponding to four map sheets in the 1:50,000 series or one quarter of a map sheet in the 1:250,000 series. These images are generated on a digital image correction system composed of a minicomputer, standard peripherals, an image display terminal for ground control points acquisition and a micro-programmed corrector. (Author)

**A80-26750 #** **A Landsat digital examination of Khumbu glacier, Nepal.** D. C. Rundquist and S. A. Samson (Nebraska, University, Omaha, Neb.). *Remote Sensing Quarterly*, vol. 2, Jan. 1980, p. 4-15. 19 refs. Research supported by the United Nations.

The analysis of a glacier in eastern Nepal by means of Landsat computer-compatible tape data is reported. The tape for eastern Nepal was subjected to single-channel thresholding, paralleliped classification, and unsupervised and supervised classification, and results were compared with ground truth in the forms of detailed maps and verbal descriptions of the region. MSS channel 5 is found to be the most useful channel for distinguishing the snow, firm, clean

ice, debris-covered ice, and moraine regions of the glacier, and unsupervised clustering using all four Landsat bands and seven cluster classes confirmed the existence of a statistical decision boundary between the clean ice and snow on the glacier. It is concluded that Landsat digital data can be used to prepare rapidly and inexpensively useful glacier maps identifying major surface features (glacial outline, accumulation and ablation zones, debris-covered ice, clean ice, snow, and firn).  
A.L.W.

**A80-27428** Landsat-D sensor data product generation. J. Danaher and O. J. Inscow (General Electric Co., Lanham, Md.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 30-38.

For the Landsat-D mission, NASA is developing a separate and dedicated facility at the Goddard Space Flight Center. This separate facility, designated the Data Management System (DMS), will provide for autonomous development and integration of the Landsat-D system without disrupting ongoing Landsat 1, 2, and 3 operations. The DMS employs digital processing techniques and communications satellites to minimize the loss of information between the sensor output and the ultimate user. This is to be accomplished by providing timely delivery of master data products to the public domain facility located at Sioux Falls, South Dakota. In addition, products will be provided to a Landsat Assessment System (LAS) facility, which will function as the research and development arm of the Landsat-D mission.  
(Author)

**A80-27429 \*** Spatial quantification of maps or images - Cell size or pixel size implications. M. E. Wehde (South Dakota State University, Brookings, S. Dak.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 45-64. 7 refs. Grant No. NGL-42-003-007.

The paper discusses spatial quantification of maps or images. Spatial accuracies evaluated by mapping and inventory measures were observed with a range of cell sizes for a 10.36 sq km soil survey segment. The distribution of interboundary distances in a map was evaluated as unique, characterizing information; experimentally observed relationships between accuracy and cell size and interboundary distance distribution parameters and cell size led to a model of the process of spatial quantization. Grid positioning effects were evaluated and were significant only at the level of individual mapping units; two generations of 'universal' process models were derived, implemented, and evaluated.  
A.T.

**A80-27432 \*** Error detection and rectification in digital terrain models. M. J. Hannah (NASA, Ames Research Center, Institute for Advanced Computation, Moffett Field, Calif.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 152-164. 5 refs.

Digital terrain models produced by computer correlation of stereo images are likely to contain occasional gross errors in terrain elevation. These errors typically result from having mismatched sub-areas of the two images, a problem which can occur for a variety of image- and terrain-related reasons. Such elevation errors produce undesirable effects when the models are further processed, and should be detected and corrected as early in the processing as possible. Algorithms have been developed to detect and correct errors in digital terrain models. These algorithms focus on the use of constraints on both the allowable slope and the allowable change in slope in local areas around each point. Relaxation-like techniques are employed in the iteration of the detection and correction phases to obtain best results.  
(Author)

**A80-29978 \*** Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory. W. B. Green, N. A. Bryant, P. L. Jepsen, R. G. McLeod, J. A. Mosher, R. H. Selzer, W. D. Stromberg, G. M. Yagi, and A. L. Zobrist (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Optical Engineering*, vol. 19, Mar.-Apr. 1980, p. 168-179. 17 refs. Contract No. NAS7-100.

During the past decade advanced techniques have been developed at JPL for processing large volumes of imagery returned by the more recent planetary spacecraft. In addition, the Image Processing Laboratory has become involved in the processing of earth resources imagery acquired by Landsat and a variety of other sensors flown on aircraft and spacecraft. The trend within the facility has been toward the development of technology capable of processing increasingly larger image data bases. A variety of applications in both the planetary and earth observations areas involve the merging and/or processing of more than one image and often require the correlation of data acquired by a variety of sensors.  
B.J.

**A80-30922** Different considerations in coastal mapping. S. E. Masry and S. MacRitchie (New Brunswick, University, Fredericton, Canada). (*International Society for Photogrammetry, Inter-Congress Symposium, Ottawa, Canada, Oct. 2-6, 1978.*) *Photogrammetric Engineering and Remote Sensing*, vol. 46, Apr. 1980, p. 521-528. 11 refs.

Water penetration, refraction, and incomplete stereomodels are the three main problems in photogrammetric mapping of coastal waters. These problems, together with the different means for overcoming them, are discussed. In particular, the use of simultaneous photography from two aircraft, inertial navigation, black-and-white infrared photography, and lidar are analyzed. The objective of the analysis is to acquire an insight into the configuration and requirements of a universal coastal mapping system.  
(Author)

**A80-30923** A calibration procedure for Fourier series thermal inertia models. D. A. Pratt, S. J. Foster, and C. D. Ellyett (Newcastle, University, Newcastle, Australia). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Apr. 1980, p. 529-538. 20 refs.

A simple, linear Fourier series model for the calibration of airborne and satellite thermal inertia surveys has been developed which requires only a single calibration point. Information obtained from this single calibration point is sufficient to allow the prediction of the diurnal ground surface temperature fluctuation over a wide range of thermal inertia and albedo values. Not only does this model include the radiative energy exchange of the ground surface, but also the turbulent energy transfer. The model is simple and rapid to compute and provides an absolute tie between the remote sensing data and the ground thermal properties.  
(Author)

**A80-31977** What is an analytical plotter (Qu'est-ce qu'un restituteur analytique). P. Munier (Institut Géographique National, Saint-Mandé, Val-de-Marne, France). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 23-37. In French.

Analytical stereoplotters are a new generation of photogrammetric plotting systems. This paper reviews the design and operation of analytical plotters; attention is given to the architecture, the optical-mechanical unit, the electronic unit, and the data unit and peripherals. Special emphasis is placed on the logic structure of the plotter.  
B.J.

**A80-31980** Compatibility of analytical plotters with digital imagery in the plotting of variable spaces (Compatibilité des restituteurs analytiques avec l'imagerie digitale dans la restitution d'espaces variés). B. Dubuisson. In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 129-139. In French.

Some aspects of the use of analytical plotters in photogrammetric cartography are reviewed. Attention is given to: (1) the adaptability of the plotter, (2) automation techniques based on digital correlation, and (3) the general processing of digital imagery by the analytical plotter. B.J.

**A80-31996** An interactive software for plotting thematic maps. S. Vetrella, A. Moccia, and C. Tripodi (Napoli, Università, Naples, Italy). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 482-489. Consiglio Nazionale delle Ricerche Contracts No. 76,0015; No. 76,00518,07.

The paper presents an overview of the CATART Interactive Digital Analysis System (CIDAS) for use with data from aerospace remote sensing platforms. A description of the basic overall system philosophy is presented that shows the structure and results of overlays used to get automatic thematic maps. Flowcharts of the analog and digital analysis system are presented along with the CIDAS software block diagram. C.F.W.

**A80-32101 \*** The seasonal cycle of snow cover, sea ice and surface albedo. A. Robock (Maryland, University, College Park, Md.). *Monthly Weather Review*, vol. 108, Mar. 1980, p. 267-285. 41 refs. Grant No. NSG-5209.

The paper examines satellite data used to construct mean snow cover caps for the Northern Hemisphere. The zonally averaged snow cover from these maps is used to calculate the seasonal cycle of zonally averaged surface albedo. The effects of meltwater on the surface, solar zenith angle, and cloudiness are parameterized and included in the calculations of snow and ice albedo. The data allows a calculation of surface albedo for any land or ocean 10 deg latitude band as a function of surface temperature ice and snow cover; the correct determination of the ice boundary is more important than the snow boundary for accurately simulating the ice and snow albedo feedback. A.T.

**A80-32262** Space photography and thematic mapping - A method for processing multichannel photography (Kosmicheskaya s'emka i tematicheskoe kartografirovaniye - Metodika obrabotki mnogoazonal'nykh snimkov). Edited by K. A. Salishchev and Iu. F. Knizhnikov. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979. 232 p. In Russian.

The use of multispectral aerial and space photographs for the construction of thematic (e.g., landscape, geomorphological, hydrological, and economic) maps is considered. Attention is also given to methods for processing multispectral photographs; such topics as photometric measurements, color-image synthesis, automatic classification, and digital processing are covered. B.J.

**A80-32266 #** Method for the photometric interpretation of multispectral aerial photographs (Metodika fotometricheskogo deshifirovaniia mnogoazonal'nykh aerofotosnimkov). I. A. Labutina and L. A. Kovrizhnykh. In: Space photography and thematic mapping - A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 33-39. In Russian.

A microphotometric technique for the interpretation of multispectral photographs is described; its accuracy is considered and distributions of normalized photometric image characteristics are presented. The technique has been applied to the interpretation of photographs of agricultural areas, river flows, and terrain erosion characteristics. B.J.

**A80-32267 #** Comparison of registograms in the microphotometric interpretation of multispectral photographs (Sopostavleniye registrogramm pri mikrofoto-metricheskom deshifirovaniia mnogoazonal'nykh snimkov). V. I. Kravtsova. In: Space photog-

raphy and thematic mapping - A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 39-45. In Russian.

Procedures of visual comparison in the photometric interpretation of multispectral photographs are presented. The method is a relatively simple one, based on the comparison of registograms obtained in the measurement of multispectral negatives. The interpretation of some aerial photographs of different soil types is considered by way of illustration. B.J.

**A80-32279 #** Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas (Ispol'zovanie mnogoazonal'nykh skanernykh kosmicheskikh snimkov pri sozdaniia landshaftnoi karty poluostrovov Mangyshlak i Buzachi). A. F. Voronina. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 139-148. In Russian.

**A80-32282 #** Experiment on the complex interpretation of multispectral scanner aerial photographs of Bulgaria (Eksperiment po kompleksnomu deshifirovaniu mnogoazonal'nykh skanernykh aerofotosnimkov Narodnoi Respubliki Bolgarii). V. I. Kravtsova, Kh. B. Spiridonov, and E. K. Misheva. In: Space photography and thematic mapping: A method for processing multichannel photography. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1979, p. 159-180. In Russian.

**N80-16392\*#** National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. **EVALUATION OF REGISTRATION, COMPRESSION, AND CLASSIFICATION ALGORITHMS. VOLUME 2: DOCUMENTATION**

R. Jayroe, Principal Investigator, R. Atkinson, L. Callas, J. Hodges, B. Gaggini, and J. Peterson Feb. 1979 331 p refs ERTS (E80-10042; NASA-TM-78227) Avail: NTIS HC A15/MF A01 CSCL 08B

**N80-16405\*#** National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va. **SYNTHETIC APERTURE RADAR/LANDSAT MSS IMAGE REGISTRATION**

H. E. Maurer, ed., J. D. Oberholtzer, ed., and P. E. Anuta, ed. (Purdue Univ.) Jun. 1979 233 p Sponsored in part by Goodyear Aerospace Corp. Original contains color illustrations (Contracts NAS6-2816; NAS6-2827) (NASA-RP-1039) Avail: NTIS HC A11/MF A01 CSCL 17I

Algorithms and procedures necessary to merge aircraft synthetic aperture radar (SAR) and LANDSAT multispectral scanner (MSS) imagery were determined. The design of a SAR/LANDSAT data merging system was developed. Aircraft SAR images were registered to the corresponding LANDSAT MSS scenes and were the subject of experimental investigations. Results indicate that the registration of SAR imagery with LANDSAT MSS imagery is feasible from a technical viewpoint, and useful from an information-content viewpoint. J.M.S.

**N80-19586\*#** Lockheed Engineering and Management Services Co., Inc., Houston, Tex. Systems and Services Div. **AS-BUILT DESIGN SPECIFICATIONS OF THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES). VOLUME 1: TEST AND APPENDICES**

J. Everette, A. Rios, J. Good, C. Horton, D. McCarley, and M. Nieves, Principal Investigators Dec. 1979 335 p ERTS (Contract NAS9-15800) (E80-10077; NASA-CR-160461; LEC-12904-Vol-1; JSC-14634-Vol-1) Avail: NTIS HC A15/MF A01 CSCL 05B

**N80-20651#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany). **THE TRIANGULATION NETWORK IN WEST GERMANY [UNTERSUCHUNGEN IM HAUPTDREIECKSNETZ DER BUNDESREPUBLIK DEUTSCHLAND]**

Dieter Ehlert *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 127-130 refs In GERMAN*

Avail: NTIS HC A11/MF A01

The development of the West German triangulation system is described. The precision of the network, including improvements, is examined. Corrections to consider in the experimental techniques and mathematical approach are discussed. Author (ESA)

**N80-20654#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**CARTOGRAPHY APPLICATIONS AND RESEARCH [DIE KARTOGRAPHIE IN PRAXIS UND FORSCHUNG]**

Walter Satzinger *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 141-142 In GERMAN*

Avail: NTIS HC A11/MF A01

The evolution of cartography in response to growing needs for more precise representation is briefly related. Progress in reprography and data processing have results in improved quality at lower cost. The increasing number of applications of cartography to photogrammetry are mentioned. Author (ESA)

**N80-20655#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**DEVELOPMENT, STATUS, AND GOALS OF CARTOGRAPHIC AUTOMATION [ENTWICKLUNG, AUFGABENSTELLUNG UND ZIELE DER KARTOGRAPHISCHEN AUTOMATION]**

Wilhelm L. Pfrommer *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 143-148 In GERMAN*

Avail: NTIS HC A11/MF A01

Progress in cartography with the development of automation is related briefly. Equipment in use by the EDV includes an interactive digitizing system (ARISTOGRID CD400), a cartographic automation system (coragraph DC3), and a high precision drafting table (coragraph 1700). Author (ESA)

**N80-20656#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**AUTOMATIC ACQUISITION AND PROCESSING OF CARTOGRAPHIC DATA [AUTOMATIONSGESTUETZTE ERFASSUNG UND AUFBEREITUNG KARTOGRAPHISCHER DATEN]**

Theodor Johannsen *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 149-156 In GERMAN*

Avail: NTIS HC A11/MF A01

The acquisition and processing of cartographic data is examined. Cartographic data gathered through photogrammetry, statistics or other means are digitized for computation; coordinates of points, their nature and alphanumeric symbols are recorded. Automatic drawing from optical sensors or scanners is described along with error control and correction procedures. Examples are given of the relative precision obtained at different production rates. Author (ESA)

**N80-20657#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**ON PRECISION IN THE GATHERING AND PRODUCTION OF CARTOGRAPHIC DATA [GENAUIGKEITSUNTERSUCHUNGEN BEI ERFASSUNG UND AUSGABE KARTOGRAPHISCHER DATEN]**

Theodor Johannsen *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 157-159 In GERMAN*

Avail: NTIS HC A11/MF A01

The accuracy of digitizers in analog to digital conversion is examined. Measurements show that the scale error introduced is inferior to the resolution power of the apparatus. Improved precision can be obtained by means of an optical interferometer. Errors introduced by manual operations are discussed. Satisfactory results are obtained in the case of same-scale work and also when translating to a smaller scale. Author (ESA)

**N80-20658#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**COMPUTER BASED GENERALIZATION FOR THE ELABORATION AND EXTENSION OF TOPOGRAPHIC MAPS [RECHNERGESTUETZTE GENERALISIERUNG BEI DGR HERSTELLUNG UND FORTFUEHRUNG TOPOGRAPHISCHER KARTEN]**

Fred Christ *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 161-165 refs In GERMAN*

Avail: NTIS HC A11/MF A01

Research and programming for a computer based system for automatic mapping is described. The concept of calculator-based map generalization is exposed. Interactive, semi-automatic, and automatic generalization systems are presented.

Author (ESA)

**N80-20659#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**GRAPHIC PRODUCTION OF MAPS ON SCREENS OR PHOTOCOMPOSITION DEVICES [GRAPHISCHE AUSGABE VON KARTEN AUF BILDSCHIRM UND LICHTZEICHENMASCHINE]**

Helmut Uhrig *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 167-169 In GERMAN*

Avail: NTIS HC A11/MF A01

Two image retrieval systems are described and compared. A cartographic system is discussed which converts numeric map data into analog images either on a screen or on a precision charting machine. Choice of a system depends on the desired speed and precision. Author (ESA)

Author (ESA)

**N80-20665#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**ON SPECTRAL SIGNATURES IN CENTRAL PERSPECTIVE REPRESENTATION [ZUR BERUECKSICHTIGUNG VON OBJEKTEIGENSCHAFTEN IN ZENTRALPERSPEKTIVEN ABBILDUNGEN]**

Joern Sievers *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 193-197 refs In GERMAN*

Avail: NTIS HC A11/MF A01

Object signature in aerial photography is briefly studied. Nonuniformity in tone (over the picture) due to sunlight reflection in vertical photographs is discussed, and the effect of different Sun angles is shown in several photographs. Author (ESA)

Author (ESA)

**N80-20669#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**DIGITAL HEIGHT MODEL WITH ITEK CORRELATOR [DIGITALES HOEHENMODELL MIT DEM ITEK KORRELATOR]**

Gerhard Lindig *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 219-223 refs In GERMAN*

Avail: NTIS HC A11/MF A01

Emphasis is given to the utilization of this model in the restitution of orthophotos. The most important factors taken into consideration include: determination of heights as accurately as possible; obtaining the least possible drop in correlation; rapid extraction of correlation; avoidance or domination of Floats; avoidance or recognition of Swings; elimination of systematic adaptation of parameters to different local conditions; filling in correlation loss gaps. It is concluded that the ITEK correlator EC5 can greatly contribute to the obtaining of height information for the orthophoto and also for height line maps.

Author (ESA)

**N80-20670#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE FUTURE OF ANALYTICAL EVALUATION EQUIPMENT [ERWARTUNGEN AN ANALYTISCHE AUSWERTEGERAETE]**

Karl Schuerer *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 225-227 refs In GERMAN*

Avail: NTIS HC A11/MF A01

Developments in image measurement techniques are covered with emphasis on comparators and analog evaluation techniques. Advantages and disadvantages found in both techniques are considered. The feasibility of an apparatus incorporating the advantages of both systems and computer technology is addressed. Applications in practical photogrammetry and in the field of research are included. Author (ESA)

**N80-20671#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**DIGITAL MAP BASES FROM PHOTOGRAMMETRIC MEASUREMENTS [DIGITALE KARTENGRUNDLAGEN AUS PHOTOGRAMMETRISCHEN MESSUNGEN]**

Hermann G. Neubauer *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 229-231 In GERMAN*

Avail: NTIS HC A11/MF A01

Progress in electronic data processing has led to the development of accurate automated equipment for the production of all types of maps, systems, in which out-of-date information is eliminated and new objects, of particular interest, are introduced. Various calculation procedures associated with the transfer of measured data to digital maps are indicated: adaptation to the map's coordinate system; division of stereogram areas into areas of similar usage; association of measurements from adjacent stereograms; incorporation of modifications from field comparisons; preparation of data for storage in data banks. The automatic generation of height lines from discrete points is discussed. The corresponding coloration of different cultures can also be handled in this way. Author (ESA)

**N80-20672#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**TASKS AND POSSIBILITIES OF DIGITAL IMAGE DATA PROCESSING IN PHOTOGRAMMETRY [AUFGABEN UND MOEGELICHKEITEN DGR DIGITALEN BILDVERARBEITUNG IN DGR PHOTOGRAMMETRIE]**

Bernd-Siegfried Schulz *In its Rept. on Cartography and Geodesy. Ser. 1: Original Rept. No. 73 1977 p 233-235 In GERMAN*

Avail: NTIS HC A11/MF A01

A technique to accelerate fabrication and improve the quality of topographic maps made from primary data is described. Applications include remote sensing from aircraft and satellites. The treatment of data from LANDSAT 1, 2, and 3 is discussed. Optical and geometrical effects are corrected and contrast enhanced. High sensitivity is achieved enabling various surface coverages to be identified and studied in detail (different types of region, forests, geographical, and geological features). Correlations between different parts of a single image and between different images are studied and exploited. Author (ESA)

**N80-20705#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**REPORTS ON CARTOGRAPHY AND TOPOGRAPHICAL MEASUREMENTS. SERIES 1: ORIGINAL REPORTS [NACHRICHTEN AUS DEM KARTEN UND VERMESSUNGSWESEN. REIHE 1: ORIGINALBEITRAEGE HEFT NO. 77]**

1978 179 p refs In GERMAN; ENGLISH summary Original contains color illustrations

(Rept-77: ISSN-0469-4236) Avail: NTIS HC A09/MF A01

Eight papers are presented dealing with photogrammetry, remote sensing, data enhancement using computer techniques (including least squares calculations), and application of Skylab and LANDSAT data to small scale cartography. Also treated are the production and analysis of multispectral images, definition of a reflective quantity for remote sensing data, and a calculation method for setting data for analog plotters.

**N80-20707#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**THE PROBLEM OF OBTAINING DATA FOR THE DIGITAL HEIGHT MODEL [PROBLEME DER DATENGEWINNUNG FUER DAS DIGITALE HOEHENMODELL]**

Gerhard Lindig *In its Rept. on Cartography and Topographical meas. Ser. 1: Original Rept. 1978 p 37-48 refs In GERMAN; ENGLISH summary Presented at Intern. Symp. der IGP, Komm 3, Moscow, 1978 N80-20705 11-42)*

Avail: NTIS HC A09/MF A01

The point coordinates for the Digital Height Model were measured with the necessary accuracy by photogrammetric methods. Problems were encountered in obtaining correct ground heights for wooded and built-up areas, for breaks of slope or for large fields with poor contrast by manual as well as by automatic scanning. These problems were solved only by improving the original data using computer techniques. Author (ESA)

**N80-20708#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**A METHOD FOR EXAMINING RELATIONSHIPS BETWEEN MULTISPECTRAL DATA [EINE METHODE ZUE PRUEFUNG CON ABHAENGIGKEITEN ZWISCHEN MULTISPEKTRALEN DATEN]**

Bernd-Siegfried Schulz *In its Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 49-69 refs In GERMAN; ENGLISH summary*

Avail: NTIS HC A09/MF A01

A method to examine multispectral vectors of characteristics with regard to significant difference applied for instance, to problems of spectral object separation, is presented. This method differs from former procedures by using (least squares) adjustment and visual evaluation of the corrections obtained as a result. The method saves computing time and can also be applied to large quantities of data. The method is tested through the use of several examples. Author (ESA)

**N80-20711#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**ON THE WRITING ACCURACY OF THE REPRODUCTION UNIT OF THE OPTRONICS SYSTEM P1700 [ZUR SCHRIEBGENAUIGKEIT DER WEIDERGABEEINHEIT IM OPTRONICS SYSTEM P1700]**

Bernd-Siegfried Schulz *In its Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 141-148 In GERMAN; ENGLISH summary*

Avail: NTIS HC A09/MF A01

A method for determining the accuracy of the plotting system of a digital image scanning device is described. A method is shown for eliminating linear affine distortions by introducing corrections into the writing mechanism. Author (ESA)

**N80-20719** Tennessee Univ., Knoxville.

**APPLICATION OF LANDSAT IMAGERY TO MONITOR SAND DUNES MOVEMENT IN THE SAHARA DESERT Ph.D. Thesis**

Ahmed Mokhtar Brera 1979 347 p

Avail: Univ. Microfilms Order No. 8005371

Band 5 and band 7 imagery available from LANDSAT 1 and LANDSAT 2 for the period between 1972 and 1976 over selected test areas in the Libyan Desert was used to identify and map distinct units on the ground. The results obtained were supported by ground truth data obtained from the selected sites in the form of topographic, geologic, and soil maps, aerial photographs, and meteorological information. The findings indicate that global surveillance of the status of dryland ecosystems and of land use can be achieved most economically through the use of LANDSAT imagery if proper image analysis techniques are used. Sand dune movement of the magnitude one kilometer and more can be detected easily using the proposed system.

Dissert. Abstr.

## 07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

**N80-20766\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.

**IMPROVEMENT IN CLASSIFICATION ACCURACY OF  
LANDSAT MSS DATA IN AREAS OF MOUNTAINOUS  
TERRAIN**

C. Justice, B. Holben, and S. Wharton, Principal Investigators  
*In its* Earth Survey Appl. Div.: Res. Leading to the Effective  
Use of Space Technol. in Appl. Relating to the Earth's Surface  
and Interior Jan. 1980 p 220-223 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 05B

**N80-20767\*#** National Aeronautics and Space Administration.  
Goddard Space Flight Center, Greenbelt, Md.

**SOURCES OF VARIATIONS IN LANDSAT AUTOCORRELA-  
TION**

M. L. Labovitz, Principal Investigator *In its* Earth Survey Appl.  
Div.: Res. Leading to the Effective Use of Space Technol. in  
Appl. Relating to the Earth's Surface and Interior Jan. 1980  
p 224-227 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 05B

## INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

**A80-22380 \* #** **The Massively Parallel Processor and its applications.** J. P. Strong, D. H. Schaefer, J. R. Fischer, K. R. Wallgren, and P. A. Bracken (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 37-45.

A long-term experimental development program conducted at Goddard Space Flight Center to implement an ultrahigh-speed data processing system known as the Massively Parallel Processor (MPP) is described. The MPP is a single instruction multiple data stream computer designed to perform logical, integer, and floating point arithmetic operations on variable word length data. Information is presented on system architecture, the system configuration, the array unit architecture, individual processing units, and expected operating rates for several image processing applications (including the processing of Landsat data). B.J.

**A80-22381 #** **The CCRS Image Analysis Processor.** D. G. Goodenough, W. M. Strome (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and S. F. Gourley (DIPIX Systems, Ltd., Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 47-59. 9 refs.

The Image Analysis Processor (IAP) was designed to meet three processing needs in the Image Analysis System of the Canada Centre for Remote Sensing: (1) classification with the maximum likelihood decision rule, (2) computation of two-dimensional Fourier transforms, and (3) high-speed image transfers to the display refresh memory. The IAP operates in parallel, internally and externally, to permit, for example, the classification of a full Landsat frame into 32 classes in about six minutes, which compares favorably with the four minutes required on the ILLIAC IV. This paper gives an overview of the Image Analysis System and describes IAP hardware and operations. B.J.

**A80-22390 #** **Multi-sensor Landsat MSS registration.** S. S. Rifman, A. T. Monuki, and C. P. Shortwell (TRW Defense and Space Systems Group, Redondo Beach, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 245-258. 13 refs.

An account is given of the methods developed for precision registration of full scene MSS data obtained from different Landsat spacecraft. Results are presented for Landsat 1/2 scene registration as well as multitemporal registration of data from the same satellite. Direct cross correlation measurements show registration accuracies of about 1/3 pixel for Landsat 1/2. (Author)

**A80-22391 #** **Correction of synthetic aperture radar and multispectral scanner data sets.** D. G. Goodenough, B. Guindon, and P. M. Teillet (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 259-270. 5 refs.

Techniques developed for the radiometric and geometric correction of satellite and airborne SAR and MSS data are described with reference to agricultural data acquired in Canada. It is found that the use of a digital terrain model along with an aircraft altitude model would allow the rectification of large SAR images to a UTM projection. The classification and interpretation of SAR images are significantly improved if the data are median-filtered. With median-filtered SAR data, an average classification accuracy of 82 plus or minus 4 sem % was obtained for the classification of corn, trees, and alfalfa; and wheat, soybeans, and soybean stubble. B.J.

**A80-22409 \* #** **Signature evaluation of natural targets using high spectral resolution techniques.** W. Collins (NASA, Goddard Institute for Space Studies; Columbia University, New York, N.Y.) and H.-Y. Chiu (Geophysical and Environmental Research, Inc.; Columbia University, New York, N.Y.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 567-582. 7 refs.

The concept of 'spectral signature' identification has been applied to LANDSAT and other broad-band multi-spectral scanner data to classify various materials on the earth's surface. A large amount of the spectral information available is invisible, however, to the broad-band sensors. Although the natural targets of interest in remote sensing do not exhibit fine line features such as those associated with gaseous media, there is significant information to be extracted from smoothly varying spectral reflection functions of most natural targets. Subtle variations observed recently in the high resolution 'spectral signatures' of vegetation targets, in particular, promise to open new avenues of application using higher spectral and radiometric resolution techniques. This research was accomplished using a 500-band spectroradiometer system specially adapted to rapid airborne operations. (Author)

**A80-22420 \* #** **Surface temperature variations as measured by the Heat Capacity Mapping Mission.** J. C. Price (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 765-770. 7 refs.

The AEM-1 satellite, the Heat Capacity Mapping Mission, has acquired high-quality thermal infrared data at times of day especially suited for studying the earth's surface and the exchange of heat and moisture with the atmosphere. Selected imagery illustrates the considerable variability of surface temperature in and around cities, in the dry southwestern United States, in the Appalachian Mountains, and in agricultural areas. Through simplifying assumptions, an analytic experience is derived that relates day/night temperature differences to the near-surface layer (thermal inertia) and to meteorological factors. Analysis of the result suggests that, in arid regions, estimates of relative thermal inertia may be inferred, whereas, in agricultural areas, a hydrologic interpretation is possible. (Author)

**A80-22425 \* #** **Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah.** V. Gornitz (NASA, Goddard Institute for Space Studies; Columbia University, New York, N.Y.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 825-834. 15 refs. Grant No. NSG-5163.

**A80-22442 #** **Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data.** J. Dejaice, J. Mégier, M. Kohl, G. Maracci, P. Reiniger, G. Tassone (EURATOM and Comitato Nazionale per l'Energia Nucleare Centro Comune di

Ricerche, Ispra, Italy), and J. Huygen. In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1015-1024. 9 refs.

A multiple search and interpolation method has been developed in order to use the 'Tell-us' model to map thermal inertia, soil moisture and cumulative daily evaporation by starting from thermal and visible data acquired by air borne scanner. Interpolations are made within and between look-up tables generated previously by the model which uses a reverse temperature simulation process. After the necessary geometric, radiometric and atmospheric corrections have been applied, the scanner data are processed together with ground and meteorological data to produce moisture and evaporation maps. Comparison with available measurements indicates a tendency to underestimate soil moisture content; a similar trend seems to be also verified for cumulative daily evaporation. Mapping of locally non-homogeneous areas encounters some difficulties which are discussed. (Author)

**A80-22472 \* #** Geometric correction of satellite data using curvilinear features and virtual control points. V. R. Algazi, G. E. Ford, and D. I. Meyer (California, University, Davis, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1377-1383. 6 refs. Grant No. N5G-5092.

A simple, yet effective procedure for the geometric correction of partial Landsat scenes is described. The procedure is based on the acquisition of actual and virtual control points from the line printer output of enhanced curvilinear features. The accuracy of this method compares favorably with that of the conventional approach in which an interactive image display system is employed. (Author)

**A80-22513 #** Main aspects of two Chilean remote sensing projects developed under extreme severe environmental conditions - Desert North and Antarctic South. M. Araya (Chile, Universidad; Instituto Antártico Chileno, Santiago, Chile). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 3. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1895-1906.

Remote sensing techniques are being employed to study the natural resources of remote, rough areas of Chile. Airborne sensors including a multiband camera, a thermal infrared scanner, and conventional B/W photography are being used to study the geothermal resources of the Atacama Desert. In addition, a multi-disciplinary approach to gathering environmental data on the Chilean Antarctic Territory is discussed, with emphasis on the Landsat satellite working in conjunction with automatic data collection platforms including the Weddell Sea installation. J.P.B.

**A80-24075** The ROS-580 Project (Le Projet ROS-580). K. P. B. Thomson and R. T. Lowry (Intera Environmental Consultants, Ltd., Ottawa, Canada). In: Remote sensing and resources management; Congress, 1st, Montreal, Canada, November 1977 and Congress, 2nd, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings. Sainte-Foy, Quebec, Canada, Association Québécoise de Télédétection, 1979, p. 251-264. 28 refs. In French.

ROS-580 is the airborne part of the Canadian SURSAT program. An ERIM four-channel synthetic aperture radar was installed on the Convair 580 aircraft of the Canada Centre for Remote Sensing. Experiments flown between June 1978 and May 1979 collected data across Canada in four major discipline areas: oceans, ice, human activities, and renewable resources. The planning of the SAR-580 project is examined, and preliminary results for several experiments are given. B.J.

**A80-25332 \*** Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMMR/. E. G. Njoku

(California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). (Inter Union Commission on Radio Meteorology, Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978.) *Boundary-Layer Meteorology*, vol. 18, Feb. 1980, p. 79-98. 12 refs.

Procedures for correcting antenna temperature measurements and retrieving the true brightness temperatures are developed for the Scanning Multichannel Microwave Radiometer (SMMR) flown on the Seasat-A and Nimbus-G satellites. These procedures are necessary to meet the measurement accuracies required for deriving sea surface temperatures and wind speeds. It is shown that sidelobe contributions and polarization cross-coupling are major effects to be accounted for, in addition to some unique features of the SMMR instrument such as integration times and antenna scan characteristics. Methods are presented for data averaging and data reformatting, these are to be used with geophysical parameter retrieval algorithms. (Author)

**A80-25567** Landsat MSS coordinate transformations. B. K. P. Horn (MIT, Cambridge, Mass.) and R. J. Woodham (British Columbia, University, Vancouver, Canada). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 59-68. 11 refs.

A number of image analysis tasks require the registration of a surface model with an image. In the case of satellite images, the surface model may be a map or digital terrain model in the form of surface elevations on a grid of points. An affine transformation is developed between coordinates of Multi-Spectral Scanner (MSS) images produced by the Landsat satellites, and coordinates of a system lying in a plane tangent to the earth's surface near the sub-satellite (Nadir) point. (Author)

**A80-25592** An approach to nonlinear mapping for pattern recognition. N. Duong, R.-M. Li, and D. B. Simons (Colorado State University, Fort Collins, Colo.). In: Machine processing of remotely sensed data; Proceedings of the Fifth Annual Symposium, West Lafayette, Ind., June 27-29, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 323-330. 10 refs.

A two-stage process of nonlinear mapping for pattern classification is presented. In the first stage, a data-straightening operation is used to obtain the new configuration of the training data points in a one-dimensional space, in the second stage, pattern classification is conducted in the one-dimensional transformed space through the use of a minimum-resistance rule. C.F.W.

**A80-25770 \* #** Enhancement of remote sensing through microwave technology. M. Cehelsky (NASA, Office of Space and Terrestrial Applications, Washington, D.C.) and J. Kiebler (NASA, Goddard Space Flight Center, Communications Technology Div., Greenbelt, Md.). *ITU Telecommunication Journal*, vol. 47, Jan. 1980, p. 28-34. 16 refs.

This overview begins with a brief look at remote sensing to date, focusing on the state of the art and the benefits that have been derived from it. Current and future microwave sensing developments are discussed pointing out special advantages and capabilities and noting the anticipated benefits. The frequency requirements of microwave sensing are outlined and the particular need to both allocate, and when necessary, protect active and passive operational sensing frequencies is emphasized. V.T.

**A80-26085 \* #** The Surface Contour Radar, a unique remote sensing instrument. J. E. Kenney, E. A. Uliana (U.S. Navy, Naval Research Laboratory, Washington, D.C.), and E. J. Walsh (NASA, Wallops Flight Center, Wallops Island, Va.). (Institute of Electrical and Electronics Engineers, International Microwave Symposium, Orlando, Fla., Apr. 30-May 2, 1979.) *IEEE Transactions on Microwave Theory and Techniques*, vol. MTT-27, Dec. 1979, p. 1080-1092. 6 refs.

A 36 GHz computer controlled airborne Surface Contour Radar (SCR) is described, which was developed by the Naval Research Laboratory and NASA. The system uses pulse-compression techniques and dual frequency carriers spaced far enough apart to be decorrelated on the sea surface. The continuous wave transmitter is biphasic modulated, the return signal is autocorrelated, and the code length and clock rate are variable, providing selectable range resolutions of 0.15, 0.30, 0.61 and 1.52 m. The SCR generates a false-color coded elevation map of the sea surface below the aircraft in real time, and can routinely produce ocean directional wave spectra with off-line data processing. J.P.B.

**A80-26317 \*** **Observation of the Grand Canyon wall structure with an airborne imaging radar.** C. Elachi and T. G. Farr (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing of Environment*, vol. 9, Mar. 1980, p. 171-174. Contract No. NAS7-100.

The paper reports on radar images of the Grand Canyon region obtained with the Jet Propulsion Laboratory L-band (25 cm wavelength) airborne synthetic aperture radar in order to determine the capability of such a system to observe wall stratifications compared with optical sensors. Comparisons are made between these and Landsat images of the same area. Finally, it is noted that the observations do not furnish any new information on the geology of the Grand Canyon, rather, they add to the data base which is required in the interpretation of radar images from unknown remote regions such as the surface of Venus. M.E.P.

**A80-26807** **90 GHz radiometric imaging through clouds.** H. E. King (Aerospace Corp., El Segundo, Calif.). In: EASCON '79; Electronics and Aerospace Systems Conference, Arlington, Va., October 9-11, 1979, Conference Record, Volume 2.

New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 372-377. 7 refs.

A 90 GHz (3 mm wavelength) radiometer with a noise output fluctuation of 0.22 K (RMS), with a scanning antenna beam mirror, and the data processing system are described. Real-time radiometric imaging of terrain and man-made objects are shown. With a flight taken over optically opaque clouds, the imager was able to distinguish bridges, rivers, marshland and other landforms. Antenna temperature distributions of a variety of land targets are tabulated, and the complexity of deriving target brightness temperatures from the measured antenna temperatures are discussed. (Author)

**A80-27426** **American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings.** Edited by J. Cowser and L. Cameron. Falls Church, Va., American Society of Photogrammetry, 1979. 293 p. Members, \$5.00; nonmembers, \$10.00.

The meeting focused on the observing and measuring the planet earth; data acquisition and information; surveying and remote sensing in energy and mineral source production, in the management and use of water resources, and in food and fiber production and management of natural vegetation; and marine surveying and mapping. Papers were presented on data acquisition and applications of the Landsat-D observations, Landsat-D sensor data product generation, spatial quantification of maps or images - cell size or pixel size implications, wetland flow resistance determination using Landsat data, error detection and rectification in digital terrain models, and monitoring man's impact in the coastal zone. A.T.

**A80-27427 \*** **Data acquisition and projected applications of the observations from Landsat-D.** D. L. Williams and V. V. Salomonson (NASA, Goddard Space Flight Center, Applications Directorate, Greenbelt, Md.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings. Falls Church, Va., American Society of Photogrammetry, 1979, p. 16-29. 11 refs.

The paper considers data acquisition and projected applications of the Landsat-D observations. The Landsat-D system will use communication satellites to relay sensor measurements in near-real time to ground data processing facilities. Other improvements result from advanced capabilities of the Thematic Mapper (TM) over those of the Multispectral Scanner Subsystem which include: (1) better spatial resolution; (2) narrower spectral bands in the 0.5 to 0.9 micron region and new bands covering regions from 0.45 to 2.35 microns; and (3) better radiometric resolution. These improvements in spatial, spectral, and radiometric resolution are expected to enhance the satellite applicability in agriculture, forest and range-land, water, and land use. A.T.

**A80-29163** **Preliminary estimates of the resolution capability of the SEASAT radar altimeter.** R. F. Brammer and R. V. Sailor (Analytic Sciences Corp., Reading, Mass.). *Geophysical Research Letters*, vol. 7, Mar. 1980, p. 193-196.

This paper reports preliminary results on the capability of the SEASAT radar altimeter to resolve short wavelength geoid features. Spectral coherence calculated for pairs of repeat tracks provides an estimate of the shortest repeatable (geoid) wavelength that can be resolved in the data. Coherence is high for wavelengths longer than 70 km but is insignificant for wavelengths shorter than about 30 km. For SEASAT, oceanographic effects may be more significant than the instrument noise in limiting geoidal resolution. A parametric error model for SEASAT data based on repeat track analysis is also presented. This model will be useful for filtering or smoothing SEASAT data. (Author)

**A80-31121 #** **Aspects of the spaceborne remote sensing of the earth (Nekotorye problemy kosmicheskogo zemlevedeniia).** B. V. Vinogradov. *Akademiia Nauk SSSR, Vestnik*, no. 12, 1979, p. 86-94. In Russian.

Certain technical aspects of the remote sensing of earth resources are reviewed with emphasis on recent developments in the Soviet Union. Attention is given to such topics as thematic mapping, environmental monitoring, and remote phenology. B.J.

**A80-31987** **Systems of image data acquisition and digitization (Systèmes d'acquisition et de numérisation de données image).** J. C. Terrisson (Centre National d'Etudes Spatiales, Toulouse, France). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 287-318. In French.

Problems associated with the handling and recording of multi-spectral scanner data are examined. Signal digitization principles and equipment are reviewed, and attention is given to the CNES complete data acquisition system, which includes a quick-look system, a digitization/calibration system, and a PCM acquisition system. B.J.

**A80-31998** **Cartography and remote sensing.** P. Lagrave and M. Thonus (Matra, S.A., Division Optique, Rueil-Malmaison, Hauts-de-Seine, France). In: Equipment for analytic photogrammetry and remote sensing; International Symposium, Paris, France, September 12-14, 1978, Proceedings. Paris, Editions Technip, 1979, p. 496-511.

The definition of a range of standard products capable of meeting the requirements, at the lowest possible cost, of people interested in the synthesis of remote sensing data and cartographic documents is given. The fact that data may be provided by airborne campaigns or by satellite instruments generating image data directly in digital form is taken into account. Equipment for photogrammetric restitution and a system for processing the multispectral

## 08 INSTRUMENTATION AND SENSORS

remote sensing data are introduced, and general considerations on the techniques currently employed for a study of a sample of terrain are presented. O.L.

**N80-16402\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**A SPECTRAL FILTER FOR ESMR'S SIDELobe ERRORS**  
Dennis Chesters Sep. 1979 26 p refs  
(NASA-TM-80555) Avail: NTIS HC A03/MF A01 CSCL 08B

Fourier analysis was used to remove periodic errors from a series of NIMBUS-5 electronically scanned microwave radiometer brightness temperatures. The observations were all taken from the midnight orbits over fixed sites in the Australian grasslands. The angular dependence of the data indicates calibration errors consisted of broad sidelobes and some miscalibration as a function of beam position. Even though an angular recalibration curve cannot be derived from the available data, the systematic errors can be removed with a spectral filter. The 7 day cycle in the drift of the orbit of NIMBUS-5, coupled to the look-angle biases, produces an error pattern with peaks in its power spectrum at the weekly harmonics. About plus or minus 4 K of error is removed by simply blocking the variations near two- and three-cycles-per-week. R.E.S.

**N80-16676\*#** National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.

**THE ROLE OF SATELLITE ALTIMETRY IN CLIMATE STUDIES**

C. L. Parsons Washington Jan. 1980 32 p refs  
(NASA-TP-1570) Avail: NTIS HC A03/MF A01 CSCL 04B

The results of three generations of satellite-borne radar altimetry experiments are summarized. The diverse measurements possible from this instrument are shown to be directly applicable to studies of the importance of the oceans in climate. The radar altimeter has unique value for investigations seeking knowledge of the interconnections between ocean dynamics, heat and momentum transfer across the air-sea interface, sea ice extent, and polar ice sheet thickness. Author

**N80-17535\*#** Jet Propulsion Lab., California Inst. of Tech., Pasadena.

**SEASAT GULF OF ALASKA WORKSHOP REPORT. VOLUME 1: PANEL REPORTS**

Apr. 1979 374 p refs Workshop held at Pasadena, Calif., 22 Sep. 1979; sponsored in part by NASA Sponsored by NASA

(NASA-CR-162759; PB-300413/2; NOAA-79073114; Rept-622-101) Avail: NTIS HC A16/MF A01 CSCL 08E

The comparison of surface observations with satellite sensor data as well as the intercomparison of data from sensors measuring common geophysical parameters were covered. There is clear evidence that a real time oceanic monitoring system, patterned after the Seasat sensors, yield extremely important data for meteorology, climatology, ocean circulation, navigation, and numerous other oceanographic and geodetic applications. The salient conclusions are given, on a sensor by sensor basis. GRA

**N80-17855#** Eurosat S.A., Geneva (Switzerland).  
**STUDY FOR THE DETERMINATION OF GEOMETRIC AND SPECTRAL RESOLUTION REQUIREMENTS OF OPTICAL IMAGING INSTRUMENTS FOR EARTH RESOURCES SATELLITES, VOLUME 1 Final Report**

C. L. P. Miller May 1979 55 p  
(Contract ESA-3529/78-F-HS(SC))  
(CM/PR/3384-Vol-1; ESA-CR(P)-1239-Vol-1) Avail: NTIS HC A04/MF A01

A study aimed at establishing optimum values of sensor related parameters is reviewed. The history is traced from the original call for ideas to the final statements of objectives and proposed methodology. Recommendations for the activation of the study are made selecting three alternatives with various levels of constraint. Author (ESA)

**N80-19589\*#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**SMMR SIMULATOR RADIATIVE TRANSFER CALIBRATION MODEL 1: DERIVATION**

Charles D. Calhoun, Susan Link, Michael Doyle, and Brian Krupp. Principal Investigators (Systems and Applied Sciences Corp., Riverdale, Md.) Aug. 1979 67 p refs ERTS (E80-10081; NASA-TM-80244) Avail: NTIS HC A04/MF A01 CSCL 14B

**N80-20017\*#** National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

**THE REDUCTION OF REMOTE SENSING DATA BY VISUAL MEANS**

Robert N. Colwell (California Univ., Berkeley), Charles E. Poulton, and Barry J. Schrupf (Oregon State Univ., Corvallis) *In its* Conf. of Remote Sensing Educators (CORSE-78) Mar. 1980 p 453-526 refs

Avail: NTIS HC A99/MF A01 CSCL 05B

Issues likely to be of concern to educators called upon to teach courses involving the reduction (interpretation) of remotely sensed data by visual means are considered. Topics covered include: (1) information requirements of those using remotely-sensed data; (2) educational concepts involved in teaching students how to generate the desired information from a visual analysis of the data; (3) principles and techniques specific to the photointerpretation process; (4) concepts involved in the making of photographic measurements, as dictated by the geometry of remote sensing imagery; (5) the nature of the various kinds of mapping, plotting, and photointerpretation equipment; and (6) some special considerations with respect to the convergence of evidence and other principles involved in the interpretation of photographs. A recommended procedure for determining the usefulness of any given type of aerial or space photography in relation to the inventory of natural resources is included. A.R.H.

**N80-20564\*#** National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.

**AN INITIAL ASSESSMENT OF THE PERFORMANCE ACHIEVED BY THE SEASAT-1 RADAR ALTIMETER**

William F. Townsend Feb. 1980 41 p refs  
(NASA-TM-73279) Avail: NTIS HC A03/MF A01 CSCL 14B

The results of an initial on-orbit engineering assessment of the performance achieved by the radar altimeter system flown on SEASAT-1 are presented. Additionally, the general design characteristics of this system are discussed and illustrations of altimeter data product are provided. The instrument consists of a 13.5 GHz monostatic radar system that tracks in range only using a one meter parabolic antenna pointed at the satellite nadir. Two of its unique features are a linear FM transmitter with 320 MHz bandwidth which yields a 3.125 nanosecond time delay resolution, and microprocessor implemented closed loop range tracking, automatic gain control (AGC), and real time estimation of significant wave height (SWH). Results presented show that the altimeter generally performed in accordance with its original performance requirements of measuring altitude to a precision of less than 10 cm RMS, significant wave height to an accuracy of + or - 0.5 m or 10%, whichever is greater, and ocean backscatter coefficient to an accuracy of + or - 1 db, all over an SWH range of 1 to 20 meters. J.M.S.

**N80-20697#** Bayerische Akademie der Wissenschaften, Munich (West Germany).

**THE EROS-DOPPLER OBSERVATION CAMPAIGN (EROS-DOC) [DIE EROS DOPPLER BEOBACHTUNGSKAMPAGNE (EROS-DOC)]**

Wolfgang Schlueter, Hermann Seeger, Gerhard Soltau, Peter Wilson, and Peter Wolf *In its* Res. Program 78, Satellite Geodesy Program 1978 p 65-71 refs In GERMAN

Avail: NTIS HC A09/MF A01

Data from the Doppler observation program (EROS-1) conducted by eight satellite observation stations are presented. The calculations are discussed in reference to the broadcast ephemeris and the precise ephemeris. Author (ESA)

**N80-20706#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**CONTRIBUTIONS TO THE CREATION OF A CONCLUSIVE SYSTEM OF CONCEPTS OF PHOTOGRAMMETRY AND AERIAL PHOTOGRAPH CARTOGRAPHY [BEITRAG ZUM AUFBAU EINES GESCHLOSSENEN BEGRIFFSSYSTEMS DER PHOTOGRAMMETRIES UND DER LUFTBILDKARTOGRAPHIES]**

Heinz Schmidt-Falkenberg *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 7-35 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

In connection with the revision of the German standard DIN 18 716 (photogrammetry and remote sensing) a review is presented of the conceptual connections within the fields of image recording, image processing and image evaluation as well as aerial photograph cartography, which is to serve as a contribution to the creation of a theoretical basis for photogrammetry and aerial photograph cartography. Author (ESA)

**N80-20709#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**SETTING DATA FROM MULTISTAGE ANALYTICAL ORIENTATION [EINSTELLDATEN AUS MEHRSTUFIGEN ANALYTISCHEN ORIENTIERUNGSVORGANGEN]**

Karl Schuerer *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 71-84 refs In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

From the angles of rotation and the base components determined during the multistage analytical orientation, setting data for different analog plotting instruments are calculated. Preliminary experience shows that these data influences the economy of analog plotting considerably. Author (ESA)

**N80-20712#** Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

**PRODUCTION OF COLOR COMPOSITES FROM MULTISPECTRAL DATA RECORDS [DIE HERSTELLUNG VON FARBKOMPOSITEN AUS MULTISPEKTRALAUFNAHMEN]**

Hans Peter Groetsch *In its* Rept. on Cartography and Topographical Meas. Ser. 1: Original Rept. 1978 p 149-160 In GERMAN; ENGLISH summary

Avail: NTIS HC A09/MF A01

Production techniques and applications for color composites made from multispectral images are described. The use of Diazofolils results in higher accuracy than possible with film processes. Author (ESA)

**N80-20759\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**THE EFFECT OF SEA STATE ON ALTIMETER MEASUREMENTS**

R. Kolenkiewicz, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 187-189 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 08C

**N80-20783\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**MULTISPECTRAL LINEAR ARRAY SENSOR DEVELOPMENT**

C. C. Schnetzler, Principal Investigator *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 297-298 refs ERTS

Avail: NTIS HC A14/MF A01 CSCL 14B

**N80-20784\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**LINEAR ARRAY PUSHBROOM RADIOMETER DATA ANALYSIS**

J. Irons and S. Wharton, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 299-302 ERTS

Avail: NTIS HC A14/MF A01 CSCL 14B

**N80-21002#** National Environmental Satellite Center, Washington, D. C.

**SATELLITE ACTIVITIES OF NOAA 1978**

Jun. 1979 23 p (PB80-112782; NOAA-79100504) Avail: NTIS HC A02/MF A01 CSCL 04B

The NOAA elements that participate in the polar orbiting and geostationary satellite systems are listed with descriptions of their individual programs. Satellite data uses described include wind and temperature determination, environmental warning services, and the monitoring of ocean, hydrological, agricultural, and fishery conditions. Space support activities are also discussed. K.L.

**N80-21800#** National Environmental Satellite Service, Washington, D. C.

**METEOROLOGICAL SATELLITES: STATUS AND OUTLOOK**

D. S. Johnson *In* ESA Use of Data from Meteorol. Satellites Nov. 1979 p 3-14

Avail: NTIS HC A12/MF A01

The performance of the Argos and Tiros-N satellites is assessed. Data from the very high resolution radiometer aboard the Tiros-N, the altimeter, scatterometer, and the synthetic aperture radar aboard the Seasat satellite, and the scanning multichannel microwave radiometer and coastal zone color scanner aboard the Nimbus-7 are presented. Author (ESA)

## 09 GENERAL

Includes economic analysis.

**A80-22376 \*** **International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volumes 1, 2 & 3.** Symposium sponsored by the Environmental Research Institute of Michigan, NASA, U.S. Federal Highway Administration, DOT, et al. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979. Vol. 1, 656 p.; vol. 2, 661 p.; vol. 3, 676 p. Price of three volumes, \$70.

The presentations document current activities in the field of remote sensing. Papers include those concerned with data collection, processing, and analysis hardware and methodology, as well as the application of this technology to monitoring and managing the earth's resources and man's global environment. Ground-based, airborne, and spaceborne sensor systems and both manual and machine-assisted data analysis and interpretation are considered. B.J.

**A80-22377 #** **European remote sensing activities.** P. Morel (Centre National d'Etudes Spatiales, Paris, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 3-12.

European plans for participating in earth surveys are summarized with reference to organizational matters, acquisition and processing of earth resources satellite data, and airborne remote sensing. Consideration is also given to the Meteosat program, Spacelab remote sensing instruments, the SPOT earth observation technology satellite, and certain follow-on projects. Emphasis is placed on equipment characteristics. B.J.

**A80-22378 #** **The Canadian remote sensing program.** L. W. Morley (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 13-25; Discussion, p. 27, 28.

The paper describes the activities of the Canada Centre for Remote Sensing and reviews current Canadian remote sensing projects. Particular consideration is given to: (1) lidar bathymeter experiments, (2) ERIM radar measurements, (3) Seasat surveys, (4) the Sursat program, and (5) Landsat observations. B.J.

**A80-22379 \* #** **NASA policy issues.** R. A. Frosch (NASA, Washington, D.C.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 1. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 29-34; Discussion, p. 34, 35.

U.S. remote sensing policy is discussed, with emphasis on problems associated with the development of operational systems. Certain economic and legislative aspects are examined. B.J.

**A80-22419 \* #** **The Landsat-D Assessment System.** P. A. Bracken, J. B. Billingsley, T. J. Lynch, and J. J. Quann (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2.

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 755-763.

The overall Landsat-D system is discussed with emphasis on the objectives, configuration, and capabilities of the Landsat-D Assessment System. This system is being developed to support investiga-

tions which demonstrate, evaluate, and assess the utility of Landsat-D data for a wide variety of earth observations applications. (Author)

**A80-22429 #** **SPOT - First French remote sensing satellite geometrical performance.** B. Cabrieres (Institut Géographique National, Saint-Mandé, Val-de-Marne, France), J. C. Cazaux, and G. Weill (Centre National d'Etudes Spatiales, Paris, France). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 867-877.

The paper deals with selection of the orbit parameters of the SPOT mission. The parameters are related to overall geometric and timing performance necessary for carrying out the cartographic and planimetric objectives of the mission. Consideration is given to payload characteristics, operation, and data product simulation. V.T.

**A80-22432 #** **Possibilities of optimal planning of multi-purpose survey from space.** K. Ia. Kondrat'ev (Glavnaia Geofizicheskaya Observatoriia, Leningrad, USSR), A. I. Belivskii, and O. M. Pokrovskii (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 903-910. 6 refs.

The paper discusses the problem of developing well grounded requirements for measurement instruments and conditions of surveying natural formations from space. On the basis of the factor analysis algorithm, requirements are formulated for spatial resolution, survey geometry, illumination conditions, periodicity, etc. Finally, groups and complexes of remote sensing problems which provide the most efficient agreement of the requirements with the previously mentioned parameters are determined. M.E.P.

**A80-22455 #** **Guidelines for evaluating remote sensing demonstration projects.** J. M. Sharp (California, University, Berkeley, Calif.). In: International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings. Volume 2. Ann Arbor, Mich., Environmental Research Institute of Michigan, 1979, p. 1167-1176. 23 refs.

Demonstration projects, a major part of NASA's program for remote sensing user development, are also the subject of a recent report issued by the Office of Technology Assessment (OTA). The author's experience with Landsat remote sensing demonstrations in state and local agencies is compared with the OTA guidelines, and the comparison suggests that too much is being expected from the Landsat demonstration projects. Project sponsors often must contend with conflicting goals and various inflexibilities, impecunious users with poorly-understood needs, a technology full of uncertainties, and an underdeveloped institutional environment. It is recommended that those associated with the Landsat effort lower their expectations and concentrate on ways to learn more from the demonstrations. (Author)

**A80-24051** **Remote sensing and resources management; Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Université de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings (Télé-détection et gestion des ressources; Congrès, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congrès, 2nd, Université de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Comptes Rendus).** Congresses sponsored by the Association Québécoise de Télé-détection, Ministère de l'Éducation du Québec, and Association Canadienne-Française pour l'Avancement des Sciences. Edited by F. J. Bonn (Sherbrooke, Université, Sherbrooke, Quebec, Canada). Sainte-Foy, Quebec, Canada, Association Québécoise de Télé-détection, 1979. 269 p. In French and English. \$28.

Papers are presented on the applications of remote sensing technology to resources management. Specific topics include the remote sensing of soils, water resources and vegetation, remote

sensing techniques in geomorphology, the remote sensing of water resources from satellite measurements of temperature and albedo, color infrared aerial photography for the evaluation of spruce budworm damage, the utilization of thermography to detect heating losses from buildings, and new techniques for the monitoring of natural resources. A.L.W.

**N80-16401\*#** National Conference of State Legislatures, Denver, Colo.

**NCSL REMOTE SENSING PROJECT Final Report, 16 Jul. 1978 - 20 Sep. 1979**

Paul A. Tessar, Principal Investigator 20 Sep. 1979 88 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NASw-3230)

(E80-10053; NASA-CR-162523) Avail: NTIS HC A05/MF A01 CSCL 05B

**N80-16424\*#** Illinois Inst. of Natural Resources, Springfield. **ILLINOIS LANDSAT FEASIBILITY STUDY**

John A. Bishop Apr. 1979 94 p refs Sponsored by NASA (NASA-CR-162760; PB-300409/0; ILLDOE-79/13) Avail: NTIS HC A05/MF A01 CSCL 22A

Satellite remote sensing technology and its application to natural resources planning and management is discussed as well as the satellite's advantages and limitations for data gathering. Recommendations for its use in Illinois are suggested. GRA

**N80-16950\*** Denver Univ., Colo. Industrial Economics Div. **SPACE BENEFITS: THE SECONDARY APPLICATION OF AEROSPACE TECHNOLOGY IN OTHER SECTORS OF THE ECONOMY**

Jan. 1980 236 p

(Contract NASw-3113)

(NASA-CR-162697) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 05A

Over 580 examples of the beneficial use of NASA aerospace technology by public and private organizations are described to demonstrate the effects of mission-oriented programs on technological progress in the United States. General observations regarding technology transfer activity are presented. Benefit cases are listed in 20 categories along with pertinent information such as communication link with NASA; the DRI transfer example file number and individual case numbers associated with the technology and examples used; and the date of the latest contract with user organizations. Subject, organization, geographic, and field center indexes are included. A.R.H.

**N80-17913#** Committee on Science and Technology (U. S. House).

**NASA AUTHORIZATION, 1981, PROGRAM REVIEW, VOLUME 1**

Washington GPO 1979 649 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 16-18 Oct. 1979 (GPO-53-814) Avail: Subcomm. on Space Sci. and Applications

The status of NASA programs is reviewed as a preliminary to fiscal 1981 authorization hearings. Problems of cost, performance, and scheduling which can affect the budget program performance are examined. Particular emphasis is given to advanced research and development, technology utilization, and aerospace technology transfer in communications, space processing, energy conversion, electric propulsion systems, life sciences, planetary exploration, astrophysics, solar terrestrial interactions, and Earth resources observation. A.R.H.

**N80-19593\*#** South Dakota State Univ., Brookings. Remote Sensing Inst.

**REMOTE SENSING APPLICATIONS TO RESOURCE PROBLEMS IN SOUTH DAKOTA Semiannual Progress Report, 1 Jul. - 31 Dec. 1979**

Victor I. Myers, Principal Investigator, R. G. Best, K. J. Dalsted, J. E. Eidsenink, R. Fowler, J. L. Heilman, and F. A. Schmer 31 Dec. 1979 122 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (Grant NGL-42-003-007)

(E80-10086; NASA-CR-162784; SDSU-RSI-80-02) Avail: NTIS HC A06/MF A01 CSCL 08F

**N80-20003\*#** National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.

**CONFERENCE OF REMOTE SENSING EDUCATORS (CORSE-78)**

Washington Mar. 1978 664 p refs Conf. held at Stanford, Calif., 26-30 Jun. 1978

(NASA-CP-2102; A-7755) Avail: NTIS HC A99/MF A01

CSCL 05I

Ways of improving the teaching of remote sensing students at colleges and universities are discussed. Formal papers and workshops on various Earth resources disciplines, image interpretation, and data processing concepts are presented. An inventory of existing remote sensing and related subject courses being given in western regional universities is included.

**N80-20014\*#** Denver Univ., Colo.

**TEXTBOOKS AND TECHNICAL REFERENCES FOR REMOTE SENSING**

Robert D. Rudd, Leonard W. Bowden (California Univ., Riverside), Robert N. Colwell (California Univ., Berkeley), and John E. Estes (California Univ., Santa Barbara) *In* NASA, Ames Res. Center Conf. of Remote Sensing Educators (CORSE-78) Mar. 1980 p 269-288 refs

Avail: NTIS HC A99/MF A01 CSCL 05B

A selective bibliography is presented which cites 89 textbooks, monographs, and articles covering introductory and advanced remote sensing techniques, photointerpretation, photogrammetry, and image processing. A.R.H.

**N80-20782\*#** National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

**LANDSAT-D ASSESSMENT SYSTEM**

D. Williams, D. Deering, K. Meehan, and J. Tucker, Principal Investigators *In its* Earth Survey Appl. Div.: Res. Leading to the Effective Use of Space Technol. in Appl. Relating to the Earth's Surface and Interior Jan. 1980 p 292-296 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A14/MF A01 CSCL 05B

**N80-21822\*#** National Aeronautics and Space Administration, Washington, D. C.

**FINDINGS OF THE OPIT STUDY IN AMERICA**

Alain Couzy et al Mar. 1980 18 p Transl. into ENGLISH of "Mission d'Etude en Amerique." Rept-79/1564-29, Paris, Mar. - Apr. 1979 p 1-19 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Centre National d'Etudes Spatiales (France)

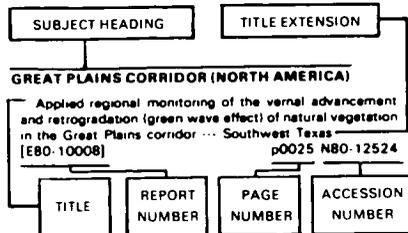
(Contract NASw-3199)

(NASA-TM-76106; Rept-79/1564-29) Avail: NTIS

HC A02/MF A01 CSCL 05B

The results of operational applications of American satellite remote sensing are presented. The application of data from satellites such as LANDSAT in European conditions is evaluated. J.M.S.

### Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section (of this supplement). If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

## A

**ABSORPTION SPECTRA**  
 Remote sensing of leaf water content in the near infrared p0071 N80-20768  
 Time of day effects on wheat reflectance in fifteen selected bands --- Phoenix, Arizona p0072 N80-20774  
 Spectra of isolated vegetational constituents p0072 N80-20779

**ACCURACY**  
 Testing the accuracy of cartographic equipment: First results p0083 N80-20683

**ACOUSTIC MEASUREMENTS**  
 GSFIC site stability p0085 N80-20741  
 Geodetic stability of the Green Bank, West Virginia VLB1 site p0085 N80-20742

**AERIAL PHOTOGRAPHY**  
 Terrain evaluation for environmental inventory and impact assessment p0075 A80-22426  
 Remote sensing studies of vegetation p0063 A80-24055  
 Twenty-five years of aerial photography by the Institute of Applied Geodesy p0083 N80-20676

**AERIAL RECONNAISSANCE**  
 Utilization of a portable thermograph in the Ministère des Terres et Forêts p0064 A80-24067

**AEROSOLS**  
 An algorithm for remote sensing of water color from space p0097 A80-25342  
 A design study for an advanced ocean color scanner system --- spaceborne equipment p0097 A80-25346

**AEROSPACE TECHNOLOGY TRANSFER**  
 An evaluation of Landsat-D for Canadian applications p0060 A80-22437  
 Guidelines for evaluating remote sensing demonstration projects p0121 A80-22455  
 NCSL remote sensing project --- State Legislature considerations and activities p0122 N80-16401  
 Illinois LANDSAT feasibility study p0122 N80-16424  
 [NASA-CR-162760] p0122 N80-16950  
 [NASA-CR-162697] p0122 N80-16950  
 NASA authorization, 1981, program review, volume 1 [GPO-53-814] p0122 N80-17913  
 Forest resource information system --- Baker County, Florida and Picalyune, Mississippi sites: St. Regis Paper Company p0069 N80-18515  
 [EBO-10065]

**AFRICA**  
 CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite p0087 A80-22443  
 Application of LANDSAT imagery to monitor sand dunes movement in the Sahara Desert p0113 N80-20719  
 Geophysical atlas p0090 N80-20734  
 Gravity model development p0085 N80-20748

**AGRICULTURE**  
 Advances in earth resources management p0059 A80-21896  
 Precision of crop-area estimates p0059 A80-22386  
 Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412  
 The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413  
 Determination of range biomass using Landsat p0060 A80-22414  
 Possibilities of optimal planning of multipurpose survey from space --- oceanography, hydrology, geology, forestry and agriculture p0121 A80-22432  
 An evaluation of Landsat-D for Canadian applications p0060 A80-22437  
 An evaluation of several different classification schemes - Their parameters and performance --- maximum likelihood decision for crop identification p0061 A80-22453  
 Estimation of primary production of vegetation in agricultural and forested areas using Landsat data p0061 A80-22456  
 Agricultural and resource assessment in Jamaica using an area sampling frame p0062 A80-22487  
 Possible future directions in crop yield forecasting p0062 A80-22505  
 Remote sensing and the agricultural zoning of lands p0064 A80-24069  
 Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435  
 Use of low altitude aerial biosensing with color infrared photography as a crop management service p0067 A80-27437  
 Method for the photometric interpretation of multispectral aerial photographs p0111 A80-32266  
 Experience with the use of synthesized color images for the interpretation of agricultural objects p0067 A80-32270  
 The use of microwave radiometry for the operational mapping of soil moisture p0067 A80-32281  
 Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs p0067 A80-32283  
 Crop identification using space photographs taken at different times / A study of the lower Volga Basin used as an example/ p0067 A80-32284  
 Thermography for estimating near-surface soil moisture under developing crop canopies p0067 A80-32518  
 Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [EBO-10044] p0068 N80-16394  
 Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study p0068 N80-16400  
 [EBO-10052] p0068 N80-16400  
 NCSL remote sensing project --- State Legislature considerations and activities p0122 N80-16401  
 [EBO-10053] p0122 N80-16401  
 L-band radar sensing of soil moisture --- Kern County, California [NASA-TM-80628] p0068 N80-16404  
 Development of LANDSAT-based technology for crop inventories p0069 N80-18506  
 [EBO-10054] p0069 N80-18506  
 Development of LANDSAT-based technology for crop inventories: Appendices p0069 N80-18507  
 [EBO-10055] p0069 N80-18507  
 LACIE evaluation and outlook panel transcript: The LACIE Symposium [EBO-10069] p0070 N80-18518  
 AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [EBO-10079] p0070 N80-18526  
 The easy remote sensing problem p0070 N80-18528  
 [REPT-20] p0070 N80-18528  
 The Cramer-Rao lower bound as a criteria for evaluating a large data reduction system such as LACIE [REPT-21] p0070 N80-18529  
 Application of statistical correlation in the study of available water in layers of Cerrado soil [INPE-1607-TDL/014] p0070 N80-18531

Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532  
 Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [EBO-10078] p0071 N80-19587  
 Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [EBO-10084] p0084 N80-20722  
 Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [EBO-10087] p0084 N80-20723  
 Remote sensing of leaf water content in the near infrared p0071 N80-20768  
 Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770  
 Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771  
 Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775  
 Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils p0072 N80-20776  
 Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777  
 Thematic mapper versus multispectral scanner for crop monitoring p0072 N80-20778  
 Satellite contribution to the study of the physical properties of soils. Utilization in the water and agricultural domains p0073 N80-21817  
 Agrometeorological applications p0073 N80-21818

**AGRISTARS PROJECT**  
 Development of LANDSAT-based technology for crop inventories [EBO-10054] p0069 N80-18506  
 Development of LANDSAT-based technology for crop inventories: Appendices [EBO-10055] p0069 N80-18507  
 AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [EBO-10079] p0070 N80-18526

**AGROCLIMATOLOGY**  
 LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086

**AGROMETEOROLOGY**  
 The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413  
 Possible future directions in crop yield forecasting p0062 A80-22505  
 LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086  
 The use of microwave radiometry for the operational mapping of soil moisture p0067 A80-32281  
 LACIE evaluation and outlook panel transcript: The LACIE Symposium [EBO-10069] p0070 N80-18518  
 Satellite activities of NOAA 1978 --- geostationary and polar orbiting systems [PB80-112782] p0119 N80-21002  
 Satellite contribution to the study of the physical properties of soils. Utilization in the water and agricultural domains p0073 N80-21817  
 Agrometeorological applications p0073 N80-21818

**AIR POLLUTION**  
 Remote sensing of regional air pollution from satellites p0075 A80-22400  
 Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600  
 Remote sensing applied to pollution monitoring. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0732/2] p0079 N80-20952

**AIR QUALITY**  
 Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane [NASA-TM-80146] p0078 N80-16575  
 Altitude characteristics of selected air quality analyzers [NASA-CR-159165] p0078 N80-16578

**AIR WATER INTERACTIONS**  
 The aqueous thermal boundary layer p0096 A80-25334  
 OCEANS '79: Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979 p0097 A80-28251

## ALABAMA

- Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263  
The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676  
SMNR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589

## ALABAMA

- Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600

## ALASKA

- Optimum Landsat sun angles for extreme contrasts of terrain p0087 A80-22458  
Seasat Gulf of Alaska Workshop report. Volume 1: Panel reports [NASA-CR-162759] p0118 N80-17535  
Landsat digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19588  
Geophysical atlas p0090 N80-20734

## ALBEDO

- Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301

## ALFALFA

- Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391  
Monitoring drought in Colorado with Landsat MSS p0071 N80-20770

## ALGAE

- A laser-fluoresensor technique for water quality assessment p0101 A80-22399  
Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18678

## ALGORITHMS

- An image registration algorithm using sampled binary correlation --- of satellite-borne photographs p0108 A80-25580  
AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526

## ALLUVIUM

- Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489

## ALPS MOUNTAINS (EUROPE)

- Investigations on snow parameters by radiometry in the 3- to 60-mm wavelength region p0103 A80-24827  
Regional modeling: The Ivrea zone --- Northern Italy p0085 N80-20731  
Geophysical atlas p0090 N80-20734

## ALTIMETERS

- The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676  
The effect of sea state on altimeter measurements p0119 N80-20759  
Mean sea surface computation using GEOS-3 altimeter data p0099 N80-20760

## ANALOG DATA

- The future of analytical evaluation equipment --- image measurement techniques p0112 N80-20670

## ANALOG TO DIGITAL CONVERTERS

- Systems of image data acquisition and digitization p0117 A80-31987  
Development, status, and goals of cartographic automation p0112 N80-20655  
Automatic acquisition and processing of cartographic data p0112 N80-20656  
On precision in the gathering and production of cartographic data p0112 N80-20657  
Testing the accuracy of cartographic equipment: First results p0083 N80-20683

## ANALYSIS OF VARIANCE

- Sources of variations in LANDSAT autocorrelation --- Richmond, Virginia and Denver, Colorado p0114 N80-20767

## ANDESITE

- Remote sensing data of SP mountain and SP lava flow in north-central Arizona p0088 A80-26316

## ANEMOMETERS

- Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407

## ANGULAR RESOLUTION

- Study for the determination of geometric and spectral resolution requirements of optical imaging instruments for Earth resources satellites, volume 1 [CM/PR/3384-VOL-1] p0118 N80-17855

## ANIMALS

- State of the art and needs of the earth platform --- in application of satellite tracking to animals p0060 A80-22405

## ANNUAL VARIATIONS

- Measuring ecological changes in multitemporal Landsat data using principal components p0076 A80-22452  
The seasonal cycle of snow cover, sea ice and surface albedo p0111 A80-32101  
Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs p0067 A80-32283

## ANTARCTIC REGIONS

- Main aspects of two Chilean remote sensing projects developed under extreme severe environmental conditions - Desert North and Antarctic South p0116 A80-22513

## ANTENNA RADIATION PATTERNS

- Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer / SMMR/ p0116 A80-25332

## APPALACHIAN MOUNTAINS (NORTH AMERICA)

- Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420

## AQUIFERS

- Use of satellite imagery for the derivation of the hydrogeologic characteristics of a test area in semiarid climates p0105 N80-18545

## ARCHITECTURE (COMPUTERS)

- The Massively Parallel Processor and its applications --- for environmental monitoring p0115 A80-22380  
The suitability of the ILLIAC IV architecture for image processing p0107 A80-22382

## ARCTIC REGIONS

- The use of models for predicting ice floes in Baffin Bay p0094 A80-22434  
Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333

## ARGENTINA

- Study of the Argentine Pampa's lowland by means of interpretation of Landsat satellite information p0102 A80-22478

- LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086

## ARID LANDS

- Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420  
Terrain evaluation for environmental inventory and impact assessment p0075 A80-22426  
Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs p0077 A80-32273

- Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas p0111 A80-32279  
HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516

- Use of satellite imagery for the derivation of the hydrogeologic characteristics of a test area in semiarid climates p0105 N80-18545  
Heat Capacity Mapping Mission (HCMM) --- australia [E80-10066] p0079 N80-20721

## ARIZONA

- A stratified-cluster sampling procedure applied to a woodland vegetation inventory using remote sensing p0059 A80-22389  
Remote sensing data of SP mountain and SP lava flow in north-central Arizona p0088 A80-26316  
Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317  
Investigation of the application of HCMM thermal data to snow hydrology --- Sierra Nevada Mountains, California and the Arizona test site [E80-10049] p0104 N80-16397

- Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona p0089 N80-16398

- Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771

- Thermal anisotropy of vegetation canopies --- Phoenix, Arizona p0072 N80-20773

- Time of day effects on wheat reflectance in fifteen selected bands --- Phoenix, Arizona p0072 N80-20774

- Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803

## ASIA

- NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977 p0105 N80-19594

- Geophysical atlas p0090 N80-20734  
Gravity model development p0085 N80-20748

## ASTRONOMICAL COORDINATES

- Elaborating an astronomical longitude system p0082 N80-20647  
Determination of azimuth and astronomical coordinates p0082 N80-20648

## ATLANTIC OCEAN

- Remote sensing of ocean circulation using a satellite-borne radar altimeter p0093 A80-22383  
Spatial and temporal variations in lagoon and coastal processes of the southern Brazilian Coast p0095 A80-22495

- Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations p0096 A80-25336

- Oceanographic implications of features in NOAA satellite visible imagery p0096 A80-25337  
Scales oceanic parameters as monitored from space p0097 A80-26751

- Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263

- Preliminary estimates of the resolution capability of the SEASAT radar altimeter p0117 A80-29163

- Coastal water temperatures in the southeastern portion of Brazil from oceanographic data and NOAA satellite observations, volume 1 [INPE-1569-RPE/070] p0099 N80-18671

- Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585  
Ocean circulation p0099 N80-20761

## ATMOSPHERIC ATTENUATION

- A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances p0094 A80-22417

- Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978, Proceedings, Parts 1, 2 & 3 p0096 A80-25327

- Applications of a two-flow model for remote sensing of substances in water p0097 A80-25340  
An algorithm for remote sensing of water color from space p0097 A80-25342

- Atmospheric effects in the remote sensing of phytoplankton pigments p0097 A80-25345

## ATMOSPHERIC BOUNDARY LAYER

- Oceanographic implications of features in NOAA satellite visible imagery p0096 A80-25337

## ATMOSPHERIC EFFECTS

- A design study for an advanced ocean color scanner system --- spaceborne equipment p0097 A80-25346

## ATMOSPHERIC HEAT BUDGET

- Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420

- The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources p0102 A80-24060

## ATMOSPHERIC MODELS

- Agrometeorological applications p0073 N80-21818

## ATMOSPHERIC SCATTERING

- The ocean observed with microwaves --- remote sensing from satellites p0093 A80-21963

- In-water and remote measurements of ocean color p0096 A80-25338

## ATMOSPHERIC TEMPERATURE

- Relationship of physiography and snow area to stream discharge --- Kings River Watershed, California [E80-10046] p0104 N80-16396

## AUSTRALIA

- Terrain evaluation for environmental inventory and impact assessment p0075 A80-22426

- Measuring ecological changes in multitemporal Landsat data using principal components p0076 A80-22452  
Wombats detected from space --- Landsat satellite imagery application p0063 A80-23296

- LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086

- Assessment of the fertilizer requirement of improved pasture from remote sensing information p0066 A80-26315

- Urban residential ground cover using Landsat digital data p0077 A80-30925

- A spectral filter for ESMR's sidelobe errors [NASA-TM-80555] p0118 N80-16402  
Heat Capacity Mapping Mission (HCMM) --- australia [E80-10066] p0079 N80-20721

- Crustal anomaly representation p0084 N80-20728  
Gravity model development p0085 N80-20748

## AUTOCORRELATION

- Classification results using spatially correlated Landsat data p0107 A80-22481

- Autocorrelation in Landsat data p0107 A80-22483  
Sources of variations in LANDSAT autocorrelation --- Richmond, Virginia and Denver, Colorado p0114 N80-20767

## AXES OF ROTATION

- Polar motion research p0085 N80-20755

## AZIMUTH

- Optimum Landsat sun angles for extreme contrasts of terrain p0087 A80-22458

- Determination of azimuth and astronomical coordinates p0082 N80-20648  
Time of day effects on wheat reflectance in fifteen selected bands --- Phoenix, Arizona p0072 N80-20774

## B

## BANGLADESH

- National land use and settlement assessment - An real data base model for Landsat information for Bangladesh p0076 A80-22493

## BARLEY

- Crop identification in a parkland environment using aerial photography p0066 A80-26312

- Crop emergence date determination from spectral data p0067 A80-27458

- Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506

- Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510

- HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524

- AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526

- Monitoring drought in Colorado with LANDSAT MSS  
p0071 N80-20770
- BARREN LAND**  
Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573  
L-band radar sensing of soil moisture --- Kern County, California  
[NASA-TM-80628] p0068 N80-16404  
Surface mine monitoring --- Pennsylvania p0091 N80-20764
- BATCH PROCESSING**  
Locational characteristics and the sequence of computer assisted processes of cartographic generalization p0083 N80-20685
- BATHYMETERS**  
Landsat bathymetric mapping by multitemporal processing p0094 A80-22464  
Near-surface bathymetry system p0104 A80-27438
- BAYS (TOPOGRAPHIC FEATURES)**  
The use of models for predicting ice floes in Baffin Bay p0094 A80-22434  
Marine pollution analysis in Tokyo Bay by Landsat 1 and 2 p0095 A80-22496  
Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585
- BEACHES**  
The use of remote sensing in the determination of beach sand parameters p0075 A80-22422  
Monitoring man's impact in the coastal zone p0104 A80-27436
- BEDROCK**  
A comparative study of various remote sensing techniques applied to geomorphology p0102 A80-24058
- BERMUDA**  
The SEASAT altimeter height bias using four Bermuda overflights p0086 N80-20758  
The effect of sea state on altimeter measurements p0119 N80-20759
- BIBLIOGRAPHIES**  
Large Area Crop Inventory Experiment (LACIE). Bibliographic addenda, technical reports, papers, and memorandums published under supporting research and technology and other research, test, and evaluation contracts for the Earth observations division [E80-10070] p0070 N80-18519  
Textbooks and technical references for remote sensing p0122 N80-20014  
Remote sensing applied to pollution monitoring. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0732/2] p0079 N80-20952  
Tectonics, volume 2. Citations from the NTIS data base [PB80-804529] p0091 N80-21925
- BIOMASS**  
Determination of range biomass using Landsat p0060 A80-22414  
Assessment of tidal wetland habitat and productivity p0094 A80-22416  
Estimation of primary production of vegetation in agricultural and forested areas using Landsat data p0061 A80-22456  
Remote sensing studies of vegetation p0063 A80-24055  
A spectral method for determining the percentage of green herbage material in clipped samples p0066 A80-26318  
A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass [E80-10082] p0071 N80-19590  
Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592  
Off-nadir viewing effects on spectral assessment of green biomass p0072 N80-20772  
Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775  
A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780  
Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples --- Texas p0073 N80-20781
- BIOSPHERE**  
U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429  
U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430
- BOLIVIA**  
Integrated survey of natural resources of the low lands of Bolivia using Landsat images p0108 A80-22488  
Transfer of remote sensing computer technology to the developing world - Case examples p0109 A80-25587
- BOUNDARY LAYERS**  
The aqueous thermal boundary layer p0096 A80-25334
- BRAZIL**  
Spatial and temporal variations in lagoon and coastal processes of the southern Brazilian Coast p0095 A80-22495  
Classification of areas using pixel-by-pixel and sample classifiers --- for Landsat MSS data p0077 A80-25601  
LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086  
Application of statistical correlation in the study of available water in layers of Cerrado soil [INPE-1607-TDL/014] p0070 N80-18531  
Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532  
Coastal water temperatures in the southeastern portion of Brazil from oceanographic data and NOAA satellite observations, volume 1 [INPE-1569-RPE/070] p0099 N80-18671
- BRIGHTNESS TEMPERATURE**  
Investigations on snow parameters by radiometry in the 3- to 60-mm wavelength region p0103 A80-24827  
Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330  
Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMMR/ p0116 A80-25332  
Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333  
California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568  
90 GHz radiometric imaging through clouds p0117 A80-26807  
Microwave approaches in hydrology p0104 A80-30920  
A spectral filter for ESMR's sidelobe errors [NASA-TM-80555] p0118 N80-16402  
Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513  
Effect of soil texture on the microwave emission from soils [NASA-TM-80632] p0070 N80-18530
- BULGARIA**  
Experiment on the complex interpretation of multispectral scanner aerial photographs of Bulgaria p0111 A80-32282
- BUOYS**  
Geostationary and orbiting satellites applied to remote ocean buoy data acquisition p0093 A80-22406
- BUTTES**  
Video processing of remote sensor data applied to uranium exploration in Wyoming [GJBX-171(79)] p0089 N80-19603
- C**
- CADAstral MAPPING**  
On the displacement problem as part of a process in generalizing topographical maps. Proposition for hierarchical order and the search for EDP assisted solutions p0082 N80-20675  
Computer-assisted thematic mapping for federal planning p0083 N80-20686
- CALIBRATING**  
A calibration procedure for Fourier series thermal inertia models --- surface temperature surveys p0110 A80-30923  
The SEASAT altimeter height bias using four Bermuda overflights p0086 N80-20758
- CALIFORNIA**  
Digital image processing techniques of integrated images and non-image data sets --- from satellite remote sensing p0107 A80-22401  
Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486  
California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568  
Using guided clustering techniques to analyze Landsat data for mapping forest land cover in northern California p0065 A80-25595  
An assessment of electromagnetic remote sensing systems for the detection of perched water tables p0103 A80-26787  
Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435  
Relationship of physiography and snow area to stream discharge --- Kings River Watershed, California [E80-10046] p0104 N80-16396  
Investigation of the application of HCMM thermal data to snow hydrology --- Sierra Nevada Mountains, California and the Arizona test site [E80-10049] p0104 N80-16397  
L-band radar sensing of soil moisture --- Kern County, California [NASA-TM-80628] p0068 N80-16404  
HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516
- Statistical analysis of terrain and water backgrounds in the vicinity of Port Hueneme, California [AD-A077025] p0078 N80-19599  
Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723  
Crustal deformation: Crustal dynamics project p0090 N80-20736  
On the selection of station sites for observing strain steps and earthquake forerunners in California p0090 N80-20740  
Earthquake and crustal deformation studies --- San Francisco and Fort Ross, California p0091 N80-20743  
Crustal motion measurements in California (SAFE) p0091 N80-20746  
Mantle convection and subcrustal stress p0085 N80-20752  
The spaceborne laser ranging system p0086 N80-20785
- CANADA**  
The Canadian remote sensing program p0121 A80-22378  
The CCRS Image Analysis Processor --- Canada Centre for Remote Sensing p0115 A80-22381  
Radar and ship observations of coastal sea surface roughness patterns in the Gulf of Georgia p0093 A80-22385  
Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391  
Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423  
An evaluation of Landsat-D for Canadian applications p0060 A80-22437  
The ROS-580 Project --- airborne synthetic aperture radar remote sensing p0116 A80-24075  
LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086  
The geometric correction of Landsat images at the Canada Centre for Remote Sensing p0109 A80-26311  
Crop identification in a parkland environment using aerial photography p0066 A80-26312
- CANYONS**  
Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317
- CAPIES (LANDFORMS)**  
Gravity model development p0085 N80-20748
- CAROTENE**  
Spectra of isolated vegetational constituents p0072 N80-20779
- CASCADE RANGE (CA-OR-WA)**  
HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516
- CENSUS**  
NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765
- CEYLON**  
Transfer of remote sensing computer technology to the developing world - Case examples p0109 A80-25587
- CHILE**  
Main aspects of two Chilean remote sensing projects developed under extreme severe environmental conditions - Desert North and Antarctic South p0116 A80-22513
- CHINESE PEOPLES REPUBLIC**  
Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722
- CHLOROPHYLLS**  
A laser-fluorosensor technique for water quality assessment p0101 A80-22399  
A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances p0094 A80-22417  
Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22490  
An algorithm for remote sensing of water color from space p0097 A80-25342  
Atmospheric effects in the remote sensing of phytoplankton pigments p0097 A80-25345  
Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18678  
Spectra of isolated vegetational constituents p0072 N80-20779  
A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780  
Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples --- Texas p0073 N80-20781  
Airborne laser fluorosensing of surface water chlorophyll a --- Lake Mead, Nevada [PB80-113400] p0105 N80-20797  
Biological applications including pollution monitoring --- ocean surface monitoring p0100 N80-21821

**CHRONOPHOTOGRAPHY**

**CHRONOPHOTOGRAPHY**  
 Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333

**CITIES**  
 The elimination approach to monitoring urban growth from Landsat data p0076 A80-22492  
 Urban residential ground cover using Landsat digital data p0077 A80-30925  
 Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593  
 NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765

**CITRUS TREES**  
 Computer recognition of citrus infestations p0066 A80-25599

**CLASSIFICATIONS**  
 Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423  
 Thematic adaptive spatial filtering of Landsat landuse classification results p0075 A80-22444  
 Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan p0101 A80-22451  
 An evaluation of several different classification schemes - Their parameters and performance --- maximum likelihood decision for crop identification p0061 A80-22453  
 California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568  
 Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573  
 A method for classifying multispectral remote sensing data using context p0109 A80-25594  
 Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392  
 Implementation of Badhar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511

**CLIMATE**  
 Measuring ecological changes in multitemporal Landsat data using principal components p0076 A80-22452

**CLIMATOLOGY**  
 Geostationary and orbiting satellites applied to remote ocean buoy data acquisition p0093 A80-22406  
 Analysis of remote sensing data in oceanography and climatology p0098 N80-31989  
 The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676

**CLOUD COVER**  
 90 GHz radiometric imaging through clouds p0117 A80-26807  
 Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521  
 Sources of variations in LANDSAT autocorrelation --- Richmond, Virginia and Denver, Colorado p0114 N80-20767

**CLOUD PHYSICS**  
 SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589

**COAL**  
 Identification of surface-disturbed features through IRSURL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577  
 Surface mine monitoring --- Pennsylvania p0091 N80-20764  
 Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787  
 Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803

**COASTAL CURRENTS**  
 IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447  
 Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263

**COASTAL ECOLOGY**  
 Impacts of land use on estuarine water quality p0101 A80-22398  
 Assessment of tidal wetland habitat and productivity p0094 A80-22416  
 Monitoring man's impact in the coastal zone p0104 A80-27436

**COASTAL PLAINS**  
 Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan p0101 A80-22451  
 Study of the Argentine Pampa's lowland by means of interpretation of Landsat satellite information p0102 A80-22478  
 Landsat applications to land use mapping of the Cul de Sac Plain of Haiti p0076 A80-22479  
 Larger perspective for geomorphic studies on Landsat imagery - A case study: Andhra Pradesh, India p0088 A80-22510

**COASTAL WATER**  
 Radar and ship observations of coastal sea surface roughness patterns in the Gulf of Georgia p0093 A80-22385  
 Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea p0094 A80-22449  
 Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22490  
 Spatial and temporal variations in lagoon and coastal processes of the southern Brazilian Coast p0095 A80-22495  
 Remote sensing of the sea around Singapore p0095 A80-22506  
 Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263  
 Different considerations in coastal mapping p0110 A80-30922  
 Coastal water temperatures in the southeastern portion of Brazil from oceanographic data and NOAA satellite observations, volume 1 [INPE-1569-RPE/070] p0099 N80-18671  
 Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585  
 Coastal Oceans Monitoring Satellite System (COMSS). Volume 1: Executive summary [ESS/SS-930] p0100 N80-21406  
 Meteorological satellites: Status and outlook p0119 N80-21800  
 Biological applications including pollution monitoring --- ocean surface monitoring p0100 N80-21821

**COASTS**  
 American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings p0117 A80-27426  
 NCSL remote sensing project --- State Legislature considerations and activities p0122 N80-16401  
 Gravity model development p0085 N80-20748

**COLOR**  
 Karhunen-Loeve analysis of multispectral data from landscapes p0075 A80-22138

**COLOR PHOTOGRAPHY**  
 Crop identification in a parkland environment using aerial photography p0066 A80-26312  
 Experience with the use of synthesized color images for the interpretation of agricultural objects p0067 A80-32270  
 Production of color composites from multispectral data records p0119 N80-20712

**COLORADO**  
 Determination of range biomass using Landsat p0060 A80-22414  
 Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables p0060 A80-22415  
 Optimum Landsat sun angles for extreme contrasts of terrain p0087 A80-22458  
 Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado [E80-10041] p0068 N80-16391  
 Computer-aided processing of LANDSAT MSS data for classification of forestlands --- San Juan Mountains, Colorado [E80-10043] p0068 N80-16393  
 Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
 Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725  
 NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765  
 Sources of variations in LANDSAT autocorrelation --- Richmond, Virginia and Denver, Colorado p0114 N80-20767  
 Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770  
 Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803

**COLORADO PLATEAU (US)**  
 Landsat wildland mapping accuracy p0067 A80-30921

**COLORADO RIVER (NORTH AMERICA)**  
 The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah p0101 A80-22467

**COLORIMETRY**  
 A design study for an advanced ocean color scanner system --- spaceborne equipment p0097 A80-25346

**COMMUNITIES**  
 Settlement detection with radar imagery p0077 A80-27430

**COMPARATORS**  
 The future of analytical evaluation equipment --- image measurement techniques p0112 N80-20670

**COMPUTER ASSISTED INSTRUCTION**  
 Conference of Remote Sensing Educators (CORSE-78) [NASA-CP-2102] p0122 N80-20003

**COMPUTER GRAPHICS**  
 Forest stand classification in western Washington using Landsat and computer-based resource data p0062 A80-22497  
 An interactive color display system for labelling crops p0066 A80-25600  
 An interactive software for plotting thematic maps p0111 A80-31996  
 Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs p0077 A80-32273  
 Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510  
 AGRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526  
 As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices p0111 N80-19586  
 Development, status, and goals of cartographic automation p0112 N80-20655  
 Automatic acquisition and processing of cartographic data p0112 N80-20656  
 A program for the fully automated displacement of point and line features in cartographic generalization p0083 N80-20680  
 A digital terrain model for large surfaces and direct storage access p0083 N80-20681  
 Locational characteristics and the sequence of computer assisted processes of cartographic generalization p0083 N80-20685  
 Computer-assisted thematic mapping for federal planning p0083 N80-20686  
 Map projection change: Some programs for the transformation of the contents of available maps according to different map projections p0084 N80-20690

**COMPUTER PROGRAMMING**  
 Computer based generalization for the elaboration and extension of topographic maps p0112 N80-20658

**COMPUTER PROGRAMS**  
 An interactive software for plotting thematic maps p0111 A80-31996  
 Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506  
 Development of LANDSAT-based technology for crop inventories: Appendices p0069 N80-18507  
 Implementation of Badhar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511  
 Forest resource information system --- Baker County, Florida and Picayune, Mississippi sites: St. Regis Paper Company [E80-10065] p0069 N80-18515  
 The easy remote sensing problem [REPT-20] p0070 N80-18528  
 A program for the fully automated displacement of point and line features in cartographic generalization p0083 N80-20680  
 The RGST chain program for the determination of potential coefficients and station coordinates p0084 N80-20702  
 Geodyn program systems development p0085 N80-20747

**COMPUTER SYSTEMS DESIGN**  
 The Massively Parallel Processor and its applications --- for environmental monitoring p0115 A80-22380  
 As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices [E80-10077] p0111 N80-19586

**COMPUTER SYSTEMS PROGRAMS**  
 As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices [E80-10077] p0111 N80-19586

**COMPUTER TECHNIQUES**  
 Autocorrelation in Landsat data p0107 A80-22483  
 Machine processing of remotely sensed data: Proceedings of the Fifth Annual Symposium, Purdue University, West Lafayette, Ind., June 27-29, 1979 p0108 A80-25561  
 A non-interactive approach to land use determination p0077 A80-25572  
 A methodology for a national coverage land use study by computer p0077 A80-25574  
 Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado [E80-10041] p0068 N80-16391  
 Computer-aided processing of LANDSAT MSS data for classification of forestlands --- San Juan Mountains, Colorado [E80-10043] p0068 N80-16393  
 The data bank in the cartographic automation system p0082 N80-20660  
 The future of analytical evaluation equipment --- image measurement techniques p0112 N80-20670

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- American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings p0117 A80-27426
- OCEANS '79: Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979 p0097 A80-28251
- Seasat Gulf of Alaska Workshop report. Volume 1: Panel reports [NASA-CR-162759] p0118 N80-17535
- LACIE evaluation and outlook panel transcript: The LACIE Symposium [E80-10069] p0070 N80-18518
- Conference of Remote Sensing Educators (CORSE-78) [NASA-CP-2102] p0122 N80-20003

## CONGRESSIONAL REPORTS

- NASA authorization, 1981, program review, volume 1 [GPO-53-814] p0122 N80-17913

## CONIFERS

- Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables p0060 A80-22415
- Coniferous tree species mapping using Landsat data p0062 A80-23294
- Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064
- Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065

## CONTAMINANTS

- Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263

## CONVECTION CURRENTS

- Global intra-plate volcanism p0091 N80-20744

## CONVECTIVE FLOW

- The gravity field in the central pacific from satellite-to-satellite tracking and implications for mantle convection p0085 N80-20750
- Mantle convection and subcrustal stress p0085 N80-20752
- Information theory density distribution --- Earth Mantle p0085 N80-20753

## COORDINATE TRANSFORMATIONS

- Landsat MSS coordinate transformations p0116 A80-25567
- Map projection change: Some programs for the transformation of the contents of available maps according to different map projections p0084 N80-20690

## COORDINATES

- Setting data from multistage analytical orientation p0119 N80-20709

## CORAL REEFS

- Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries p0095 A80-22466

## CORN

- Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391
- An evaluation of several different classification schemes - Their parameters and performance --- maximum likelihood decision for crop identification p0061 A80-22453
- Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394
- Large Area Crop Inventory Experiment (LACIE). Evaluation of three-category classification [E80-10058] p0069 N80-18509
- Implementation of Badhwar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511
- AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526
- Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770
- Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils p0072 N80-20776
- Thematic mapper versus multispectral scanner for crop monitoring p0072 N80-20778

## COTTON

- Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs p0067 A80-32283
- Plant stress and relationships to spectral responses --- cotton and tomato plants p0071 N80-20769

## CROP GROWTH

- Temporal study on Paddy /rice/ using X-band scatterometer p0061 A80-22438
- Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures p0063 A80-23295

- An interactive color display system for labelling crops p0066 A80-25600
- Crop emergence date determination from spectral data p0067 A80-27458
- Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs p0067 A80-32283
- Thermography for estimating near-surface soil moisture under developing crop canopies p0067 A80-32518
- Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587
- Plant stress and relationships to spectral responses --- cotton and tomato plants p0071 N80-20769
- Off-nadir viewing effects on spectral assessment of green biomass p0072 N80-20772
- Thematic mapper versus multispectral scanner for crop monitoring p0072 N80-20778

## CROP IDENTIFICATION

- Signature evaluation of natural targets using high spectral resolution techniques p0115 A80-22409
- Radar discrimination of crops p0060 A80-22424
- An evaluation of several different classification schemes - Their parameters and performance --- maximum likelihood decision for crop identification p0061 A80-22453
- A low cost classification algorithm for developing countries --- for multispectral remote sensor data p0108 A80-22484
- Temporal resolution for crop discrimination estimated using J-M distance p0062 A80-22502
- Multi-temporal classification of winter wheat using a growth state model p0064 A80-25571
- Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576
- Transfer of remote sensing computer technology to the developing world - Case examples p0109 A80-25587
- An approach to nonlinear mapping for pattern recognition --- in Landsat multispectral scanner data p0116 A80-25592
- Computer recognition of citrus infestations p0066 A80-25599
- An interactive color display system for labelling crops p0066 A80-25600
- Classification of areas using pixel-by-pixel and sample classifiers --- for Landsat MSS data p0077 A80-25601
- Crop identification in a parkland environment using aerial photography p0066 A80-28312
- Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435
- Use of low altitude aerial biosensing with color infrared photography as a crop management service p0067 A80-27437

- Crop emergence date determination from spectral data p0067 A80-27458
- Crop identification using space photographs taken at different times /A study of the lower Volga Basin used as an example/ p0067 A80-32284
- Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510
- Large Area Crop Inventory Experiment (LACIE). Bibliographic addenda, technical reports, papers, and memorandums published under supporting research and technology and other research, test, and evaluation contracts for the Earth observations division [E80-10070] p0070 N80-18519
- Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593

## CROP INVENTORIES

- Preliminary results of an investigation into the potential application of X-band SLR images for crop-type inventory purposes p0059 A80-21446
- Advances in earth resources management p0059 A80-21896
- Precision of crop-area estimates p0059 A80-22386
- Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387
- The role of phenology in statistical crop acreage measurement p0059 A80-22388
- Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413
- Estimation of primary production of vegetation in agricultural and forested areas using Landsat data p0061 A80-22456
- Agricultural and resource assessment in Jamaica using an area sampling frame p0062 A80-22487
- Area estimates by Landsat - Kansas 1976 winter wheat p0062 A80-22500
- Possible future directions in crop yield forecasting p0062 A80-22505
- Estimation of grain yields by remote sensing of crop senescence rates p0063 A80-23299
- Remote sensing and the agricultural zoning of lands p0064 A80-24069

- Crop-area estimates from Landsat - Transition from research and development to timely results p0064 A80-25569

- Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach --- from classifications of Landsat data p0064 A80-25570
- Transfer of remote sensing computer technology to the developing world - Case examples p0109 A80-25587
- Large Area Crop Inventory Experiment (LACIE). Detailed description of the wheat acreage estimation procedure used in the Large Area Crop Inventory Experiment [E80-10051] p0068 N80-16399
- Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study [E80-10052] p0068 N80-16400
- Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506
- Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507
- Large Area Crop Inventory Experiment (LACIE). Evaluation of three-category classification [E80-10058] p0069 N80-18509
- Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510
- Implementation of Badhwar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511
- Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-met data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525
- AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526
- The easy remote sensing problem [REPT-20] p0070 N80-18528
- Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532
- Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587
- A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass [E80-10082] p0071 N80-19590
- Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770
- Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775

## CROP VIGOR

- Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600
- Application of statistical correlation in the study of available water in layers of Cerrado soil [INPE-1607-TD/L014] p0070 N80-18531
- Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770
- Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777

## CRUDE OIL

- Some application of Landsat imagery interpretation for petroleum targeting in India p0087 A80-22433
- An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas p0088 A80-32276
- CRUSTAL FRACTURES**
- On the selection of station sites for observing strain stresses and earthquake forerunners in California p0090 N80-20740
- Earthquake and crustal deformation studies --- San Francisco and Fort Ross, California p0091 N80-20743

## D

## DATA ACQUISITION

- Landsat-D data acquisition and processing p0108 A80-25563
- Data acquisition and projected applications of the observations from Landsat-D p0117 A80-27427
- Satellite activities of NOAA 1978 --- geostationary and polar orbiting systems [PB80-112782] p0119 N80-21002

## DATA BASES

- Georgia's operational Landsat processing system p0109 A80-25590
- Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978
- U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429

## DATA COLLECTION PLATFORMS

U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430  
Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-met data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525  
As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices [E80-10077] p0111 N80-19586  
The data bank in the cartographic automation system p0082 N80-20660

### DATA COLLECTION PLATFORMS

Operational data collection and platform location by satellite --- Tiros-N technology assessment p0107 A80-22404  
State of the art and needs of the earth platform --- in application of satellite tracking to animals p0060 A80-22405  
Application of HCMM data to soil moisture snow and estuarine current studies [E80-10068] p0104 N80-18517  
Development of A seismic data collection platform p0091 N80-20745

### DATA COMPRESSION

Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392  
Sources of variations in LANDSAT autocorrelation --- Richmond, Virginia and Denver, Colorado p0114 N80-20767

### DATA CORRELATION

An image registration algorithm using sampled binary correlation --- of satellite-borne photographs p0108 A80-25580  
Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978  
Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513  
Sources of variations in LANDSAT autocorrelation --- Richmond, Virginia and Denver, Colorado p0114 N80-20767

### DATA MANAGEMENT

Landat-D sensor data product generation p0110 A80-27428

### DATA PROCESSING

The suitability of the ILLIAC IV architecture for image processing p0107 A80-22382  
Digital image processing techniques of integrated images and non-image data sets --- from satellite remote sensing p0107 A80-22401  
Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea p0094 A80-22449  
A regression technique for evaluation and quantification for water quality parameters from remote sensing data p0102 A80-22470  
Machine processing of remotely sensed data: Proceedings of the Fifth Annual Symposium, Purdue University, West Lafayette, Ind., June 27-29, 1979 p0108 A80-25561  
Landat-D data acquisition and processing p0108 A80-25563  
Crop-area estimates from Landsat - Transition from research and development to timely results p0064 A80-25569  
IMAGENET - An image analysis network --- for LANDSAT images p0109 A80-25588  
Georgia's operational Landsat processing system p0109 A80-25590  
Conference of Remote Sensing Educators (CORSE-78) [NASA-CP-2102] p0122 N80-20003  
On the displacement problem as part of a process in generalizing topographical maps. Proposition for hierarchical order and the search for EDP assisted solutions p0082 N80-20675  
Linear array pushbroom radiometer data analysis p0119 N80-20784  
Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803

### DATA PROCESSING EQUIPMENT

The CCRS Image Analysis Processor --- Canada Centre for Remote Sensing p0115 A80-22381

### DATA REDUCTION

AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526  
The easy remote sensing problem [REPT-20] p0070 N80-18528  
The Cramer-Rao lower bound as a criteria for evaluating a large data reduction system such as LACIE [REPT-21] p0070 N80-18529  
The reduction of remote sensing data by visual means --- education p0118 N80-20017

### DATA SAMPLING

A stratified-cluster sampling procedure applied to a wild, and vegetation inventory using remote sensing p0059 A80-22389

Sampling techniques to monitor forest area change p0061 A80-22474  
Autocorrelation in Landsat data p0107 A80-22483  
Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach --- from classifications of Landsat data p0064 A80-25570

### DATA SMOOTHING

Applying contrast, filtering and smoothing techniques to Landsat images p0107 A80-22471  
Geometric correction of satellite data using curvilinear features and virtual control points p0116 A80-22472

### DATA SYSTEMS

A system for processing Landsat and other georeferenced data for resource management applications p0109 A80-25589  
Landat-D sensor data product generation p0110 A80-27428

### DATA TRANSMISSION

Landat-D data acquisition and processing p0108 A80-25563

### DATUM (ELEVATION)

A digital terrain model for large surfaces and direct storage access p0083 N80-20681

### DECIDUOUS TREES

An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508  
Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064  
Remote sensing and the agricultural zoning of lands p0064 A80-24069  
Landat-2 data for inventorying rangelands in south Texas p0065 A80-25573  
Remote monitoring of forest cover conditions --- deciduous tree defoliation in Pennsylvania p0071 N80-20763

### DEER

Feature selection and classifier design with applications to remote sensing of mule deer p0069 N80-18505

### DEFOLIATION

A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596  
Remote monitoring of forest cover conditions --- deciduous tree defoliation in Pennsylvania p0071 N80-20763

### DEFORESTATION

Transfer of remote sensing computer technology to the developing world - Case examples p0109 A80-25587

### DEHYDRATION

Remote sensing of leaf water content in the near infrared p0071 N80-20768

### DELTA

Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan p0101 A80-22451  
Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22490  
Monitoring man's impact in the coastal zone p0104 A80-27436  
The use of multispectral photographs for soil cover studies p0067 A80-32280

### DENSITY DISTRIBUTION

Information theory density distribution --- Earth Mantle p0085 N80-20753

### DEPTH MEASUREMENT

Landat bathymetric mapping by multitemporal processing p0094 A80-22464

### DESERTS

Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation p0081 A80-22509  
Main aspects of two Chilean remote sensing projects developed under extreme severe environmental conditions - Desert North and Antarctic South p0116 A80-22513  
California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568  
Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301

### DEVELOPING NATIONS

A low cost classification algorithm for developing countries --- for multispectral remote sensor data p0108 A80-22484  
Agricultural and resource assessment in Jamaica using an area sampling frame p0062 A80-22487  
Production of small-scale maps and inventories using Landsat data p0081 A80-22503  
Transfer of remote sensing computer technology to the developing world - Case examples p0109 A80-25587

### DIGITAL DATA

Integration of Landsat, Seasat, and other geo-data sources p0107 A80-22392  
A study of digitized radar images p0107 A80-22430  
Small forest cuttings mapped with Landsat digital data p0061 A80-22439  
Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures p0063 A80-23295  
Analysis of numerical data handling systems in remote sensing p0108 A80-24073  
Analyzing accuracy attributes of Landsat and digital terrain tape data in the context of a digital geobase information system p0108 A80-25579  
A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-26750  
Cartography and remote sensing p0117 A80-31998

Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766  
Linear array pushbroom radiometer data analysis p0119 N80-20784

### DIGITAL FILTERS

Quadratic image destriping --- G O E S photograph enhancement p0108 A80-22498

### DIGITAL SIMULATION

Error detection and rectification in digital terrain models p0110 A80-27432  
A digital terrain model for large surfaces and direct storage access p0083 N80-20681

### DIGITAL TECHNIQUES

Digital processing of Landsat data of ice and snow areas at Vatnajökull, Iceland - A possibility for improved morphological tectonic interpretation p0087 A80-21839  
Karhunen-Loeve analysis of multispectral data from landscapes p0075 A80-22138  
Digital image processing techniques of integrated images and non-image data sets --- from satellite remote sensing p0107 A80-22401  
Applying contrast, filtering and smoothing techniques to Landsat images p0107 A80-22471  
Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511  
Landat-D data acquisition and processing p0108 A80-25563  
California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568  
IMAGENET - An image analysis network --- for LANDSAT images p0109 A80-25588  
Computer recognition of citrus infestations p0066 A80-25599  
The geometric correction of Landsat images at the Canada Centre for Remote Sensing p0109 A80-26311  
A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-26750  
Compatibility of analytical plotters with digital imagery in the plotting of variable spaces p0110 A80-31980  
An interactive software for plotting thematic maps p0111 A80-31996  
Development, status, and goals of cartographic automation p0112 N80-20655  
Automatic acquisition and processing of cartographic data p0112 N80-20656  
Computer based generalization for the elaboration and extension of topographic maps p0112 N80-20658  
The data bank in the cartographic automation system p0082 N80-20660

Digital height model with ITEK correlator p0112 N80-20669

Digital map bases from photogrammetric measurements p0113 N80-20671  
Tasks and possibilities of digital image data processing in photogrammetry p0113 N80-20672

### DIGITAL TO ANALOG CONVERTERS

Graphic production of maps on screens or photocomposition devices p0112 N80-20659  
Setting data from multistage analytical orientation p0119 N80-20709  
On the writing accuracy of the reproduction unit of the Optronics System P1700 p0113 N80-20711

### DISPLACEMENT

On the displacement problem as part of a process in generalizing topographical maps. Proposition for hierarchical order and the search for EDP assisted solutions p0082 N80-20675

### DISTRIBUTION (PROPERTY)

Machine processing of Landsat MSS data and DMA topographic data for forest cover type mapping p0065 A80-25597

### DISTRICT OF COLUMBIA

NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765

### DOPPLER EFFECT

The satellite station Wetzell p0082 N80-20641  
The EROS-Doppler Observation Campaign (EROS-DOC) p0119 N80-20697

### DOPPLER RADAR

Free Doppler network adjustment p0081 A80-24810

### DRAINAGE

An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508  
Remote sensing and the agricultural zoning of lands p0064 A80-24069  
Wetland flow resistance determination using Landsat data p0103 A80-27431

### DRAINAGE PATTERNS

Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591

### DROUGHT

Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures p0063 A80-23295  
Remote sensing of leaf water content in the near infrared p0071 N80-20768  
Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770

## SUBJECT INDEX

**DUNES**

- Use of remote sensing for land use policy formulation  
--- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and  
Wexford counties, Michigan  
[EBO-10085] p0078 N80-19592  
Application of LANDSAT imagery to monitor sand dunes  
movement in the Sahara Desert p0113 N80-20719

**E****EARTH ALBEDO**

- The measurement of hourly variations in earth  
temperature and albedo by satellite - Application to the  
remote sensing of water resources p0102 A80-24060  
A calibration procedure for Fourier series thermal inertia  
models --- surface temperature surveys  
p0110 A80-30923  
The seasonal cycle of snow cover, sea ice and surface  
albedo p0111 A80-32101

**EARTH CORE**

- Spherical harmonic models of the core field  
p0084 N80-20727

**EARTH CRUST**

- Study of geological and geophysical manifestations of  
horizontal stresses in the crust based on satellite imagery  
p0088 A80-26727  
Earth Survey Applications Division: Research leading  
to the effective use of space technology in applications  
relating to the Earth's surface and interior  
[EBO-10084] p0084 N80-20722  
Earth survey applications division: Research leading to  
the effective use of space technology in applications relating  
to the Earth's surface and interior  
[EBO-10087] p0084 N80-20723  
Geological/geophysical resource assessment --- Rio  
Grande rift p0090 N80-20725  
Magnetic field modeling and crustal studies  
p0084 N80-20726  
Crustal anomaly representation p0084 N80-20728  
Regional modeling: The Ivrea zone --- Northern Italy  
p0085 N80-20731  
Global geology and geophysics using satellite-derived  
data p0090 N80-20733  
Geophysical atlas p0090 N80-20734  
Comparative planetology/crustal evolution  
p0090 N80-20735  
Crustal deformation: Crustal dynamics project  
p0090 N80-20736  
Investigation of crustal dynamics using VLBI  
p0090 N80-20737  
Crustal structure and dynamics of southeastern US ---  
Maryland, Virginia, North Carolina, South Carolina, West  
Virginia, Georgia, Tennessee, and Kentucky  
p0090 N80-20738  
Development of A seismic data collection platform  
p0091 N80-20745  
Crustal motion measurements in California (SAFE)  
p0091 N80-20746  
Gravity model development p0085 N80-20748  
Information theory density distribution --- Earth Mantle  
p0085 N80-20753

**EARTH MANTLE**

- Regional modeling: The Ivrea zone --- Northern Italy  
p0085 N80-20731  
Interpretation of geoid anomalies in the vicinity of  
subduction zones --- Tonga-Kermadec and the New  
Hebrides island arc, North Fiji, South Fiji and Lau-havre  
p0090 N80-20732  
Global intra-plate volcanism p0091 N80-20744  
The gravity field in the central Pacific from  
satellite-to-satellite tracking and implications for mantle  
convection p0085 N80-20750  
Mantle convection and subcrustal stress  
p0085 N80-20752  
Information theory density distribution --- Earth Mantle  
p0085 N80-20753  
Mean sea surface computation using GEOS-3 altimeter  
data p0099 N80-20760

**EARTH MOVEMENTS**

- Investigation of crustal dynamics using VLBI  
p0090 N80-20737  
GSFC site stability p0085 N80-20741  
Geodetic stability of the Green Bank, West Virginia VLBI  
site p0085 N80-20742  
Crustal motion measurements in California (SAFE)  
p0091 N80-20746  
The enhanced nodal equilibrium ocean tide and polar  
motion p0085 N80-20754  
Polar motion research p0085 N80-20755

**EARTH OBSERVATIONS (FROM SPACE)**

- Possibilities of optimal planning of multipurpose survey  
from space --- oceanography, hydrology, geology, forestry  
and agriculture p0121 A80-22432

**EARTH PLANETARY STRUCTURE**

- Comparative planetology/crustal evolution  
p0090 N80-20735  
Plate boundary deformation in California --- Southern  
California: Elsinore, Earthquake Valley, and San Felipe  
Faults p0090 N80-20739  
A determination of GM p0086 N80-20756

**EARTH RESOURCES**

- National land use and settlement assessment - An areal  
data base model for Landsat information for Bangladesh  
p0076 A80-22493

- Estimation of grain yields by remote sensing of crop  
senescence rates p0063 A80-23299

**EARTH ROTATION**

- Geodyn program systems development  
p0085 N80-20747  
Unexplained Lageos perturbation p0085 N80-20751  
Polar motion and Earth rotation results from Lageos  
p0086 N80-20757

**EARTH SURFACE**

- Surface temperature variations as measured by the Heat  
Capacity Mapping Mission p0115 A80-22420

**EARTH TIDES**

- A survey of the geodetical work of the IFAG from  
1952-1977 p0082 N80-20640  
The enhanced nodal equilibrium ocean tide and polar  
motion p0085 N80-20754  
Starlette orbit analyses for ocean tidal studies  
p0100 N80-20762

**EARTHQUAKE DAMAGE**

- Earthquake and crustal deformation studies --- San  
Francisco and Fort Ross, California p0091 N80-20743

**EARTHQUAKES**

- Application of Landsat in evaluation of selected  
earthquake prone areas p0087 A80-22489  
On the selection of station sites for observing strain strips  
and earthquake forerunners in California  
p0090 N80-20740  
Earthquake and crustal deformation studies --- San  
Francisco and Fort Ross, California p0091 N80-20743  
Development of A seismic data collection platform  
p0091 N80-20745

**ECOLOGY**

- Land use/cover changes in the Kainji Reservoir area  
/Nigeria/ p0075 A80-22445  
Measuring ecological changes in multitemporal Landsat  
data using principal components p0076 A80-22452  
Fill-up of the LG 2 reservoir - Surveillance aided by  
Landsat images --- water rise and ecology of French  
reservoir p0103 A80-24061  
LANDSAT digital analysis of the initial recovery of the  
Kokolik River tundra fire area, Alaska  
[EBO-10080] p0071 N80-19588

**ECONOMIC DEVELOPMENT**

- Space benefits: The secondary application of aerospace  
technology in other sectors of the economy  
[NASA-CR-162697] p0122 N80-16950

**EDUCATION**

- Conference of Remote Sensing Educators (CORSE-78)  
[NASA-CP-2102] p0122 N80-20003  
Textbooks and technical references for remote sensing  
p0122 N80-20014  
The reduction of remote sensing data by visual means  
--- education p0118 N80-20017

**EGYPT**

- An evaluation of Landsat 3 RBV imagery for an area of  
complex terrain in Southern Italy p0081 A80-22508  
Transfer of remote sensing computer technology to the  
developing world - Case examples p0109 A80-25587

**EMISSION SPECTRA**

- Field performance of a laser fluorosensor for the detection  
of oil spills p0097 A80-27331

**ENERGY TRANSFER**

- Applications of HCMM satellite data --- water quality,  
hydrology, and energy exchange of Lake Erie and Lake  
Ontario  
[EBO-10071] p0104 N80-18520

**ENGLISH CHANNEL**

- Sea surface temperature of the coastal zones of France.  
Heat Capacity Mapping Mission (HCMM)  
[EBO-10057] p0099 N80-19585

**ENVIRONMENTAL EFFECTS**

- LANDSAT digital analysis of the initial recovery of the  
Kokolik River tundra fire area, Alaska  
[EBO-10080] p0071 N80-19588  
Use of remote sensing for land use policy formulation  
--- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and  
Wexford counties, Michigan  
[EBO-10085] p0078 N80-19592

**ENVIRONMENTAL MONITORING**

- International Symposium on Remote Sensing of  
Environment, 13th, Ann Arbor, Mich., April 23-27, 1979.  
Proceedings. Volumes 1, 2 & 3 p0121 A80-22376  
European remote sensing activities p0121 A80-22377  
The Canadian remote sensing program  
p0121 A80-22378  
NASA policy issues --- for remote sensors environmental  
monitoring development p0121 A80-22379  
A stratified-cluster sampling procedure applied to a  
wildland vegetation inventory using remote sensing  
p0059 A80-22389  
Correction of synthetic aperture radar and multispectral  
scanner data sets p0115 A80-22391  
Impacts of land use on estuarine water quality  
p0101 A80-22398  
Operational data collection and platform location by  
satellite --- Tiros-N technology assessment  
p0107 A80-22404  
Geostationary and orbiting satellites applied to remote  
ocean buoy data acquisition p0093 A80-22406  
Terrain evaluation for environmental inventory and impact  
assessment p0075 A80-22426  
An evaluation of parametric and non-parametric  
algorithms for unsupervised classification of surface  
disturbed lands p0087 A80-22435

- Temporal study on Paddy /rice/ using X-band  
scatterometer p0061 A80-22438  
Land use/cover changes in the Kainji Reservoir area  
/Nigeria/ p0075 A80-22445  
Enhancement of Landsat imagery for the monitoring of  
coastal waters Application to the southern part of the North  
Sea p0094 A80-22449  
Measuring ecological changes in multitemporal Landsat  
data using principal components p0076 A80-22452  
On the penetration of microwaves in snow and soil  
p0101 A80-22461  
Urban environmental survey by remote sensing  
p0076 A80-22468  
Sampling techniques to monitor forest area change  
p0061 A80-22474  
Marine pollution analysis in Tokyo Bay by Landsat 1  
and 2 p0095 A80-22496  
Remote sensing and water resources in Quebec  
p0102 A80-24054  
Remote sensing studies of vegetation  
p0063 A80-24055  
Hydraulic analysis of urbanized river by aerial MSS data  
- A case study on the Tama River through the Tokyo  
metropolis p0102 A80-24059  
Remote sensing and the agricultural zoning of lands  
p0064 A80-24069  
New earth resource monitoring techniques  
p0076 A80-24074  
American Society of Photogrammetry and American  
Congress on Surveying and Mapping, Fall Technical  
Meeting, Sioux Falls, S. Dak., September 17-21, 1979.  
Joint Proceedings p0117 A80-27426  
Monitoring man's impact in the coastal zone  
p0104 A80-27436  
Aspects of the spaceborne remote sensing of the earth  
p0117 A80-31121  
Illinois LANDSAT feasibility study  
[NASA-CR-162760] p0122 N80-16424  
LACIE evaluation and outlook panel transcript: The LACIE  
Symposium  
[EBO-10069] p0070 N80-18518  
NOAA satellite monitoring of snow cover in the Northern  
Hemisphere during the winter of 1977  
p0105 N80-19594  
Remote monitoring of forest cover conditions ---  
deciduous tree defoliation in Pennsylvania  
p0071 N80-20763  
Surface mine monitoring --- Pennsylvania  
p0091 N80-20764  
Microwave remote sensing technology for the marine  
oil pollution surveillance  
[REPT-202] p0100 N80-20786  
Assessment of satellite and aircraft multispectral scanner  
data for strip-mine monitoring  
[NASA-TM-79268] p0091 N80-20787  
Satellite activities of NOAA 1978 --- geostationary and  
polar orbiting systems  
[PB80-112782] p0119 N80-21002  
Coastal Oceans Monitoring Satellite System (COMSS).  
Volume 1: Executive summary  
[ESS/SS-930] p0100 N80-21406  
Monitoring the sea surface  
p0100 N80-21820
- EROS (SATELLITES)**  
The EROS-Doppler Observation Campaign (EROS-DOC)  
p0119 N80-20697
- EROSION**  
Remote sensing applied to soils p0063 A80-24053  
Remote sensing studies of vegetation  
p0063 A80-24055
- ERROR ANALYSIS**  
Sampling for area estimation - A comparison of full-frame  
sampling with the sample segment approach --- from  
classifications of Landsat data p0064 A80-25570  
Analyzing accuracy attributes of Landsat and digital  
terrain tape data in the context of a digital geobase  
information system p0108 A80-25579
- ERROR CORRECTING CODES**  
Error detection and rectification in digital terrain  
models p0110 A80-27432
- ERROR CORRECTING DEVICES**  
On the writing accuracy of the reproduction unit of the  
Optronics System P1700 p0113 N80-20711
- ERROR DETECTION CODES**  
Error detection and rectification in digital terrain  
models p0110 A80-27432
- ESTIMATING**  
Crop-area estimates from Landsat - Transition from  
research and development to timely results  
p0064 A80-25569
- ESTUARIES**  
Impacts of land use on estuarine water quality  
p0101 A80-22398  
Assessment of tidal wetland habitat and productivity  
p0094 A80-22416  
Field study of pollutant migration in the vicinity of a  
coastal front p0098 A80-28263  
Application of HCMM data to soil moisture snow and  
estuarine current studies  
[EBO-10068] p0104 N80-18517  
Sea surface temperature of the coastal zones of France.  
Heat Capacity Mapping Mission (HCMM)  
[EBO-10057] p0099 N80-19585

## EUROPE

- NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977 p0105 N80-19594
- Elaborating an astronomical longitude system p0082 N80-20647  
p0090 N80-20734
- Geophysical atlas p0090 N80-20734
- Investigation of crustal dynamics using VLBI p0090 N80-20737
- Findings of the OPIT study in America --- application of remote sensing information [NASA-TM-76106] p0122 N80-21822

## EUROPEAN SPACE PROGRAMS

- European remote sensing activities p0121 A80-22377
- Study for the determination of geometric and spectral resolution requirements of optical imaging instruments for Earth resources satellites, volume 1 [CM/PR/3384-VOL-1] p0118 N80-17855
- Coastal Oceans Monitoring Satellite System (COMSS), Volume 1: Executive summary [ESS/SS-930] p0100 N80-21406

## EVAPORATION

- Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420
- Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442

## EVAPOTRANSPIRATION

- Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures p0063 A80-23295
- The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources p0102 A80-24060
- Improvements in lake water budget computations using Landsat data p0103 A80-27434
- Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521
- Application of statistical correlation in the study of available water in layers of Carrizo soil [INPE-1607-TDL/014] p0070 N80-18531
- Agrometeorological applications p0073 N80-21818

## F

## FACTOR ANALYSIS

- AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526

## FARM CROPS

- Preliminary results of an investigation into the potential application of X-band SLR images for crop-type inventory purposes p0059 A80-21446
- Precision of crop-area estimates p0059 A80-22386
- Mapping New Zealand's moisture rich soils from Landsat p0061 A80-22485
- Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach --- from classifications of Landsat data p0064 A80-25570
- Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs p0067 A80-32283
- Plant stress and relationships to spectral responses --- cotton and tomato plants p0071 N80-20769
- Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770

## FARMLANDS

- Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420
- Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573
- Method for the photometric interpretation of multispectral aerial photographs p0111 A80-32266
- Experience with the use of synthesized color images for the interpretation of agricultural objects p0067 A80-32270
- Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394
- Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513
- Measurement of soil moisture trends with airborne scatterometers --- Guymon, Oklahoma and Sublett, Kansas [E80-10064] p0069 N80-18514
- Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521
- Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522
- Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523
- The easy remote sensing problem [REPT-20] p0070 N80-18528

- Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592
- Surface mine monitoring --- Pennsylvania p0091 N80-20764

## FEDERAL BUDGETS

- NASA authorization, 1981, program review, volume 1 [GPO-53-814] p0122 N80-17913

## FERTILIZERS

- Assessment of the fertilizer requirement of improved pasture from remote sensing information p0066 A80-26315

## FIRE DAMAGE

- An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon p0068 N80-18500
- LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19588

## FISHES

- Remote sensing of living marine resources p0094 A80-22418
- Use of satellite navigation by tuna seiners p0095 A80-25153
- Satellite activities of NOAA 1978 --- geostationary and polar orbiting systems [PB80-112782] p0119 N80-21002

## FLOOD PLAINS

- Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis p0102 A80-24059
- Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591

## FLOODS

- Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522

## FLORIDA

- Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data p0093 A80-21454
- Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0066 A80-26313
- Wetland flow resistance determination using Landsat data p0103 A80-27431
- Improvements in lake water budget computations using Landsat data p0103 A80-27434
- Forest resource information system --- Baker County, Florida and Picayune, Mississippi sites; St. Regis Paper Company [E80-10065] p0069 N80-18515
- NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765

## FLOW RESISTANCE

- Wetland flow resistance determination using Landsat data p0103 A80-27431

## FLOW VELOCITY

- The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384

## FLUORESCENCE

- A laser-fluorosensor technique for water quality assessment p0101 A80-22399
- Field performance of a laser fluorosensor for the detection of oil spills p0097 A80-27331
- Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18678
- Airborne laser fluorosensing of surface water chlorophyll a --- Lake Mead, Nevada [PB80-113400] p0105 N80-20797

## FOCUSING

- Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448

## FOLIAGE

- Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-18600
- Remote sensing of leaf water content in the near infrared p0071 N80-20768
- Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775

## FORECASTING

- Possible future directions in crop yield forecasting p0062 A80-22505

## FOREST FIRES

- Production of small-scale maps and inventories using Landsat data p0081 A80-22503
- Utilization of a portable thermograph in the Ministere des Terres et Forets p0064 A80-24067
- An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon p0068 N80-18500

## FOREST MANAGEMENT

- Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423
- An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- Small forest cuttings mapped with Landsat digital data p0061 A80-22439

- Forest inventory of clearcuts utilizing remote sensing techniques p0061 A80-22473
- Forest stand classification in western Washington using Landsat and computer-based resource data p0062 A80-22497

- Remote sensing studies of vegetation p0063 A80-24055

- Remote sensing and forestry in Quebec p0063 A80-24056

- Mortality infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065

- Utilization of a portable thermograph in the Ministere des Terres et Forets p0064 A80-24067

- A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596

- Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722

- Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723

- Remote monitoring of forest cover conditions --- deciduous tree defoliation in Pennsylvania p0071 N80-20763

## FORESTS

- A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing p0059 A80-22389

- Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables p0060 A80-22415

- A study of digitized radar images p0107 A80-22430

- Possibilities of optimal planning of multipurpose survey from space --- oceanography, hydrology, geology, forestry and agriculture p0121 A80-22432

- Estimation of primary production of vegetation in agricultural and forested areas using Landsat data p0061 A80-22456

- Sampling techniques to monitor forest area change p0061 A80-22474

- Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486

- Forest stand classification in western Washington using Landsat and computer-based resource data p0062 A80-22497

- Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501

- Remote sensing and forestry in Quebec p0063 A80-24056

- Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064

- The utilization of a stereotransflescope and very-small-scale photography for the acquisition of forest maps at a scale of 1:20,000 p0064 A80-24066

- Using guided clustering techniques to analyze Landsat data for mapping forest land cover in northern California p0065 A80-25595

- Machine processing of Landsat MSS data and DMA topographic data for forest cover type mapping p0065 A80-25597

- Texture analysis by space filter and application to forest-type classification p0066 A80-25598

- Investigation of landscapes of the Turgay steppe using multispectral aerial photography p0078 A80-32278

- Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado [E80-10041] p0068 N80-16391

- Computer-aided processing of LANDSAT MSS data for classification of forestlands --- San Juan Mountains, Colorado [E80-10043] p0068 N80-16393

- An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon p0068 N80-18500

- Forest resource information system --- Baker County, Florida and Picayune, Mississippi sites; St. Regis Paper Company [E80-10065] p0069 N80-18515

- Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522

- The problem of obtaining data for the Digital Height Model p0113 N80-20707

- Geobotanical exploration --- Mineral, Virginia p0090 N80-20724

- Surface mine monitoring --- Pennsylvania p0091 N80-20764

- FOURIER SERIES
- A calibration procedure for Fourier series thermal inertia models --- surface temperature surveys p0110 A80-30923

- FRANCE
- A study of digitized radar images p0107 A80-22430

- Production of small-scale maps and inventories using Landsat data p0081 A80-22503

- Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images --- water rise and ecology of French reservoir p0103 A80-24061

- Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585
- FREEZING**  
Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521
- FRENCH SATELLITES**  
Terrain modeling and geometric corrections using the Spot satellite p0081 A80-22407  
Starlette orbit analyses for ocean tidal studies p0100 N80-20762
- FRENCH SPACE PROGRAMS**  
SPOT - First French remote sensing satellite geometrical performance p0121 A80-22429
- FRESH WATER**  
Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301
- G**
- GARP ATLANTIC TROPICAL EXPERIMENT**  
Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations p0096 A80-25336
- GEOBOTANY**  
Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723  
Geobotanical exploration --- Mineral, Virginia p0090 N80-20724
- GEOCENTRIC COORDINATES**  
The EROS-Doppler Observation Campaign (EROS-DOC) p0119 N80-20697
- GEODESY**  
Free Doppler network adjustment p0081 A80-24810  
Landsat MSS coordinate transformations p0116 A80-25567  
Reports on cartography and geodesy. Series 1: Original report no. 73 [REPT-73] p0082 N80-20638  
The 25 years at the Institute for Applied Geodesy p0082 N80-20639  
A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640  
The satellite station Wetzell p0082 N80-20641  
Determination of azimuth and astronomical coordinates p0082 N80-20648  
The EROS-Doppler Observation Campaign (EROS-DOC) p0119 N80-20697  
The RGST chain program for the determination of potential coefficients and station coordinates p0084 N80-20702  
Study for a project for a European high precision laser network p0084 N80-20704  
Setting data from multistage analytical orientation p0119 N80-20709  
Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723  
Interpretation of geoid anomalies in the vicinity of subduction zones --- Tonga-Kermadec and the New Hebrides island arc, North Fiji, South Fiji and Lau-havre p0090 N80-20732  
Global geology and geophysics using satellite-derived data p0090 N80-20733  
Investigation of crustal dynamics using VLBI p0090 N80-20737  
GSFC site stability p0085 N80-20741  
Geodetic stability of the Green Bank, West Virginia VLBI site p0085 N80-20742  
Geodyn program systems development p0085 N80-20747  
Gravity model development p0085 N80-20748  
Gravity model improvement for SEASAT p0085 N80-20749  
A determination of GM p0086 N80-20756  
The SEASAT altimeter height bias using four Bermuda overflights p0086 N80-20758  
Mean sea surface computation using GEOS-3 altimeter data p0099 N80-20760  
Ocean circulation p0099 N80-20761  
Starlette orbit analyses for ocean tidal studies p0100 N80-20762  
The spaceborne laser ranging system p0086 N80-20785
- GEODETTIC COORDINATES**  
The triangulation network in West Germany p0111 N80-20651  
Map projection change: Some programs for the transformation of the contents of available maps according to different map projections p0084 N80-20690
- The RGST chain program for the determination of potential coefficients and station coordinates p0084 N80-20702  
The problem of obtaining data for the Digital Height Model p0113 N80-20707  
Geodyn program systems development p0085 N80-20747  
Information theory density distribution --- Earth Mantle p0085 N80-20753  
Polar motion research p0085 N80-20755  
A determination of GM p0086 N80-20756
- GEODETTIC SATELLITES**  
The satellite station Wetzell p0082 N80-20641
- GEODETTIC SURVEYS**  
American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings p0117 A80-27426  
Reports on cartography and geodesy. Series 1: Original report no. 73 [REPT-73] p0082 N80-20638
- GEODYNAMICS**  
A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640  
The satellite station Wetzell p0082 N80-20641  
Geophysical atlas p0090 N80-20734  
Crustal deformation: Crustal dynamics project p0090 N80-20736  
Investigation of crustal dynamics using VLBI p0090 N80-20737  
Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738  
Plate boundary deformation in California --- Southern California: Elsinore, Earthquake Valley, and San Felipe Faults p0090 N80-20739  
On the selection of station sites for observing strain strips and earthquake fore-runners in California p0090 N80-20740  
Earthquake and crustal deformation studies --- San Francisco and Fort Ross, California p0091 N80-20743  
Global intra-plate volcanism p0091 N80-20744  
Development of A seismic data collection platform p0091 N80-20745  
Mantle convection and subcrustal stress p0085 N80-20752  
The enhanced nodal equilibrium ocean tide and polar motion p0085 N80-20754  
Polar motion research p0085 N80-20755  
The spaceborne laser ranging system p0086 N80-20785
- GEOGRAPHY**  
Integration of remote sensing and geographic information systems p0075 A80-22403  
Aspects of the spaceborne remote sensing of the earth p0117 A80-31121  
Results of a preliminary complex geographic interpretation of multiresource survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275  
The topographic synoptic map 1:200,000 p0078 N80-20661  
The synoptic map 1:500,000 (World, Series 1404) p0078 N80-20662  
The international world map 1:1,000,000 (HWK) p0079 N80-20663
- GEOIDS**  
Preliminary estimates of the resolution capability of the SEASAT radar altimeter p0117 A80-29163  
Interpretation of geoid anomalies in the vicinity of subduction zones --- Tonga-Kermadec and the New Hebrides island arc, North Fiji, South Fiji and Lau-havre p0090 N80-20732
- GEOLOGICAL FAULTS**  
Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults p0087 A80-22441  
Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489  
Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725  
Regional Modeling: The Kentucky anomaly p0090 N80-20730  
Comparative planetology/crustal evolution p0090 N80-20735  
Crustal deformation: Crustal dynamics project p0090 N80-20736  
Plate boundary deformation in California --- Southern California: Elsinore, Earthquake Valley, and San Felipe Faults p0090 N80-20739  
Earthquake and crustal deformation studies --- San Francisco and Fort Ross, California p0091 N80-20743
- GEOLOGICAL SURVEYS**  
Digital image processing techniques of integrated images and non-image data sets --- from satellite remote sensing p0107 A80-22401  
Possibilities of optimal planning of multipurpose survey from space --- oceanography, hydrology, geology, forestry and agriculture p0121 A80-22432  
Some application of Landsat imagery interpretation for petroleum targeting in India p0087 A80-22433  
Cartography with combined Landsat and navigational satellite data p0081 A80-22440
- Integrated survey of natural resources of the low lands of Bolivia using Landsat images p0108 A80-22488  
The applicability of remote sensing technique for geological and mineral exploration in Nepal p0088 A80-22491  
Stereosat - A new astrodynamics challenge --- satellite-borne stereo imaging for geoscience, cartography and earth resource exploration [AIAA PAPER 80-0237] p0108 A80-22744  
Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region p0089 A80-32277  
U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429  
U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430  
Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651
- GEOLOGY**  
Operational data collection and platform location by satellite --- Tiro-N technology assessment p0107 A80-22404  
High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- GEOMAGNETIC LATITUDE**  
Crustal anomaly representation p0084 N80-20728
- GEOMAGNETISM**  
Integration of Landsat, Seasat, and other geo-data sources p0107 A80-22392  
Magnetic field modeling and crustal studies p0084 N80-20726  
Spherical harmonic models of the core field p0084 N80-20727  
Crustal anomaly representation p0084 N80-20728  
Anomaly verification: Comparison of Pogo magnetic data with aeromagnetic measurements p0085 N80-20729  
Regional Modeling: The Kentucky anomaly p0090 N80-20730  
Regional modeling: The Ivrea zone --- Northern Italy p0085 N80-20731  
Tectonics, volume 2. Citations from the NTIS data base [PB80-804529] p0091 N80-21925
- GEO MORPHOLOGY**  
An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508  
Larger perspective for geomorphic studies on Landsat imagery - A case study: Andhra Pradesh, India p0088 A80-22510  
Remote sensing and resources management: Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Universite de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings p0121 A80-24051  
A comparative study of various remote sensing techniques applied to geomorphology p0102 A80-24058  
Remote sensing data of SP mountain and SP lava flow in north-central Arizona p0088 A80-26316  
Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317  
An evaluation of landscape units --- geological surveys by photographic imaging techniques p0088 A80-27456  
Space photography and thematic mapping - A method for processing multichannel photography --- Russian book p0111 A80-32262  
Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas p0111 A80-32279  
Comparative planetology/crustal evolution p0090 N80-20735  
Tectonics, volume 2. Citations from the NTIS data base [PB80-804529] p0091 N80-21925
- GEO PHYSICS**  
Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723  
Regional modeling: The Ivrea zone --- Northern Italy p0085 N80-20731  
Information theory density distribution --- Earth Mantle p0085 N80-20753  
A determination of GM p0086 N80-20756  
Tectonics, volume 2. Citations from the NTIS data base [PB80-804529] p0091 N80-21925
- GEO POTENTIAL**  
Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725  
Spherical harmonic models of the core field p0084 N80-20727  
Global geology and geophysics using satellite-derived data p0090 N80-20733  
Gravity model development p0085 N80-20748

**GEORGIA**

Georgia's operational Landsat processing system p0109 A80-25590  
 Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738

**GEOS 3 SATELLITE**

Mean sea surface computation using GEOS-3 altimeter data p0099 N80-20760  
 Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p0100 N80-20790

**GEOTHERMAL RESOURCES**

Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah p0115 A80-22425  
 Main aspects of two Chilean remote sensing projects developed under extreme severe environmental conditions - Desert North and Antarctic South p0116 A80-22513

**GERMANY**

Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454  
 The triangulation network in West Germany p0111 N80-20651  
 The topographic synoptic map 1:200,000 p0078 N80-20661  
 The synoptic map 1:500,000 (World, Series 1404) p0078 N80-20662  
 Obtaining surface information for topography and town and country planning from remote sensing p0079 N80-20668  
 On the displacement problem as part of a process in generalizing topographical maps. Proposition for hierarchical order and the search for EDP assisted solutions p0082 N80-20875  
 Twenty-five years of aerial photography by the Institute of Applied Geodesy p0083 N80-20876

**GLACIAL DRIFT**

A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-26750

**GLACIERS**

Remote sensing and resources management; Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Universite de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings p0121 A80-24051  
 A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-26750  
 Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591

**GLOBAL ATMOSPHERIC RESEARCH PROGRAM**

Meteorological satellites: Status and outlook p0119 N80-21800

**GLOBAL POSITIONING SYSTEM**

GPS application to seismic oil exploration p0088 A80-25159

**GOES SATELLITES**

Quadratic image destriping --- GOES photograph enhancement p0108 A80-22498

**GOVERNMENT/INDUSTRY RELATIONS**

NASA policy issues --- for remote sensors environmental monitoring development p0121 A80-22379

**GOVERNMENTS**

NCSL remote sensing project --- State Legislature considerations and activities [E80-10053] p0122 N80-16401

**GRAINS (FOOD)**

Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387  
 Estimation of grain yields by remote sensing of crop senescence rates p0063 A80-23299  
 Crop identification in a parkland environment using aerial photography p0066 A80-26312  
 Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study [E80-10052] p0068 N80-16400  
 Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506  
 Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507  
 AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526

**GRAND CANYON (AZ)**

Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317

**GRASSES**

A spectral method for determining the percentage of green herbage material in clipped samples p0066 A80-26318  
 A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780  
 Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples --- Texas p0073 N80-20781

**GRASSLANDS**

Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573  
 A spectral filter for ESMR's sidelobe errors [NASA-TM-80555] p0118 N80-16402  
 Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522  
 Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523  
 A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass [E80-10082] p0071 N80-19590  
 Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770  
 Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777

**GRAVIMETRY**

Reports on cartography and geodesy. Series 1: Original report no. 73 [REPT-73] p0082 N80-20638  
 The 25 years at the Institute for Applied Geodesy p0082 N80-20639  
 A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640  
 GSFC site stability p0085 N80-20741  
 Gravity model development p0085 N80-20748  
**GRAVITATIONAL CONSTANT**  
 A determination of GM p0086 N80-20756  
**GRAVITATIONAL FIELDS**  
 Gravity model improvement for SEASAT p0085 N80-20749  
 The gravity field in the central pacific from satellite-to-satellite tracking and implications for mantle convection p0085 N80-20750  
 Mantle convection and subcrustal stress p0085 N80-20752

**GRAVITY ANOMALIES**

Anomaly verification: Comparison of Pogo magnetic data with aeromagnetic measurements p0085 N80-20729  
 Regional Modeling: The Kentucky anomaly p0090 N80-20730  
 Regional modeling: The Ivrea zone --- Northern Italy p0085 N80-20731  
 Global geology and geophysics using satellite-derived data p0090 N80-20733  
 Gravity model development p0085 N80-20748  
 The gravity field in the central pacific from satellite-to-satellite tracking and implications for mantle convection p0085 N80-20750

**GRAZING INCIDENCE**

Preliminary results of an investigation into the potential application of X-band SLR images for crop-type inventory purposes p0059 A80-21446

**GREAT PLAINS CORRIDOR (NORTH AMERICA)**

Advances in earth resources management p0059 A80-21896  
 LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086  
 Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513

**GREEN WAVE EFFECT**

Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506  
 Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507  
 AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526  
 Off-nadir viewing effects on spectral assessment of green biomass p0072 N80-20772  
 Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775

**GREENLAND**

Crustal anomaly representation p0084 N80-20728

**GROUND TRUTH**

Precision of crop-area estimates p0059 A80-22386  
 Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387  
 Radar discrimination of crops p0080 A80-22424  
 Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941  
 A methodology for a national coverage land use study by computer p0077 A80-25574  
 Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263  
 Large Area Crop Inventory Experiment (LACIE). Evaluation of three-category classification [E80-10058] p0069 N80-18509  
 Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510

Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-met data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525

**GROUND WATER**

An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508  
 HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524  
 Use of satellite imagery for the derivation of the hydrogeologic characteristics of a test area in semiarid climates p0105 N80-18545

**GULF OF ALASKA**

Seasat Gulf of Alaska Workshop report. Volume 1: Panel reports [NASA-CR-162759] p0118 N80-17535  
 Seasat gulf of Alaska workshop report [NASA-CR-162463] p0099 N80-18549

**GULF OF CALIFORNIA (MEXICO)**

Crustal motion measurements in California (SAFE) p0091 N80-20746

**GULF OF MEXICO**

Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data p0093 A80-21454  
 Gulf of Mexico, ocean-color surface-truth measurements p0097 A80-25343  
 Monitoring man's impact in the coastal zone p0104 A80-27436

**GULF STREAM**

The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384  
 Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941  
 Spatial Gauss-Markov models of ocean currents p0095 A80-23286  
 Gulf stream ring trajectories p0095 A80-24546  
 Ocean circulation p0099 N80-20781

**GULFS**

Radar and ship observations of coastal sea surface roughness patterns in the Gulf of Georgia p0093 A80-22385

**H**

**HABITATS**

Assessment of tidal wetland habitat and productivity p0094 A80-22416  
 Wombats detected from space --- Landsat satellite imagery application p0063 A80-23296  
 Remote sensing studies of vegetation p0063 A80-24055

**HAITI**

Landsat applications to land use mapping of the Cul de Sac Plain of Haiti p0076 A80-22479

**HARMONIC ANALYSIS**

Gravity model improvement for SEASAT p0085 N80-20749

**HAWAII**

The gravity field in the central pacific from satellite-to-satellite tracking and implications for mantle convection p0085 N80-20750  
 Information theory density distribution --- Earth Mantle p0085 N80-20753

**HAY**

Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770  
 Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples --- Texas p0073 N80-20781

**HEAT CAPACITY MAPPING MISSION**

Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420  
 Remote sensing and soils - An application p0063 A80-24052  
 The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources p0102 A80-24060  
 Pasture/wheat surface temperature differences - Indicator of relative soil moisture differences p0065 A80-25582

Scales oceanic parameters as monitored from space p0097 A80-26751

Investigation of the application of HCMM thermal data to snow hydrology --- Sierra Nevada Mountains, California and the Arizona test site [E80-10049] p0104 N80-16397

Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10050] p0089 N80-16398

Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512

HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516

Application of HCMM data to soil moisture snow and estuarine current studies [E80-10068] p0104 N80-18517

Applications of HCMM satellite data --- water quality, hydrology, and energy exchange of Lake Erie and Lake Ontario [E80-10071] p0104 N80-18520

- Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521
- Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523
- HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524
- Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585
- Heat Capacity Mapping Mission (HCMM) --- Australia [E80-10066] p0079 N80-20721
- HEIGHT**
- Digital height model with ITEX correlator p0112 N80-20669
- HIGH RESOLUTION**
- Signature evaluation of natural targets using high spectral resolution techniques p0115 A80-22409
- High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- HIGHWAYS**
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- HIMALAYAS**
- Some application of Landsat imagery interpretation for petroleum targeting in India p0087 A80-22433
- A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-28750
- Geophysical atlas p0090 N80-20734
- HYDROGEOLOGY**
- CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite p0087 A80-22443
- An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508
- Larger perspective for geomorphic studies on Landsat imagery - A case study: Andhra Pradesh, India p0088 A80-22510
- Results of a preliminary complex geographic interpretation of multiresolution survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-22275
- Study of oceanic lithosphere using GEOS-3 radar altimeter data [AD-A077344] p0099 N80-18673
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- Heat Capacity Mapping Mission (HCMM) --- Australia [E80-10066] p0079 N80-20721
- HYDROGRAPHY**
- Spatial and temporal variations in lagoon and coastal processes of the southern Brazilian Coast p0095 A80-22495
- Spatial Gauss-Markov models of ocean currents p0095 A80-23286
- Remote sensing and water resources in Quebec p0102 A80-24054
- Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images --- water rise and ecology of French reservoir p0103 A80-24061
- Gulf stream ring trajectories p0095 A80-24546
- Near-surface bathymetry system p0104 A80-27438
- HYDROLOGY**
- Possibilities of optimal planning of multipurpose survey from space --- oceanography, hydrology, geology, forestry and agriculture p0121 A80-22432
- The use of models for predicting ice floes in Baffin Bay p0094 A80-22434
- An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- Land use/cover changes in the Kainji Reservoir area /Nigeria/ p0075 A80-22445
- Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454
- Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis p0102 A80-24059
- The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources p0102 A80-24060
- A non-interactive approach to land use determination p0077 A80-25572
- Microwave approaches in hydrology p0104 A80-30920
- Space photography and thematic mapping - A method for processing multichannel photography --- Russian book p0111 A80-32282
- Method for the photometric interpretation of multispectral aerial photographs p0111 A80-32266
- Radar target for remotely sensing hydrological phenomena [NASA-CASE-LAR-12344-1] p0104 N80-18498
- Applications of HCMM satellite data --- water quality, hydrology, and energy exchange of Lake Erie and Lake Ontario [E80-10071] p0104 N80-18520
- Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522
- HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524
- Use of satellite imagery for the derivation of the hydrogeologic characteristics of a test area in semiarid climates p0105 N80-18545
- Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591
- The production of photomaps from tidal flat areas p0083 N80-20682
- Satellite activities of NOAA 1978 --- geostationary and polar orbiting systems [PB80-112782] p0119 N80-21002
- Snow and ice mapping: Norwegian examples for run-off prediction p0105 N80-21816
- Satellite contribution to the study of the physical properties of soils. Utilization in the water and agricultural domains p0073 N80-21817
- HYDROLOGY MODELS**
- Spatial Gauss-Markov models of ocean currents p0095 A80-23286
- HYDROMETEOROLOGY**
- Spatial and temporal variations in lagoon and coastal processes of the southern Brazilian Coast p0095 A80-22495
- Relationship of physiography and snow area to stream discharge --- Kings River Watershed, California [E80-10046] p0104 N80-16396
- ICE**
- Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images --- water rise and ecology of French reservoir p0103 A80-24061
- ICE ENVIRONMENTS**
- Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333
- ICE FLOES**
- The use of models for predicting ice floes in Baffin Bay p0094 A80-22434
- ICE MAPPING**
- Digital processing of Landsat data of ice and snow areas at Vatnajökull, Iceland - A possibility for improved morphological tectonic interpretation p0087 A80-21839
- The use of models for predicting ice floes in Baffin Bay p0094 A80-22434
- An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447
- The ROS-580 Project --- airborne synthetic aperture radar remote sensing p0116 A80-24075
- A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-28750
- The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676
- Backscatter measurements of sea ice with a helicopter-borne scatterometer [AD-A077614] p0098 N80-18542
- Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360
- SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589
- Statistical analysis of terrain and water (ice) backgrounds in a winter scene from northern Michigan [AD-A077554] p0078 N80-19598
- Snow and ice mapping: Norwegian examples for run-off prediction p0105 N80-21816
- ICELAND**
- Digital processing of Landsat data of ice and snow areas at Vatnajökull, Iceland - A possibility for improved morphological tectonic interpretation p0087 A80-21839
- IDAHO**
- Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429
- ILLIAC 4 COMPUTER**
- The suitability of the ILLIAC IV architecture for image processing p0107 A80-22382
- ILLINOIS**
- An evaluation of several different classification schemes - Their parameters and performance --- maximum likelihood decision for crop identification p0061 A80-22453
- Illinois LANDSAT feasibility study [NASA-CR-162760] p0122 N80-16424
- Implementation of Badhwar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511
- IMAGE CONTRAST**
- On spectral signatures in central perspective representation p0112 N80-20665
- IMAGE CORRELATORS**
- Compatibility of analytical plotters with digital imagery in the plotting of variable spaces p0110 A80-31980
- Digital height model with ITEX correlator p0112 N80-20669
- IMAGE ENHANCEMENT**
- Radar discrimination of crops p0060 A80-22424
- Thematic adaptive spatial filtering of Landsat landuse classification results p0075 A80-22444
- IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447
- Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea p0094 A80-22449
- Applying contrast, filtering and smoothing techniques to Landsat images p0107 A80-22471
- Geometric correction of satellite data using curvilinear features and virtual control points p0116 A80-22472
- Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22480
- Spatial quantification of maps or images - Cell size or pixel size implications p0110 A80-27429
- IMAGE PROCESSING**
- Karhunen-Loeve analysis of multispectral data from landscapes p0075 A80-22138
- International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings, Volumes 1, 2 & 3 p0121 A80-22376
- The Massively Parallel Processor and its applications --- for environmental monitoring p0115 A80-22380
- The CCRS Image Analysis Processor --- Canada Centre for Remote Sensing p0115 A80-22381
- The suitability of the ILLIAC IV architecture for image processing p0107 A80-22382
- Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391
- Integration of Landsat, Seasat, and other geo-data sources p0107 A80-22392
- Digital image processing techniques of integrated images and non-image data sets --- from satellite remote sensing p0107 A80-22401
- Terrain modeling and geometric corrections using the Spot satellite p0081 A80-22407
- Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables p0060 A80-22415
- Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423
- Radar discrimination of crops p0060 A80-22424
- A study of digitized radar images p0107 A80-22430
- Thematic adaptive spatial filtering of Landsat landuse classification results p0075 A80-22444
- Land use/cover changes in the Kainji Reservoir area /Nigeria/ p0075 A80-22445
- Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448
- An evaluation of several different classification schemes - Their parameters and performance --- maximum likelihood decision for crop identification p0061 A80-22453
- Applying contrast, filtering and smoothing techniques to Landsat images p0107 A80-22471
- Autocorrelation in Landsat data p0107 A80-22483
- A low cost classification algorithm for developing countries --- for multispectral remote sensor data p0108 A80-22484
- Quadratic image destriping --- GOES photograph enhancement p0108 A80-22498
- Temporal resolution for crop discrimination estimated using J-M distance p0062 A80-22502
- Production of small-scale maps and inventories using Landsat data p0081 A80-22503
- Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511
- Coniferous tree species mapping using Landsat data p0062 A80-23294
- Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064
- Analysis of numerical data handling systems in remote sensing p0108 A80-24073
- New earth resource monitoring techniques p0076 A80-24074
- Machine processing of remotely sensed data: Proceedings of the Fifth Annual Symposium, Purdue University, West Lafayette, Ind., June 27-29, 1979 p0108 A80-25561
- Landsat MSS coordinate transformations p0116 A80-25567
- California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568
- Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach --- from classifications of Landsat data p0064 A80-25570
- Multi-temporal classification of winter wheat using a growth state model p0064 A80-25571
- A non-interactive approach to land use determination p0077 A80-25572

A methodology for a national coverage land use study by computer p0077 A80-25574  
 The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants p0077 A80-25575  
 Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576  
 Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577  
 Analyzing accuracy attributes of Landsat and digital terrain tape data in the context of a digital geobase information system p0108 A80-25579  
 An image registration algorithm using sampled binary correlation --- of satellite-borne photographs p0108 A80-25580  
 Pasture/wheat surface temperature differences - indicator of relative soil moisture differences p0065 A80-25582  
 Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana p0065 A80-25583  
 Extraction of soil information from a vegetated area p0065 A80-25584  
 Predictability of change in soil reflectance on wetting p0065 A80-25586  
 Transfer of remote sensing computer technology to the developing world - Case examples p0109 A80-25587  
 IMAGENET - An image analysis network --- for LANDSAT images p0109 A80-25588  
 A system for processing Landsat and other georeferenced data for resource management applications p0109 A80-25589  
 Georgia's operational Landsat processing system p0109 A80-25590  
 A method for classifying multispectral remote sensing data using context p0109 A80-25594  
 Using guided clustering techniques to analyze Landsat data for mapping forest land cover in northern California p0065 A80-25595  
 A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596  
 Texture analysis by space filter and application to foresttype classification p0066 A80-25598  
 An interactive color display system for labelling crops p0066 A80-25600  
 The geometric correction of Landsat images at the Canada Centre for Remote Sensing p0109 A80-26311  
 Error detection and rectification in digital terrain models p0110 A80-27432  
 An evaluation of landscape units --- geological surveys by photographic imaging techniques p0088 A80-27456  
 Effects of interpretation techniques on land-use mapping accuracy p0077 A80-27457  
 Crop emergence date determination from spectral data p0067 A80-27458  
 Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978  
 Compatibility of analytical plotters with digital imagery in the plotting of variable spaces p0110 A80-31980  
 Systems of image data acquisition and digitization p0117 A80-31987  
 Analysis of remote sensing data in oceanography and climatology p0098 A80-31989  
 Cartography and remote sensing p0117 A80-31998  
 Experience with the use of synthesized color images for the interpretation of agricultural objects p0067 A80-32270  
 Experiment on the complex interpretation of multispectral scanner aerial photographs of Bulgaria p0111 A80-32282  
 Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392  
 Computer-aided processing of LANDSAT MSS data for classification of forestlands --- San Juan Mountains, Colorado [E80-10043] p0068 N80-16393  
 Synthetic aperture radar/LANDSAT MSS image registration [NASA-RP-1039] p0111 N80-16405  
 Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651  
 Feature selection and classifier design with applications to remote sensing of mule deer p0069 N80-18505  
 Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512  
 Forest resource information system --- Baker County, Florida and Picalyune, Mississippi sites: St. Regis Paper Company [E80-10065] p0069 N80-18515  
 AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526  
 The easy remote sensing problem [REPT-20] p0070 N80-18528  
 Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532

As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices [E80-10077] p0111 N80-19586  
 Video processing of remote sensor data applied to uranium exploration in Wyoming [GJBX-171(79)] p0089 N80-19603  
 Conference of Remote Sensing Educators (CORSE-78) [NASA-CP-2102] p0122 N80-20003  
 Textbooks and technical references for remote sensing p0122 N80-20014  
 The reduction of remote sensing data by visual means --- education p0118 N80-20017  
 Tasks and possibilities of digital image data processing in photogrammetry p0113 N80-20672  
 Reports on cartography and topographical measurements. Series 1: Original reports [REPT-77] p0113 N80-20705  
 Contributions to the creation of a conclusive system of concepts of photogrammetry and aerial photograph cartography p0119 N80-20706  
 A method for examining relationships between multispectral data p0113 N80-20708  
 Linear array pushbroom radiometer data analysis p0119 N80-20784  
 Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p0100 N80-20790

**IMAGE RECONSTRUCTION**

High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613

**IMAGE RESOLUTION**

Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431  
 An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508  
 Spatial quantification of maps or images - Cell size or pixel size implications p0110 A80-27429  
 Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591

**IMAGING TECHNIQUES**

Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation p0081 A80-22509  
 Stereosat - A new astrodynamics challenge --- satellite-borne stereo imaging for geoscience, cartography and earth resource exploration [AIAA PAPER 80-0237] p0108 A80-22744  
 An assessment of electromagnetic remote sensing systems for the detection of perched water tables p0103 A80-26787  
 Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978  
 Study for the determination of geometric and spectral resolution requirements of optical imaging instruments for Earth resources satellites, volume 1 [CM/PR/3384-VOL-1] p0118 N80-17855  
 The future of analytical evaluation equipment --- image measurement techniques p0112 N80-20670

**INDIA**

Some application of Landsat imagery interpretation for petroleum targeting in India p0087 A80-22433  
 Temporal study on Paddy /rice/ using X-band scatterometer p0061 A80-22438  
 Larger perspective for geomorphic studies on Landsat imagery - A case study: Andhra Pradesh, India p0088 A80-22510  
 LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086

**INDIAN OCEAN**

Landsat bathymetric mapping by multitemporal processing p0094 A80-22484  
 Remote sensing of the sea around Singapore p0095 A80-22506  
 Study of oceanic lithosphere using GEOS-3 radar altimeter data [AD-A077344] p0099 N80-18673

**INDIANA**

An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands p0087 A80-22435  
 Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577  
 Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana p0065 A80-25583  
 Predictability of change in soil reflectance on wetting p0065 A80-25586  
 Implementation of Badhwar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511

**INDUSTRIAL WASTES**

Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592

**INFESTATION**

Remote sensing and resources management: Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Universite de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979. Proceedings p0121 A80-24051  
 Remote sensing studies of vegetation p0063 A80-24055

Remote sensing and forestry in Quebec p0063 A80-24056  
 Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065

A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596  
 Computer recognition of citrus infestations p0066 A80-25599

Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592  
 Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
 Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723

Remote monitoring of forest cover conditions --- deciduous tree defoliation in Pennsylvania p0071 N80-20763

**INFORMATION DISSEMINATION**

Determination of range biomass using Landsat p0060 A80-22414

**INFORMATION SYSTEMS**

Integration of remote sensing and geographic information systems p0075 A80-22403  
 Analysis of numerical data handling systems in remote sensing p0108 A80-24073  
 Analyzing accuracy attributes of Landsat and digital terrain tape data in the context of a digital geobase information system p0108 A80-25579  
 The geometric correction of Landsat images at the Canada Centre for Remote Sensing p0109 A80-26311  
 Landsat-D sensor data product generation p0110 A80-27428

NCSL remote sensing project --- State Legislature considerations and activities [E80-10053] p0122 N80-16401

Forest resource information system --- Baker County, Florida and Picalyune, Mississippi sites: St. Regis Paper Company [E80-10065] p0069 N80-18515

**INFORMATION THEORY**

Information theory density distribution --- Earth Mantle p0085 N80-20753

**INFRARED IMAGERY**

Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data p0093 A80-21454  
 A study of digitized radar images p0107 A80-22430  
 CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite p0087 A80-22443  
 A comparative study of various remote sensing techniques applied to geomorphology p0102 A80-24058  
 The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources p0102 A80-24060  
 New earth resource monitoring techniques p0076 A80-24074

Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978. Proceedings, Parts 1, 2 & 3 p0096 A80-25327

Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576

Crop identification in a parkland environment using aerial photography p0066 A80-26312  
 Remote sensing of ocean waters p0098 A80-29389  
 Analysis of remote sensing data in oceanography and climatology p0098 A80-31989

U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429

U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430

Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600

Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651

Statistical analysis of terrain and water (ice) backgrounds in a winter scene from northern Michigan [AD-A077554] p0078 N80-19598  
 Statistical analysis of terrain and water backgrounds in the vicinity of Port Huene, California [AD-A077025] p0078 N80-19599

Remote sensing of leaf water content in the near infrared p0071 N80-20768

- Plant stress and relationships to spectral responses --- cotton and tomato plants p0071 N80-20769  
Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787
- INFRARED PHOTOGRAPHY**  
Sampling techniques to monitor forest area change p0061 A80-22474  
Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065  
The utilization of a stereotransferecope and very-small-scale photography for the acquisition of forest maps at a scale of 1:20,000 p0064 A80-24066  
Scales oceanic parameters as monitored from space p0097 A80-26751  
Use of low altitude aerial biosensing with color infrared photography as a crop management service p0067 A80-27437
- INFRARED RADIOMETERS**  
IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447  
Passive radiometry of the ocean from space - An overview p0096 A80-25328
- INLAND WATERS**  
Remote sensing and water resources in Quebec p0102 A80-24054  
Heat Capacity Mapping Mission (HCMM) --- Australia [E80-10066] p0079 N80-20721
- INSOLATION**  
Urban environmental survey by remote sensing p0076 A80-22468  
Agrometeorological applications p0073 N80-21818
- INSTRUMENT ERRORS**  
A spectral filter for ESMR's sidelobe errors [NASA-TM-80555] p0118 N80-16402  
The effect of sea state on altimeter measurements p0119 N80-20759
- INTERNATIONAL RELATIONS**  
NASA policy issues --- for remote sensors environmental monitoring development p0121 A80-22379
- IOWA**  
Precision of crop-area estimates p0059 A80-22386  
An evaluation of several different classification schemes - Their parameters and performance --- maximum likelihood decision for crop identification p0061 A80-22453  
Crop-area estimates from Landsat - Transition from research and development to timely results p0064 A80-25569  
Implementation of Badhwar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511
- IRRIGATION**  
Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435  
Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770  
Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771
- ISLANDS**  
Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512  
Information theory density distribution --- Earth Mantle p0085 N80-20753
- ISTHUSES**  
Gravity model development p0085 N80-20748
- ITALY**  
An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508  
Regional modeling: The Irvrea zone --- Northern Italy p0085 N80-20731  
Sea surface temperature anomaly mapping using the NOAA satellites p0100 N80-21819  
Biological applications including pollution monitoring --- ocean surface monitoring p0100 N80-21821
- J**
- JAMAICA**  
Agricultural and resource assessment in Jamaica using an area sampling frame p0062 A80-22487
- JAPAN**  
Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431  
Marine pollution analysis in Tokyo Bay by Landsat 1 and 2 p0095 A80-22496  
Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis p0102 A80-24059  
Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786
- K**
- KANSAS**  
Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults p0087 A80-22441  
Area estimates by Landsat - Kansas 1976 winter wheat p0062 A80-22500  
Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach --- from classifications of Landsat data p0064 A80-25570  
Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394  
Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513  
Measurement of soil moisture trends with airborne scatterometers --- Guymon, Oklahoma and Sublett, Kansas [E80-10064] p0069 N80-18514  
Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523
- KENTUCKY**  
Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410  
Regional Modeling: The Kentucky anomaly p0090 N80-20730  
Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738  
Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787
- L**
- LAGEOS (SATELLITE)**  
Unexplained Lageos perturbation p0085 N80-20751
- LAGOONS**  
Spatial and temporal variations in lagoon and coastal processes of the southern Brazilian Coast p0095 A80-22495
- LAKE ERIE**  
Applications of HCMM satellite data --- water quality, hydrology, and energy exchange of Lake Erie and Lake Ontario [E80-10071] p0104 N80-18520
- LAKE MICHIGAN**  
The use of remote sensing in the determination of beach sand parameters p0075 A80-22422
- LAKE ONTARIO**  
Applications of HCMM satellite data --- water quality, hydrology, and energy exchange of Lake Erie and Lake Ontario [E80-10071] p0104 N80-18520
- LAKES**  
The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah p0101 A80-22467  
Remote sensing and water resources in Quebec p0102 A80-24054  
Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433  
Improvements in lake water budget computations using Landsat data p0103 A80-27434  
Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region p0089 A80-32277  
Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523  
Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591  
Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593  
Airborne laser fluorescence of surface water chlorophyll a --- Lake Mead, Nevada [PB80-113400] p0105 N80-20797
- LAMBERT SURFACE**  
Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766
- LAND ICE**  
Digital processing of Landsat data of ice and snow areas at Vatnajökull, Iceland - A possibility for improved morphological tectonic interpretation p0087 A80-21839
- LAND MANAGEMENT**  
Use of low altitude aerial biosensing with color infrared photography as a crop management service p0067 A80-27437  
Surface mine monitoring --- Pennsylvania p0091 N80-20784
- LAND USE**  
Impacts of land use on estuarine water quality p0101 A80-22398
- Terrain evaluation for environmental inventory and impact assessment p0075 A80-22426  
Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431  
An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands p0087 A80-22435  
An evaluation of Landsat-D for Canadian applications p0060 A80-22437  
Thematic adaptive spatial filtering of Landsat landuse classification results p0075 A80-22444  
Land use/cover changes in the Kainji Reservoir area /Nigeria/ p0075 A80-22445  
Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450  
Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan p0101 A80-22451  
An evaluation of Michigan land cover/use inventories derived from remote sensing - Characteristics and costs p0076 A80-22462  
Urban environmental survey by remote sensing p0076 A80-22468  
Study of the Argentine Pampa's lowland by means of interpretation of Landsat satellite information p0102 A80-22478  
Landsat applications to land use mapping of the Cul de Sac Plain of Haiti p0076 A80-22479  
National land use and settlement assessment - An areal data base model for Landsat information for Bangladesh p0076 A80-22493  
Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511  
Remote sensing and the agricultural zoning of lands p0064 A80-24069  
A non-interactive approach to land use determination p0077 A80-25572  
Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573  
A methodology for a national coverage land use study by computer p0077 A80-25574  
The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants p0077 A80-25575  
Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576  
Classification of areas using pixel-by-pixel and sample classifiers --- for Landsat MSS data p0077 A80-25601  
Settlement detection with radar imagery p0077 A80-27430  
Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435  
Effects of interpretation techniques on land-use mapping accuracy p0077 A80-27457  
An interactive software for plotting thematic maps p0111 A80-31996  
NCSL remote sensing project --- State Legislature considerations and activities [E80-10053] p0122 N80-16401  
U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430  
Research project Mauretania: Satellites as development aids [NASA-TM-76064] p0078 N80-17120  
LACIE evaluation and outlook panel transcript: The LACIE Symposium [E80-10069] p0070 N80-18518  
Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522  
Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592  
Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593  
Obtaining surface information for topography and town and country planning from remote sensing p0079 N80-20868  
Heat Capacity Mapping Mission (HCMM) --- Australia [E80-10066] p0079 N80-20721  
NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765
- LANDFORMS**  
Larger perspective for geomorphic studies on Landsat imagery - A case study: Andhra Pradesh, India p0088 A80-22510
- LANDSAT D**  
The Landsat-D Assessment System p0121 A80-22419  
Landsat-D data acquisition and processing p0108 A80-25563  
Landsat-D sensor data product generation p0110 A80-27428  
LANDSAT-D assessment system p0122 N80-20782

- LANDSAT SATELLITES**  
Application of LANDSAT imagery to monitor sand dunes movement in the Sahara Desert p0113 N80-20719
- LANDSAT 2**  
Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573  
Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p0100 N80-20790
- LANDSLIDES**  
High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- LARGE AREA CROP INVENTORY EXPERIMENT**  
Advances in earth resources management p0059 A80-21896  
Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387  
The role of phenology in statistical crop acreage measurement p0059 A80-22388  
The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413  
Temporal resolution for crop discrimination estimated using J-M distance p0062 A80-22502  
LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086  
Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394  
Large Area Crop Inventory Experiment (LACIE). Detailed description of the wheat acreage estimation procedure used in the Large Area Crop Inventory Experiment [E80-10051] p0068 N80-16399  
Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study [E80-10052] p0068 N80-16400  
Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506  
Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507  
Large Area Crop Inventory Experiment (LACIE). Evaluation of three-category classification [E80-10058] p0069 N80-18509  
Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510  
LACIE evaluation and outlook panel transcript: The LACIE Symposium [E80-10069] p0070 N80-18518  
Large Area Crop Inventory Experiment (LACIE). Bibliographic addenda, technical reports, papers, and memorandums published under supporting research and technology and other research, test, and evaluation contracts for the Earth observations division [E80-10070] p0070 N80-18519  
Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-met data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525  
AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526  
The Cramer-Rao lower bound as a criteria for evaluating a large data reduction system such as LACIE [REPT-21] p0070 N80-18529
- LASER RANGE FINDERS**  
The spaceborne laser ranging system p0086 N80-20785
- LASER RANGER/TRACKER**  
Study for a project for a European high precision laser network p0084 N80-20704
- LASER SPECTROSCOPY**  
A laser-fluorosensor technique for water quality assessment p0101 A80-22399  
Field performance of a laser fluorosensor for the detection of oil spills p0097 A80-27331
- LASERS**  
Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18678
- LAVA**  
Remote sensing data of SP mountain and SP lava flow in north-central Arizona p0088 A80-26316
- LEAVES**  
Remote sensing of leaf water content in the near infrared p0071 N80-20768  
Plant stress and relationships to spectral responses --- cotton and tomato plants p0071 N80-20769  
Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775
- LEGUMINOUS PLANTS**  
Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770
- LIBYA**  
Application of LANDSAT imagery to monitor sand dunes movement in the Sahara Desert p0113 N80-20719
- LIMNOLOGY**  
The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah p0101 A80-22467  
Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images --- water rise and ecology of French reservoir p0103 A80-24061  
Improvements in lake water budget computations using Landsat data p0103 A80-27434
- LINEAR ARRAYS**  
Linear array pushbroom radiometer data analysis p0119 N80-20784
- LITHOLOGY**  
An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508  
HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516  
Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725  
Regional Modeling: The Kentucky anomaly p0090 N80-20730  
Plate boundary deformation in California --- Southern California: Elnsinore, Earthquake Valley, and San Felipe Faults p0090 N80-20739
- LITHOSPHERE**  
Study of oceanic lithosphere using GEOS-3 radar altimeter data [AD-A077344] p0099 N80-18673  
Interpretation of geoid anomalies in the vicinity of subduction zones --- Tonga-Kermadec and the New Hebrides island arc, North Fiji, South Fiji and Lau-Have p0090 N80-20732  
Global geology and geophysics using satellite-derived data p0090 N80-20733  
Geophysical atlas p0090 N80-20734  
Earthquake and crustal deformation studies --- San Francisco and Fort Ross, California p0091 N80-20743  
Global intra-plate volcanism p0091 N80-20744
- LONGITUDE MEASUREMENT**  
Elaborating an astronomical longitude system p0082 N80-20647
- M**
- MAGMA**  
Global intra-plate volcanism p0091 N80-20744
- MAGNETIC ANOMALIES**  
Spherical harmonic models of the core field p0084 N80-20727  
Crustal anomaly representation p0084 N80-20728  
Anomaly verification: Comparison of Pogo magnetic data with aeromagnetic measurements p0085 N80-20729  
Regional Modeling: The Kentucky anomaly p0090 N80-20730  
Interpretation of geoid anomalies in the vicinity of subduction zones --- Tonga-Kermadec and the New Hebrides island arc, North Fiji, South Fiji and Lau-Have p0090 N80-20732  
Global geology and geophysics using satellite-derived data p0090 N80-20733  
Geophysical atlas p0090 N80-20734
- MAGNETIC EQUATOR**  
Crustal anomaly representation p0084 N80-20728
- MAGNETIC FIELDS**  
Magnetic field modeling and crustal studies p0084 N80-20726  
Spherical harmonic models of the core field p0084 N80-20727
- MAGNETIC MEASUREMENT**  
Anomaly verification: Comparison of Pogo magnetic data with aeromagnetic measurements p0085 N80-20729
- MAGNETOSPHERE**  
Magnetic field modeling and crustal studies p0084 N80-20726
- MAPPING**  
Coniferous tree species mapping using Landsat data p0062 A80-23294  
An approach to nonlinear mapping for pattern recognition --- in Landsat multispectral scanner data p0116 A80-25592  
Machine processing of Landsat MSS data and DMA topographic data for forest cover type mapping p0065 A80-25597  
American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings p0117 A80-27426  
Spatial quantification of maps or images - Cell size or pixel size implications p0110 A80-27429  
Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado [E80-10041] p0068 N80-16391  
Reports on cartography and geodesy, Series 1: Original report no. 73 [REPT-73] p0082 N80-20638  
Cartography applications and research p0112 N80-20654  
Development, status, and goals of cartographic automation p0112 N80-20655  
Automatic acquisition and processing of cartographic data p0112 N80-20656
- On precision in the gathering and production of cartographic data p0112 N80-20657  
Computer based generalization for the elaboration and extension of topographic maps p0112 N80-20658  
Graphic production of maps on screens or photocomposition devices p0112 N80-20659  
The data bank in the cartographic automation system p0082 N80-20660  
Photogrammetry in IFAG from 1952 to 1977 p0079 N80-20664  
Aerial and space-borne photographic maps p0082 N80-20667  
On the displacement problem as part of a process in generalizing topographical maps. Proposition for hierarchical order and the search for EDP assisted solutions p0082 N80-20675  
A program for the fully automated displacement of point and line features in cartographic generalization p0083 N80-20680  
A digital terrain model for large surfaces and direct storage access p0083 N80-20681  
Testing the accuracy of cartographic equipment: First results p0083 N80-20683  
Locational characteristics and the sequence of computer assisted processes of cartographic generalization p0083 N80-20685  
Experiences gathered with a symbol disk with interchangeable symbols p0083 N80-20688  
Reports on cartography and topographical measurements, Series 1: Original reports [REPT-77] p0113 N80-20705  
The problem of obtaining data for the Digital Height Model p0113 N80-20707  
Setting data from multistage analytical orientation p0119 N80-20709  
Possibilities of application of LANDSAT and Skylab data to small scale cartography p0084 N80-20710  
The gravity field in the central pacific from satellite-to-satellite tracking and implications for mantle convection p0085 N80-20750
- MAPS**  
Cartography with combined Landsat and navigational satellite data p0081 A80-22440  
Production of small-scale maps and inventories using Landsat data p0081 A80-22503  
A program for the fully automated displacement of point and line features in cartographic generalization p0083 N80-20680  
Map projection change: Some programs for the transformation of the contents of available maps according to different map projections p0084 N80-20690  
Geophysical atlas p0090 N80-20734
- MARINE BIOLOGY**  
Assessment of tidal wetland habitat and productivity p0094 A80-22416  
A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances p0094 A80-22417
- MARINE ENVIRONMENTS**  
Geostationary and orbiting satellites applied to remote ocean buoy data acquisition p0093 A80-22406  
Remote sensing and water resources in Quebec p0102 A80-24054  
The aqueous thermal boundary layer p0096 A80-25334  
Remote sensing of ocean waters p0098 A80-29389
- MARINE MAMMALS**  
Remote sensing of living marine resources p0094 A80-22418
- MARINE METEOROLOGY**  
Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407  
The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676
- MARINE RESOURCES**  
Remote sensing of living marine resources p0094 A80-22418  
Use of satellite navigation by tuna seiners p0095 A80-25153  
OCEANS '79: Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979 p0097 A80-28251
- MARS CRATERS**  
Comparative planetology/crustal evolution p0090 N80-20735
- MARSHLANDS**  
Improvements in lake water budget computations using Landsat data p0103 A80-27434
- MARYLAND**  
Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738  
Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775  
GSFC site stability p0085 N80-20741
- MASS DISTRIBUTION**  
Information theory density distribution --- Earth Mantle p0085 N80-20753

## MASSACHUSETTS

NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765

## MATHEMATICAL MODELS

Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360  
Gravity model improvement for SEASAT p0085 N80-20749

## MAURITANIA

Research project Mauretania: Satellites as development aids [NASA-TM-76064] p0078 N80-17120

## MAXIMUM LIKELIHOOD ESTIMATES

An evaluation of several different classification schemes - Their parameters and performance --- maximum likelihood decision for crop identification p0061 A80-22453

## MEANDERS

Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data p0093 A80-21454

## MEDITERRANEAN SEA

Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585  
Sea surface temperature anomaly mapping using the NOAA satellites p100 N80-21819

## MERRITT ISLAND (FL)

Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0066 A80-26313

## MESOSCALE PHENOMENA

Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585  
Ocean circulation p0099 N80-20761

## METEOROLOGICAL PARAMETERS

LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086  
Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-net data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525

## METEOROLOGICAL SATELLITES

Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p100 N80-20790  
Satellite activities of NOAA 1978 --- geostationary and polar orbiting systems [PB80-112782] p0119 N80-21002  
Meteorological satellites: Status and outlook p0119 N80-21800

## METHANE

Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane [NASA-TM-80146] p0078 N80-16575

## MEXICO

A methodology for a national coverage land use study by computer p0077 A80-25574  
Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725

## MICHIGAN

Cartography with combined Landsat and navigational satellite data p0081 A80-22440  
Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan p0101 A80-22451  
An evaluation of Michigan land cover/use inventories derived from remote sensing - Characteristics and costs p0076 A80-22462  
Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592  
Statistical analysis of terrain and water (ice) backgrounds in a winter scene from northern Michigan [AD-A077554] p0078 N80-19598

## MICROPHOTOGRAPHS

Comparison of registograms in the microphotometric interpretation of multispectral photographs p0111 A80-32267

## MICROWAVE EMISSION

Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513  
Effect of soil texture on the microwave emission from soils [NASA-TM-80632] p0070 N80-18530

## MICROWAVE IMAGERY

On the penetration of microwaves in snow and soil p0101 A80-22461  
Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978. Proceedings, Parts 1, 2 & 3 p0096 A80-25327  
Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333  
90 GHz radiometric imaging through clouds p0117 A80-26807

## MICROWAVE RADIOMETERS

Investigations on snow parameters by radiometry in the 3- to 60-mm wavelength region p0103 A80-24827

Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330  
Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMRM/ p0116 A80-25332

The use of microwave radiometry for the operational mapping of soil moisture p0067 A80-32281  
A spectral filter for ESMR's sidelobe errors [NASA-TM-80555] p0118 N80-16402  
Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360  
SMRM simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589

## MICROWAVE SCATTERING

Temporal study on Paddy /rice/ using X-band scatterometer p0061 A80-22438

## MICROWAVE SENSORS

The ocean observed with microwaves --- remote sensing from satellites p0093 A80-21963  
Passive microwave remote sensing of the ocean - A review p0095 A80-25329  
Enhancement of remote sensing through microwave technology p0116 A80-25770  
Remote sensing of ocean waters p0098 A80-29389  
Microwave approaches in hydrology p0104 A80-30920  
Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786  
Meteorological satellites: Status and outlook p0119 N80-21800  
Monitoring the sea surface p0100 N80-21820

## MIGRATION

Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263

## MINERAL DEPOSITS

Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651  
Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725

## MINERAL EXPLORATION

The applicability of remote sensing technique for geological and mineral exploration in Nepal p0088 A80-22491  
Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation p0081 A80-22509  
A comparative study of various remote sensing techniques applied to geomorphology p0102 A80-24058  
Field performance of a laser fluorosensor for the detection of oil spills p0097 A80-27331  
Video processing of remote sensor data applied to uranium exploration in Wyoming [GJBX-17179] p0089 N80-19603  
Geobotanical exploration --- Mineral, Virginia p0090 N80-20724

## MINES (EXCAVATIONS)

An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands p0087 A80-22435  
Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576  
Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577  
Surface mine monitoring --- Pennsylvania p0091 N80-20764  
Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787  
Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803

## MINICOMPUTERS

IMAGENET - An image analysis network --- for LANDSAT images p0109 A80-25588

## MINING

Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723

## MINNESOTA

Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study [E80-10052] p0068 N80-16400

## MISSION PLANNING

Possibilities of optimal planning of multipurpose survey from space --- oceanography, hydrology, geology, forestry and agriculture p0121 A80-22432

## MISSISSIPPI

Forest resource information system --- Baker County, Florida and Picayune, Mississippi sites: St. Regis Paper Company [E80-10065] p0069 N80-18515

## MISSISSIPPI DELTA (LA)

Gulf of Mexico, ocean-color surface-truth measurements p0097 A80-25343

## MISSOURI

Implementation of Badhwar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511

## MISSOURI RIVER (US)

Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watrown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593

## MOISTURE CONTENT

The use of remote sensing in the determination of beach sand parameters p0075 A80-22422  
Radar discrimination of crops p0060 A80-22424  
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442  
On the penetration of microwaves in snow and soil p0101 A80-22461  
Remote sensing applied to soils p0063 A80-24053  
Investigations on snow parameters by radiometry in the 3- to 60-mm wavelength region p0103 A80-24827  
Microwave approaches in hydrology p0104 A80-30920

An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon p0068 N80-18500

A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass [E80-10082] p0071 N80-19590  
Remote sensing of leaf water content in the near infrared p0071 N80-20768  
Plant stress and relationships to spectral responses --- cotton and tomato plants p0071 N80-20769  
Spectra of isolated vegetational constituents p0072 N80-20779

A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780  
Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples --- Texas p0073 N80-20781

## MONTANA

U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429  
Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803

## MORTALITY

Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065

## MOTHS

Remote sensing and forestry in Quebec p0063 A80-24056  
A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596  
Remote monitoring of forest cover conditions --- deciduous tree defoliation in Pennsylvania p0071 N80-20763

## MOUNTAINS

An evaluation of landscape units --- geological surveys by photographic imaging techniques p0088 A80-27456  
Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591  
Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723  
Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766

## MULTIPROCESSING (COMPUTERS)

A method for classifying multispectral remote sensing data using context p0109 A80-25594

## MULTISPECTRAL BAND SCANNERS

Production of color composites from multispectral data records p0119 N80-20712

## MULTISPECTRAL LINEAR ARRAYS

Multispectral linear array sensor development p0119 N80-20783

## MULTISPECTRAL PHOTOGRAPHY

Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489  
Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511  
A method for classifying multispectral remote sensing data using context p0109 A80-25594  
Synthetic aperture radar/LANDSAT MSS image registration [NASA-RP-1039] p0111 N80-16405

## MULTISTATIC RADAR

A unique radio oceanographic radar [AD-A077364] p0099 N80-19332

## MUSKEGS

Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423

## N

## NATURAL GAS

Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults p0087 A80-22441

The role of navigation satellites in oil exploration p0088 A80-25152

The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas p0088 A80-32276

Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410

## NAVIGATION SATELLITES

The role of navigation satellites in oil exploration p0088 A80-25152

Use of satellite navigation by tuna seiners p0095 A80-25153

## NAVSTAR SATELLITES

GPS application to seismic oil exploration p0088 A80-25159

## NEPAL

The applicability of remote sensing technique for geological and mineral exploration in Nepal p0088 A80-22491

A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-26750

## NEVADA

Optimum Landsat sun angles for extreme contrasts of terrain p0087 A80-22458

On the selection of station sites for observing strain streps and earthquake forerunners in California p0090 N80-20740

Airborne laser fluorosensing of surface water chlorophyll a --- Lake Mead, Nevada [PB80-113400] p0105 N80-20797

## NEW GUINEA (ISLAND)

Interpretation of geoid anomalies in the vicinity of subduction zones --- Tonga-Kermadec and the New Hebrides island arc, North Fiji, South Fiji and Lau-havre p0090 N80-20732

## NEW HAMPSHIRE

Small forest cuttings mapped with Landsat digital data p0061 A80-22439

## NEW MEXICO

Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301

Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725

## NEW ZEALAND

Mapping New Zealand's moisture rich soils from Landsat p0061 A80-22485

Gravity model development p0085 N80-20748

## NIGERIA

Land use/cover changes in the Kainji Reservoir area /Nigeria/ p0075 A80-22445

The NIRAD survey of forest resources - An application of SLAR in Nigeria p0066 A80-26752

## NIMBUS SATELLITES

Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p0100 N80-20790

## NITROGEN OXIDES

Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane [NASA-TM-80146] p0078 N80-16575

Altitude characteristics of selected air quality analyzers [NASA-CR-159165] p0078 N80-16578

## NOAA SATELLITES

Oceanographic implications of features in NOAA satellite visible imagery p0096 A80-25337

## NONPARAMETRIC STATISTICS

Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577

## NORTH AMERICA

Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420

The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah p0101 A80-22467

U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430

Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513

Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521

NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977 p0105 N80-19594

Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725

Geophysical atlas p0090 N80-20734

Crustal deformation: Crustal dynamics project p0090 N80-20736

Investigation of crustal dynamics using VLB1 p0090 N80-20737

Gravity model development p0085 N80-20748

## NORTH CAROLINA

Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738

## NORTH DAKOTA

Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394

Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study [E80-10052] p0068 N80-16400

Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510

## NORTH SEA

Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea p0094 A80-22449

Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512

Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585

## NORTHERN HEMISPHERE

The seasonal cycle of snow cover, sea ice and surface albedo p0111 A80-32101

NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977 p0105 N80-19594

## NORWAY

Snow and ice mapping: Norwegian examples for run-off prediction p0105 N80-21816

## O

## OATS

Crop identification in a parkland environment using aerial photography p0066 A80-26312

Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510

Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592

## OCEAN BOTTOM

Shallow-water reflectance modeling with applications to remote sensing of the ocean floor p0093 A80-22410

Study of oceanic lithosphere using GEOS-3 radar altimeter data [AD-A077344] p0099 N80-18673

Gravity model development p0085 N80-20748

## OCEAN CURRENTS

Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data p0093 A80-21454

Remote sensing of ocean circulation using a satellite-borne radar altimeter p0093 A80-22383

The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384

IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447

Spatial Gauss-Markov models of ocean currents p0095 A80-23286

Gulf stream ring trajectories p0095 A80-24546

Scales oceanic parameters as monitored from space p0097 A80-26751

Ocean circulation p0089 N80-20761

## OCEAN DATA ACQUISITIONS SYSTEMS

Geostationary and orbiting satellites applied to remote ocean buoy data acquisition p0093 A80-22406

## OCEAN MODELS

Synthetic aperture radar modeling of surface ocean waves p0093 A80-22411

## OCEAN SURFACE

Remote sensing of ocean circulation using a satellite-borne radar altimeter p0093 A80-22383

The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384

Synthetic aperture radar modeling of surface ocean waves p0093 A80-22411

IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447

Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448

Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941

Spectral distortion inherent in airborne profilometer measurements of ocean wave heights p0095 A80-22942

Passive radiometry of the ocean from space - An overview p0096 A80-25328

Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330

Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMRM/ p0116 A80-25332

Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333

The aqueous thermal boundary layer p0096 A80-25334

Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations p0096 A80-25336

Oceanographic implications of features in NOAA satellite visible imagery p0096 A80-25337

An algorithm for remote sensing of water color from space p0097 A80-25342

Gulf of Mexico, ocean-color surface-truth measurements p0097 A80-25343

Atmospheric effects in the remote sensing of phytoplankton pigments p0097 A80-25345

The Surface Contour Radar, a unique remote sensing instrument p0116 A80-26085

The relationship between ocean surface structure and the synthetic aperture radar imagery of ocean waves p0097 A80-28256

Different considerations in coastal mapping p0110 A80-30922

The seasonal cycle of snow cover, sea ice and surface albedo p0111 A80-32101

Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407

Seasat Gulf of Alaska Workshop report. Volume 1: Panel reports [NASA-CR-162759] p0118 N80-17535

Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512

Seasat gulf of Alaska workshop report [NASA-CR-162463] p0099 N80-18549

Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18578

A unique radio oceanographic radar [AD-A077364] p0099 N80-19332

Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585

SMRM simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589

An initial assessment of the performance achieved by the Seasat-1 radar altimeter [NASA-TM-73279] p0118 N80-20564

The effect of sea state on altimeter measurements p0118 N80-20564

Mean sea surface computation using GEOS-3 altimeter data p0099 N80-20760

Wave sensor survey [PB80-118581] p0100 N80-21010

Coastal Oceans Monitoring Satellite System (COMSS). Volume 1: Executive summary [ESS/SS-930] p0100 N80-21406

Sea surface temperature anomaly mapping using the NOAA satellites p0100 N80-21819

Monitoring the sea surface p0100 N80-21820

Biological applications including pollution monitoring --- ocean surface monitoring p0100 N80-21821

**OCEANOGRAPHIC PARAMETERS**

Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448

Scales oceanic parameters as monitored from space p0097 A80-26751

Remote sensing of ocean waves p0098 A80-29389

**OCEANOGRAPHY**

Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data p0093 A80-21454

The ocean observed with microwaves --- remote sensing from satellites p0093 A80-21963

Operational data collection and platform location by satellite --- Tiros-N technology assessment p0107 A80-22404

Landsat bathymetric mapping by multimodal processing p0094 A80-22464

Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978. Proceedings, Parts 1, 2 & 3 p0096 A80-25327

Passive radiometry of the ocean from space - An overview p0096 A80-25328

Passive microwave remote sensing of the ocean - A review p0098 A80-25329

Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330

Applications of a two-flow model for remote sensing of substances in water p0097 A80-25340

Atmospheric effects in the remote sensing of phytoplankton pigments p0097 A80-25345

Near-surface bathymetry system p0104 A80-27438

OCEANS '79: Proceedings of the Fifth Annual Combined Conference, San Diego, Calif., September 17-19, 1979 p0097 A80-28251

Analysis of remote sensing data in oceanography and climatology p0098 A80-31989

Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407

The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676

Coastal water temperatures in the southeastern portion of Brazil from oceanographic data and NOAA satellite observations, volume 1 [INPE-1569-RPE/070] p0099 N80-18671

A unique radio oceanographic radar [AD-A077364] p0099 N80-19332

- Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior  
[E80-10084] p0084 N80-20722
- Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior  
[E80-10087] p0084 N80-20723
- Ocean circulation p0099 N80-20761
- Starlette orbit analyses for ocean tidal studies p0100 N80-20762
- Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p0100 N80-20790
- OCEANS**
- In-water and remote measurements of ocean color p0096 A80-25338
- A design study for an advanced ocean color scanner system --- spaceborne equipment p0097 A80-25346
- The enhanced nodal equilibrium ocean tide and polar motion p0085 N80-20754
- OFFSHORE ENERGY SOURCES**
- The role of navigation satellites in oil exploration p0088 A80-25152
- GPS application to seismic oil exploration p0088 A80-25159
- OIL EXPLORATION**
- Some application of Landsat imagery interpretation for petroleum targeting in India p0087 A80-22433
- An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults p0087 A80-22441
- An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508
- The role of navigation satellites in oil exploration p0088 A80-25152
- GPS application to seismic oil exploration p0088 A80-25159
- The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas p0088 A80-32276
- OIL POLLUTION**
- Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512
- Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18678
- Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786
- Remote sensing applied to pollution monitoring. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0732/2] p0079 N80-20952
- OIL SPILLS**
- Field performance of a laser fluorosensor for the detection of oil spills p0097 A80-27331
- Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512
- OKLAHOMA**
- Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas p0069 N80-18513
- Measurement of soil moisture trends with airborne scatterometer --- Guymon, Oklahoma and Sublett, Kansas [E80-10064] p0069 N80-18514
- Dryland pasture and crop conditions as seen by HCMC --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523
- OPTICAL DATA PROCESSING**
- Karhunen-Loeve analysis of multispectral data from landscapes p0075 A80-22138
- AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526
- Cartography applications and research p0112 N80-20654
- On precision in the gathering and production of cartographic data p0112 N80-20657
- Computer based generalization for the elaboration and extension of topographic maps p0112 N80-20658
- Graphic production of maps on screens or photocomposition devices p0112 N80-20659
- OPTICAL THICKNESS**
- An algorithm for remote sensing of water color from space p0097 A80-25342
- A design study for an advanced ocean color scanner system --- spaceborne equipment p0097 A80-25346
- ORBIT DECAY**
- Unexplained Lageos perturbation p0085 N80-20751
- OREGON**
- The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384
- Forest inventory of clearcuts utilizing remote sensing techniques p0061 A80-22473
- An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon p0068 N80-18500
- OROGRAPHY**
- Optimum Landsat sun angles for extreme contrasts of terrain p0087 A80-22458
- ORTHOPHOTOGRAPHY**
- Photogrammetry in IFAG from 1952 to 1977 p0079 N80-20664
- Orthophoto techniques and photomaps p0082 N80-20666
- Aerial and space-borne photographic maps p0082 N80-20667
- Digital height model with ITEK correlator p0112 N80-20669
- Digital map bases from photogrammetric measurements p0113 N80-20671
- OZONOMETRY**
- Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane [NASA-TM-80146] p0078 N80-16575
- Altitude characteristics of selected air quality analyzers [NASA-CR-159165] p0078 N80-16578
- P**
- PACIFIC ISLANDS**
- Interpretation of geoid anomalies in the vicinity of subduction zones --- Tonga-Kermadec and the New Hebrides island arc, North Fiji, South Fiji and Lau-havre p0090 N80-20732
- PACIFIC OCEAN**
- Marine pollution analysis in Tokyo Bay by Landsat 1 and 2 p0095 A80-22496
- Use of satellite navigation by tuna seiners p0095 A80-25153
- Preliminary estimates of the resolution capability of the SEASAT radar altimeter p0117 A80-29163
- Seasat Gulf of Alaska Workshop report. Volume 1: Panel reports [NASA-CR-162759] p0118 N80-17535
- Study of oceanic lithosphere using GEOS-3 radar altimeter data [AD-A077344] p0099 N80-18673
- The gravity field in the central pacific from satellite-to-satellite tracking and implications for mantle convection p0085 N80-20750
- Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786
- PACKET SWITCHING**
- IMAGENET - An image analysis network --- for LANDSAT images p0109 A80-25588
- PAMPAS**
- Study of the Argentine Pampas' lowland by means of interpretation of Landsat satellite information p0102 A80-22478
- PAPERS**
- Forest resource information system --- Baker County, Florida and Picayune, Mississippi sites; St. Regis Paper Company [E80-10065] p0069 N80-18515
- PARALLEL PROCESSING (COMPUTERS)**
- The Massively Parallel Processor and its applications --- for environmental monitoring p0115 A80-22380
- PARKS**
- An evaluation of landscape units --- geological surveys by photographic imaging techniques p0088 A80-27456
- U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430
- PARTICLE SIZE DISTRIBUTION**
- The use of remote sensing in the determination of beach sand parameters p0075 A80-22422
- Effect of soil texture on the microwave emission from soils [NASA-TM-80632] p0070 N80-18530
- PATTERN RECOGNITION**
- Advances in earth resources management p0059 A80-21896
- Karhunen-Loeve analysis of multispectral data from landscapes p0075 A80-22138
- Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391
- Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults p0087 A80-22441
- An evaluation of several different classification schemes - Their parameters and performance --- maximum likelihood decision for crop identification p0061 A80-22453
- A low cost classification algorithm for developing countries --- for multispectral remote sensor data p0108 A80-22484
- Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486
- The applicability of remote sensing technique for geological and mineral exploration in Nepal p0088 A80-22491
- Temporal resolution for crop discrimination estimated using J-M distance p0062 A80-22502
- Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures p0063 A80-23295
- Vegetation mapping in the Caniapiscau-Koiskoak corridor using the automatic classification of Landsat images p0063 A80-24063
- Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach --- from classifications of Landsat data p0064 A80-25570
- Analyzing accuracy attributes of Landsat and digital terrain tape data in the context of a digital geobase information system p0108 A80-25579
- Georgia's operational Landsat processing system p0109 A80-25590
- An approach to nonlinear mapping for pattern recognition --- in Landsat multispectral scanner data p0116 A80-25592
- Using guided clustering techniques to analyze Landsat data for mapping forest land cover in northern California p0065 A80-25595
- Computer recognition of citrus infestations p0066 A80-25599
- An interactive color display system for labelling crops p0066 A80-25600
- An evaluation of landscape units --- geological surveys by photographic imaging techniques p0088 A80-27456
- Computer-aided processing of LANDSAT MSS data for classification of forestlands --- San Juan Mountains, Colorado [E80-10043] p0068 N80-16393
- Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394
- Large Area Crop Inventory Experiment (LACIE). Detailed description of the wheat acreage estimation procedure used in the Large Area Crop Inventory Experiment [E80-10051] p0068 N80-16399
- Feature selection and classifier design with applications to remote sensing of mule deer p0069 N80-18505
- Large Area Crop Inventory Experiment (LACIE). Evaluation of three-category classification [E80-10058] p0069 N80-18509
- Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510
- Implementation of Badhwar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511
- Large Area Crop Inventory Experiment (LACIE). Bibliographic addenda, technical reports, papers, and memorandums published under supporting research and technology and other research, test, and evaluation contracts for the Earth observations division [E80-10070] p0070 N80-18519
- AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526
- The easy remote sensing problem [REPT-20] p0070 N80-18528
- The Cramer-Rao lower bound as a criteria for evaluating a large data reduction system such as LACIE [REPT-21] p0070 N80-18529
- Statistical analysis of terrain and water (ice) backgrounds in a winter scene from northern Michigan [AD-A077554] p0078 N80-19598
- The reduction of remote sensing data by visual means --- education p0118 N80-20017
- Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803
- PATTERN REGISTRATION**
- Multi-sensor Landsat MSS registration p0115 A80-22390
- Landsat MSS coordinate transformations p0116 A80-25567
- The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants p0077 A80-25575
- Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576
- An image registration algorithm using sampled binary correlation --- of satellite-borne photographs p0108 A80-25580
- Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392
- Synthetic aperture radar/LANDSAT MSS image registration [NASA-RP-1039] p0111 N80-16405
- PENINSULAS**
- Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501
- Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation p0081 A80-22509
- Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0066 A80-26313

- Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas p0111 A80-32279
- PENNSYLVANIA**
- A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596
- Remote monitoring of forest cover conditions --- deciduous tree defoliation in Pennsylvania p0071 N80-20763
- Surface mine monitoring --- Pennsylvania p0091 N80-20764
- PERMITTIVITY**
- Effect of soil texture on the microwave emission from soils [NASA-TM-80632] p0070 N80-18530
- PERSIAN GULF**
- The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas p0088 A80-32276
- PETROLOGY**
- Regional modeling: The Ivrea zone --- Northern Italy p0085 N80-20731
- PHENOLOGY**
- The role of phenology in statistical crop acreage measurement p0059 A80-22388
- Temporal resolution for crop discrimination estimated using J-M distance p0062 A80-22502
- Estimation of grain yields by remote sensing of crop senescence rates p0063 A80-23299
- Multi-temporal classification of winter wheat using a growth state model p0064 A80-25571
- An interactive color display system for labelling crops p0066 A80-25600
- Aspects of the spaceborne remote sensing of the earth p0117 A80-31121
- Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs p0067 A80-32283
- Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506
- Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507
- Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510
- Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587
- Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771
- PHILIPPINES**
- Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489
- Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501
- PHOTO GEOLOGY**
- Digital image processing techniques of integrated images and non-image data sets --- from satellite remote sensing p0107 A80-22401
- Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah p0115 A80-22425
- Possibilities of optimal planning of multipurpose survey from space --- oceanography, hydrology, geology, forestry and agriculture p0121 A80-22432
- Some application of Landsat imagery interpretation for petroleum targeting in India p0087 A80-22433
- Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults p0087 A80-22441
- CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite p0087 A80-22443
- Optimum Landsat sun angles for extreme contrasts of terrain p0087 A80-22458
- Urban environmental survey by remote sensing p0076 A80-22468
- The applicability of remote sensing technique for geological and mineral exploration in Nepal p0088 A80-22491
- Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation p0081 A80-22509
- Larger perspective for geomorphic studies on Landsat imagery - A case study: Andhra Pradesh, India p0088 A80-22510
- A comparative study of various remote sensing techniques applied to geomorphology p0102 A80-24058
- Remote sensing data of SP mountain and SP lava flow in north-central Arizona p0088 A80-26316
- Study of geological and geophysical manifestations of horizontal stresses in the crust based on satellite imagery p0088 A80-26727
- American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings p0117 A80-27426
- An evaluation of landscape units --- geological surveys by photographic imaging techniques p0088 A80-27456
- Landsat wildland mapping accuracy p0067 A80-30921
- Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275
- The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas p0088 A80-32276
- Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region p0089 A80-32277
- Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10050] p0089 N80-16398
- NCSL remote sensing project --- State Legislature considerations and activities [E80-10053] p0122 N80-16401
- Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410
- Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651
- Research project Mauretania: Satellites as development aids [NASA-TM-78064] p0078 N80-17120
- HCCM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516
- Video processing of remote sensor data applied to uranium exploration in Wyoming [GJXB-171(79)] p0089 N80-19603
- Plate boundary deformation in California --- Southern California: Elnore, Earthquake Valley, and San Felipe Faults p0090 N80-20739
- Tectonics, volume 2. Citations from the NTIS data base [PB80-804529] p0091 N80-21925
- PHOTOGRAMMETRY**
- Terrain modeling and geometric corrections using the Spot satellite p0081 A80-22407
- Geometric correction of satellite data using curvilinear features and virtual control points p0116 A80-22472
- American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings p0117 A80-27426
- Different considerations in coastal mapping p0110 A80-30922
- What is an analytical plotter --- stereophotogrammetric system design and operation p0110 A80-31977
- Compatibility of analytical plotters with digital imagery in the plotting of variable spaces p0110 A80-31980
- An interactive software for plotting thematic maps p0111 A80-31996
- Space photography and thematic mapping - A method for processing multichannel photography --- Russian book p0111 A80-32262
- Comparison of registograms in the microphotometric interpretation of multispectral photographs p0111 A80-32267
- Conference of Remote Sensing Educators (CORSE-78) [NASA-CP-2102] p0122 N80-20003
- Textbooks and technical references for remote sensing p0122 N80-20014
- The reduction of remote sensing data by visual means --- education p0118 N80-20017
- Reports on cartography and geodesy. Series 1: Original report no. 73 [REPT-73] p0082 N80-20638
- The 25 years at the Institute for Applied Geodesy p0082 N80-20639
- A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640
- Cartography applications and research p0112 N80-20654
- Photogrammetry in IFAG from 1952 to 1977 p0079 N80-20664
- On spectral signatures in central perspective representation p0112 N80-20665
- Orthophoto techniques and photomaps p0082 N80-20666
- Digital height model with ITEK correlator p0112 N80-20669
- The future of analytical evaluation equipment --- image measurement techniques p0112 N80-20670
- Digital map bases from photogrammetric measurements p0113 N80-20671
- Tasks and possibilities of digital image data processing in photogrammetry p0113 N80-20672
- Reports on cartography and topographical measurements. Series 1: Original reports [REPT-77] p0113 N80-20705
- Contributions to the creation of a conclusive system of concepts of photogrammetry and aerial photograph cartography p0119 N80-20706
- The problem of obtaining data for the Digital Height Model p0113 N80-20707
- A method for examining relationships between multispectral data p0113 N80-20708
- Setting data from multistage analytical orientation p0119 N80-20709
- PHOTOGRAPHIC PROCESSING**
- Space photography and thematic mapping - A method for processing multichannel photography --- Russian book p0111 A80-32262
- Production of color composites from multispectral data records p0119 N80-20712
- PHOTOGRAPHS**
- U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429
- U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430
- PHOTOGRAPHY**
- Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489
- PHOTOINTERPRETATION**
- Integration of remote sensing and geographic information systems p0075 A80-22403
- Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423
- A study of digitized radar images p0107 A80-22430
- Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431
- Some application of Landsat imagery interpretation for petroleum targeting in India p0087 A80-22433
- An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands p0087 A80-22435
- Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults p0087 A80-22441
- Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450
- An evaluation of Michigan land cover/use inventories derived from remote sensing - Characteristics and costs p0076 A80-22462
- Study of the Argentine Pampa's lowland by means of interpretation of Landsat satellite information p0102 A80-22478
- Landsat applications to land use mapping of the Cul de Sac Plain of Haiti p0076 A80-22479
- Classification results using spacially correlated Landsat data p0107 A80-22481
- Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486
- Integrated survey of natural resources of the low lands of Bolivia using Landsat images p0108 A80-22488
- Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065
- The utilization of a stereotransflescope and very-small-scale photography for the acquisition of forest maps at a scale of 1:20,000 p0064 A80-24066
- New earth resource monitoring techniques p0076 A80-24074
- Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333
- Landsat MSS coordinate transformations p0116 A80-25567
- A methodology for a national coverage land use study by computer p0077 A80-25574
- Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576
- Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577
- An interactive color display system for labelling crops p0066 A80-25600
- Classification of areas using pixel-by-pixel and sample classifiers --- for Landsat MSS data p0077 A80-25601
- Crop identification in a parkland environment using aerial photography p0068 A80-26312
- Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0068 A80-26313
- A spectral method for determining the percentage of green herbage material in clipped samples p0066 A80-26318
- Study of geological and geophysical manifestations of horizontal stresses in the crust based on satellite imagery p0088 A80-26727
- Improvements in lake water budget computations using Landsat data p0103 A80-27434
- Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435
- Use of low altitude aerial biosensing with color infrared photography as a crop management service p0067 A80-27437
- Effects of interpretation techniques on land-use mapping accuracy p0077 A80-27457
- Landsat wildland mapping accuracy p0067 A80-30921
- Urban residential ground cover using Landsat digital data p0077 A80-30925
- Method for the photometric interpretation of multispectral aerial photographs p0111 A80-32266

- Comparison of histograms in the microphotometric interpretation of multispectral photographs p0111 A80-32267
- Experience with the use of synthesized color images for the interpretation of agricultural objects p0067 A80-32270
- Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs p0077 A80-32273
- Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275
- Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region p0089 A80-32277
- The use of multispectral photographs for soil cover studies p0067 A80-32280
- Experiment on the complex interpretation of multispectral scanner aerial photographs of Bulgaria p0111 A80-32282
- Computer-aided processing of LANDSAT MSS data for classification of forestlands --- San Juan Mountains, Colorado [E80-10043] p0068 N80-16393
- Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600
- Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532
- Textbooks and technical references for remote sensing p0122 N80-20014
- The reduction of remote sensing data by visual means --- education p0118 N80-20017
- On spectral signatures in central perspective representation p0112 N80-20665
- The future of analytical evaluation equipment --- image measurement techniques p0112 N80-20670
- Application of LANDSAT imagery to monitor sand dunes movement in the Sahara Desert p0113 N80-20719
- PHOTOMAPPING**
- Digital processing of Landsat data of ice and snow areas at Vatnajokull, Iceland - A possibility for improved morphological tectonic interpretation p0087 A80-21839
- International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings, Volumes 1, 2 & 3 p0121 A80-22376
- A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing p0059 A80-22389
- Digital image processing techniques of integrated images and non-image data sets --- from satellite remote sensing p0107 A80-22401
- Integration of remote sensing and geographic information systems p0075 A80-22403
- Terrain modeling and geometric corrections using the Spot satellite p0081 A80-22407
- Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- Determination of range biomass using Landsat p0060 A80-22414
- Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables p0060 A80-22415
- Assessment of tidal wetland habitat and productivity p0094 A80-22416
- The Landsat-D Assessment System p0121 A80-22419
- The use of remote sensing in the determination of beach sand parameters p0075 A80-22422
- Terrain evaluation for environmental inventory and impact assessment p0075 A80-22426
- SPOT - First French remote sensing satellite geometrical performance p0121 A80-22429
- The use of models for predicting ice floes in Baffin Bay p0094 A80-22434
- An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands p0087 A80-22435
- An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- Small forest cuttings mapped with Landsat digital data p0061 A80-22439
- Cartography with combined Landsat and navigational satellite data p0081 A80-22440
- Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442
- CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite p0087 A80-22443
- IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447
- Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea p0094 A80-22449
- Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan p0101 A80-22451
- Measuring ecological changes in multitemporal Landsat data using principal components p0076 A80-22452
- An evaluation of Michigan land cover/use inventories derived from remote sensing - Characteristics and costs p0076 A80-22462
- Landsat bathymetric mapping by multitemporal processing p0094 A80-22464
- Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries p0095 A80-22466
- Forest inventory of clearcuts utilizing remote sensing techniques p0061 A80-22473
- Study of the Argentine Pampa's lowland by means of interpretation of Landsat satellite information p0102 A80-22478
- Landsat applications to land use mapping of the Cul de Sac Plain of Haiti p0076 A80-22479
- Autocorrelation in Landsat data p0107 A80-22483
- Mapping New Zealand's moisture rich soils from Landsat p0061 A80-22485
- Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486
- Agricultural and resource assessment in Jamaica using an area sampling frame p0062 A80-22487
- Integrated survey of natural resources of the low lands of Bolivia using Landsat images p0108 A80-22488
- National land use and settlement assessment - An areal data base model for Landsat information for Bangladesh p0076 A80-22493
- Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501
- Production of small-scale maps and inventories using Landsat data p0081 A80-22503
- Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation p0081 A80-22509
- Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511
- Stereosat - A new astrodynamics challenge --- satellite-borne stereo imaging for geoscience, cartography and earth resource exploration [AIAA PAPER 80-0237] p0108 A80-22744
- Using guided clustering techniques to analyze Landsat data for mapping forest land cover in northern California p0065 A80-25595
- Classification of areas using pixel-by-pixel and sample classifiers --- for Landsat MSS data p0077 A80-25601
- The Surface Contour Radar, a unique remote sensing instrument p0116 A80-26085
- The geometric correction of Landsat images at the Canada Centre for Remote Sensing p0109 A80-26311
- Crop identification in a parkland environment using aerial photography p0066 A80-26312
- Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0066 A80-26313
- Assessment of the fertilizer requirement of improved pasture from remote sensing information p0066 A80-26315
- Scales oceanic parameters as monitored from space p0097 A80-26751
- The NIRAD survey of forest resources - An application of SLARI in Nigeria p0066 A80-26752
- Error detection and rectification in digital terrain models p0110 A80-27432
- Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433
- Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435
- An evaluation of landscape units --- geological surveys by photographic imaging techniques p0088 A80-27456
- Effects of interpretation techniques on land-use mapping accuracy p0077 A80-27457
- Crop emergence date determination from spectral data p0067 A80-27458
- Landsat wildland mapping accuracy p0067 A80-30921
- Different considerations in coastal mapping p0110 A80-30922
- Urban residential ground cover using Landsat digital data p0077 A80-30925
- Aspects of the spaceborne remote sensing of the earth p0117 A80-31121
- Compatibility of analytical plotters with digital imagery in the plotting of variable spaces p0110 A80-31980
- Cartography and remote sensing p0117 A80-31988
- Space photography and thematic mapping - A method for processing multichannel photography --- Russian book p0111 A80-32262
- Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275
- Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region p0089 A80-32277
- Investigation of landscapes of the Turgay steppe using multispectral aerial photography p0078 A80-32278
- Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas p0111 A80-32279
- The use of ordinary and multispectral aerial and space photographs for the mapping of population centers p0078 A80-32285
- NCSL remote sensing project --- State Legislature considerations and activities [E80-10053] p0122 N80-16401
- Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410
- Orthophoto techniques and photomaps p0082 N80-20666
- Aerial and space-borne photographic maps p0082 N80-20667
- The future of analytical evaluation equipment --- image measurement techniques p0112 N80-20670
- Digital map bases from photogrammetric measurements p0113 N80-20671
- Tasks and possibilities of digital image data processing in photogrammetry p0113 N80-20672
- Twenty-five years of aerial photography by the Institute of Applied Geodesy p0083 N80-20676
- Contributions to the creation of a conclusive system of concepts of photogrammetry and aerial photograph cartography p0119 N80-20706
- Possibilities of application of LANDSAT and Skylab data to small scale cartography p0084 N80-20710
- Remote sensing applied to pollution monitoring. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0732/2] p0079 N80-20952
- PHOTOMAPS**
- The production of photomaps from tidal flat areas p0083 N80-20682
- NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765
- PHOTOMETRY**
- Method for the photometric interpretation of multispectral aerial photographs p0111 A80-32266
- PIGMENTS**
- Atmospheric effects in the remote sensing of phytoplankton pigments p0097 A80-25345
- PIPELINES**
- Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Westford counties, Michigan [E80-10085] p0078 N80-19592
- PLANETARY MASS**
- A determination of GM p0086 N80-20756
- PLANETARY STRUCTURE**
- Comparative planetology/crustal evolution p0090 N80-20735
- PLANETOLOGY**
- Comparative planetology/crustal evolution p0090 N80-20735
- PLANKTON**
- A laser-fluoresensor technique for water quality assessment p0101 A80-22399
- In-water and remote measurements of ocean color p0096 A80-25338
- Applications of a two-flow model for remote sensing of substances in water p0097 A80-25340
- Atmospheric effects in the remote sensing of phytoplankton pigments p0097 A80-25345
- PLANTS (BOTANY)**
- Assessment of tidal wetland habitat and productivity p0094 A80-22416
- Improvements in lake water budget computations using Landsat data p0103 A80-27434
- LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19598
- Remote sensing of leaf water content in the near infrared p0071 N80-20768
- Plant stress and relationships to spectral responses --- cotton and tomato plants p0071 N80-20769
- Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771
- Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775
- Spectra of isolated vegetational constituents p0072 N80-20779
- PLATEAUS**
- HCCM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516
- PLOTTERS**
- What is an analytical plotter --- stereophotogrammetric system design and operation p0110 A80-31977
- Compatibility of analytical plotters with digital imagery in the plotting of variable spaces p0110 A80-31980
- Development, status, and goals of cartographic automation p0112 N80-20655
- Automatic acquisition and processing of cartographic data p0112 N80-20658
- Experiences gathered with a symbol disk with interchangeable symbols p0083 N80-20688
- Setting data from multistage analytical orientation p0119 N80-20709
- On the writing accuracy of the reproduction unit of the Optronics System P1700 p0113 N80-20711
- PLUMES**
- Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263
- POLAR CAPS**
- The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676

## POLAR ORBITS

## POLAR ORBITS

Satellite activities of NOAA 1978 --- geostationary and polar orbiting systems  
[PB80-112782] p0119 N80-21002

## POLAR REGIONS

Crustal anomaly representation p0084 N80-20728  
Investigation of crustal dynamics using VLBI p0090 N80-20737  
Information theory density distribution --- Earth Mantle p0085 N80-20753  
The enhanced nodal equilibrium ocean tide and polar motion p0085 N80-20754  
Polar motion research p0085 N80-20755  
Polar motion and Earth rotation results from Lageos p0086 N80-20757

## POLAR WANDERING (GEOLOGY)

The enhanced nodal equilibrium ocean tide and polar motion p0085 N80-20754  
Polar motion research p0085 N80-20755  
Polar motion and Earth rotation results from Lageos p0086 N80-20757

## POLICIES

NASA policy issues --- for remote sensors environmental monitoring development p0121 A80-22379

## POLLUTION MONITORING

Remote sensing of regional air pollution from satellites p0075 A80-22400  
Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454  
Marine pollution analysis in Tokyo Bay by Landsat 1 and 2 p0095 A80-22496  
The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants p0077 A80-25575  
Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane p0078 N80-16575  
[NASA-TM-80146]  
Altitude characteristics of selected air quality analyzers [NASA-CR-159165] p0078 N80-16578  
Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512  
Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18678  
Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786  
Airborne laser fluorosensing of surface water chlorophyll a --- Lake Mead, Nevada p0105 N80-20797  
[PB80-113400]  
Remote sensing applied to pollution monitoring. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0732/2] p0079 N80-20952  
Biological applications including pollution monitoring --- ocean surface monitoring p0100 N80-21821

## POSITION (LOCATION)

Locational characteristics and the sequence of computer assisted processes of cartographic generalization p0083 N80-20685  
Sources of variations in LANDSAT autocorrelation --- Richmond, Virginia and Denver, Colorado p0114 N80-20767

## POTENTIAL ENERGY

Magnetic field modeling and crustal studies p0084 N80-20726

## PRECIPITATION (METEOROLOGY)

Microwave approaches in hydrology p0104 A80-30920  
Relationship of physiography and snow area to stream discharge --- Kings River Watershed, California [E80-10046] p0104 N80-16396  
SMRM simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589  
Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593  
Agrometeorological applications p0073 N80-21818

## PROFILOMETERS

Spectral distortion inherent in airborne profilometer measurements of ocean wave heights p0095 A80-22942

## PROGRAM VERIFICATION (COMPUTERS)

The Cramer-Rao lower bound as a criteria for evaluating a large data reduction system such as LACIE [REPT-21] p0070 N80-18529

## PROJECTIVE GEOMETRY

Map projection change: Some programs for the transformation of the contents of available maps according to different map projections p0084 N80-20690

## PYRANOMETERS

Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301

## Q

## QUEBEC

Remote sensing and water resources in Quebec p0102 A80-24054  
Remote sensing and forestry in Quebec p0063 A80-24056

A comparative study of various remote sensing techniques applied to geomorphology p0102 A80-24058  
Vegetation mapping in the Caniapiscau-Koksoak corridor using the automatic classification of Landsat images p0063 A80-24063

Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065

Utilization of a portable thermograph in the Ministere des Terres et Forets p0064 A80-24067

Analysis of numerical data handling systems in remote sensing p0108 A80-24073

## R

## RADAR DETECTION

Settlement detection with radar imagery p0077 A80-27430

## RADAR IMAGERY

Preliminary results of an investigation into the potential application of X-band SLR images for crop-type inventory purposes p0059 A80-21446

The ocean observed with microwaves --- remote sensing from satellites p0093 A80-21963

The Canadian remote sensing program p0121 A80-22378

Remote sensing of ocean circulation using a satellite-borne radar altimeter p0093 A80-22383

The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384

Radar and ship observations of coastal sea surface roughness patterns in the Gulf of Georgia p0093 A80-22385

Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391

Integration of Landsat, Seasat, and other geo-data sources p0107 A80-22392

Synthetic aperture radar modeling of surface ocean waves p0093 A80-22411

Radar discrimination of crops p0060 A80-22424

A study of digitized radar images p0107 A80-22430

Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448

Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941

Spectral distortion inherent in airborne profilometer measurements of ocean wave heights p0095 A80-22942

Remote sensing and soils - An application p0063 A80-24052

A comparative study of various remote sensing techniques applied to geomorphology p0102 A80-24058

The ROS-580 Project --- airborne synthetic aperture radar remote sensing p0116 A80-24075

Oceanographic implications of features in NOAA satellite visible imagery p0096 A80-25337

The Surface Contour Radar, a unique remote sensing instrument p0116 A80-26085

Remote sensing data of SP mountain and SP lava flow in north-central Arizona p0088 A80-26316

Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317

The NIRAD survey of forest resources - An application of SLAR in Nigeria p0066 A80-26752

Settlement detection with radar imagery p0077 A80-27430

The relationship between ocean surface structure and the synthetic aperture radar imagery of ocean waves p0097 A80-28256

Remote sensing of ocean waters p0098 A80-29389

L-band radar sensing of soil moisture --- Kern County, California p0068 N80-16404

[NASA-TM-80628] p0068 N80-16404  
Synthetic aperture radar/LANDSAT MSS image registration

[NASA-RP-1039] p0111 N80-16405

Radar target for remotely sensing hydrological phenomena

[NASA-CASE-LAR-12344-1] p0104 N80-18498

Measurement of soil moisture trends with airborne scatterometers --- Guymon, Oklahoma and Sublett, Kansas p0069 N80-18514

[E80-10064] p0069 N80-18514  
Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas

[E80-10073] p0104 N80-18522

Study of oceanic lithosphere using GEOS-3 radar altimeter data

[AD-A077344] p0099 N80-18673

Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR

[E80-10083] p0105 N80-19591

Remote sensing applied to pollution monitoring. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0732/2] p0079 N80-20952

High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613

Meteorological satellites: Status and outlook p0119 N80-21800

## RADAR MAPS

The NIRAD survey of forest resources - An application of SLAR in Nigeria p0066 A80-26752

A unique radio oceanographic radar [AD-A077364] p0099 N80-19332

## RADAR SCATTERING

Backscatter measurements of sea ice with a helicopter-borne scatterometer [AD-A077614] p0098 N80-18542

## RADAR TARGETS

Radar target for remotely sensing hydrological phenomena

[NASA-CASE-LAR-12344-1] p0104 N80-18498

## RADAR TRACKING

An initial assessment of the performance achieved by the Seasat-1 radar altimeter [NASA-TM-73279] p0118 N80-20564

## RADIANCE

A regression technique for evaluation and quantification for water quality parameters from remote sensing data p0102 A80-22470

Gulf of Mexico, ocean-color surface-truth measurements p0097 A80-25343

Atmospheric effects in the remote sensing of phytoplankton pigments p0097 A80-25345

Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766

Sources of variations in LANDSAT autocorrelation --- Richmond, Virginia and Denver, Colorado p0114 N80-20767

Off-nadir viewing effects on spectral assessment of green biomass p0072 N80-20772

Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777

A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780

[E80-10082] p0071 N80-19590

A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780

## RADIATION ABSORPTION

Applications of a two-flow model for remote sensing of substances in water p0097 A80-25340

## RADIATION DETECTORS

Multispectral linear array sensor development p0119 N80-20783

## RADIATIVE TRANSFER

Applications of a two-flow model for remote sensing of substances in water p0097 A80-25340

SMRM simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589

## RADIO ALTIMETERS

Remote sensing of ocean circulation using a satellite-borne radar altimeter p0093 A80-22383

Preliminary estimates of the resolution capability of the SEASAT radar altimeter p0117 A80-29163

Study of oceanic lithosphere using GEOS-3 radar altimeter data [AD-A077344] p0099 N80-18673

A unique radio oceanographic radar [AD-A077364] p0099 N80-19332

An initial assessment of the performance achieved by the Seasat-1 radar altimeter [NASA-TM-73279] p0118 N80-20564

## RADIOMETERS

Use of satellite imagery for the derivation of the hydrogeologic characteristics of a test area in semiarid climates p0105 N80-18545

Linear array pushbroom radiometer data analysis p0119 N80-20784

## RAIN FORESTS

The NIRAD survey of forest resources - An application of SLAR in Nigeria p0066 A80-26752

## RANGELANDS

Determination of range biomass using Landsat p0060 A80-22414

An evaluation of Landsat-D for Canadian applications p0060 A80-22437

Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573

Assessment of the fertilizer requirement of improved pasture from remote sensing information p0066 A80-26315

Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513

Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521

A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass [E80-10082] p0071 N80-19590

A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780

Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples --- Texas p0073 N80-20781

## RECLAMATION

Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787

## REEFS

Landsat bathymetric mapping by multitemporal processing p0094 A80-22464

Remote sensing of the sea around Singapore p0095 A80-22506

**REFLECTANCE**

Shallow-water reflectance modeling with applications to remote sensing of the ocean floor p0093 A80-22410  
 Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521  
 Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301

**REFLECTION**

On spectral signatures in central perspective representation p0112 N80-20665

**REGIONAL PLANNING**

Photogrammetry in IFAG from 1952 to 1977 p0079 N80-20664  
 Obtaining surface information for topography and town and country planning from remote sensing p0079 N80-20668

**REGRESSION ANALYSIS**

A regression technique for evaluation and quantification for water quality parameters from remote sensing data p0102 A80-22470  
 Predictability of change in soil reflectance on wetting p0065 A80-25586

**RELIEF MAPS**

Computer based generalization for the elaboration and extension of topographic maps p0112 N80-20658  
 The data bank in the cartographic automation system p0082 N80-20660  
 The topographic synoptic map 1:200,000 p0078 N80-20661  
 The synoptic map 1:500,000 (World, Series 1404) p0078 N80-20662  
 The international world map 1:1,000,000 (IWK) p0079 N80-20663  
 Orthophoto techniques and photomaps p0082 N80-20666  
 On the displacement problem as part of a process in generalizing topographical maps. Proposition for hierarchical order and the search for EDP assisted solutions p0082 N80-20675

**REMOTE REGIONS**

Main aspects of two Chilean remote sensing projects developed under extreme severe environmental conditions - Desert North and Antarctic South p0116 A80-22513

**REMOTE SENSORS**

Field performance of a laser fluorosensor for the detection of oil spills p0097 A80-27331  
 Radar target for remotely sensing hydrological phenomena [NASA-CASE-LAR-12344-1] p0104 N80-18498  
 Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p0100 N80-20790

**RESERVOIRS**

Land use/cover changes in the Kajinji Reservoir area /Nigeria/ p0075 A80-22445  
 Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images --- water rise and ecology of French reservoir p0103 A80-24061  
 Geodetic stability of the Green Bank, West Virginia VLIBI site p0085 N80-20742

**RESIDENTIAL AREAS**

Settlement detection with radar imagery p0077 A80-27430  
 Urban residential ground cover using Landsat digital data p0077 A80-30925

**RESOLUTION**

Data acquisition and projected applications of the observations from Landsat-D p0117 A80-27427  
 Preliminary estimates of the resolution capability of the SEASAT radar altimeter p0117 A80-29163  
 Analysis of remote sensing data in oceanography and climatology p0098 A80-31989

**RESOURCES MANAGEMENT**

Advances in earth resources management p0059 A80-21896  
 International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979, Proceedings, Volumes 1, 2 & 3 p0121 A80-22376  
 Digital image processing techniques of integrated images and non-image data sets --- from satellite remote sensing p0107 A80-22401  
 Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501  
 Remote sensing and resources management: Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Universite de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings p0121 A80-24051  
 Remote sensing and water resources in Quebec p0102 A80-24054  
 California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568  
 A system for processing Landsat and other georeferenced data for resource management applications p0109 A80-25589  
 American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings p0117 A80-27426  
 Data acquisition and projected applications of the observations from Landsat-D p0117 A80-27427

NCSL remote sensing project --- State Legislature considerations and activities [E80-10053] p0122 N80-16401  
 Illinois LANDSAT feasibility study [NASA-CR-162760] p0122 N80-16424  
 LACIE evaluation and outlook panel transcript: The LACIE Symposium [E80-10069] p0070 N80-18518  
 Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Harman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593  
 LANDSAT-D assessment system p0122 N80-20782  
 Findings of the OPIT study in America --- application of remote sensing information [NASA-TM-76106] p0122 N80-21822

**RICE**

Temporal study on Paddy /rice/ using X-band scatterometer p0061 A80-22438

**RIO GRANDE (NORTH AMERICA)**

Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521  
 Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725

**RIVER BASINS**

Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431  
 Some application of Landsat imagery interpretation for petroleum targeting in India p0087 A80-22433  
 A comparative study of various remote sensing techniques applied to geomorphology p0102 A80-24058  
 Crop identification using space photographs taken at different times /A study of the lower Volga Basin used as an example/ p0067 A80-32284  
 Relationship of physiography and snow area to stream discharge --- Kings River Watershed, California [E80-10046] p0104 N80-16396  
 Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10050] p0089 N80-16398  
 HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota p0105 N80-18524

**RIVERS**

The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384  
 Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454  
 Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis p0102 A80-24059  
 Monitoring man's impact in the coastal zone p0104 A80-27436  
 Method for the photometric interpretation of multispectral aerial photographs p0111 A80-32266

**ROCKS**

Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317  
 Regional Modeling: The Kentucky anomaly p0090 N80-20730

**ROCKY MOUNTAINS (NORTH AMERICA)**

U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430

**RUMANIA**

The use of multispectral photographs for soil cover studies p0067 A80-32280  
 Geophysical atlas p0090 N80-20734

**S**

**SAHARA DESERT (AFRICA)**

Application of LANDSAT imagery to monitor sand dunes movement in the Sahara Desert p0113 N80-20719

**SALINITY**

Remote sensing applied to soils p0063 A80-24053  
 Passive microwave remote sensing of the ocean - A review p0096 A80-25329  
 Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330

**SAN ANDREAS FAULT**

Plate boundary deformation in California --- Southern California: Elsinore, Earthquake Valley, and San Felipe Faults p0090 N80-20739  
 On the selection of station sites for observing strain steps and earthquake fore-runners in California p0090 N80-20740

**SAN ANDREAS FAULT EXPERIMENT**

Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
 Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723

Crustal deformation: Crustal dynamics project p0090 N80-20736  
 Crustal motion measurements in California (SAFE) p0091 N80-20748

**SAN FRANCISCO BAY (CA)**

Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22490

**SAN JUAN MOUNTAINS (CO)**

Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado [E80-10041] p0068 N80-16391  
 Computer-aided processing of LANDSAT MSS data for classification of forestlands --- San Juan Mountains, Colorado [E80-10043] p0068 N80-16393

**SANDS**

The use of remote sensing in the determination of beach sand parameters p0075 A80-22422  
 Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301

**SANDSTONES**

Video processing of remote sensor data applied to uranium exploration in Wyoming [GJBX-171(79)] p0089 N80-19603

**SATELLITE DRAG**

Unexplained Lageos perturbation p0085 N80-20751

**SATELLITE GROUND TRACKS**

The SEASAT altimeter height bias using four Bermuda overflights p0086 N80-20758  
 The spaceborne laser ranging system p0086 N80-20785

**SATELLITE OBSERVATION**

Research project Mauretania: Satellites as development aids [NASA-TM-76064] p0078 N80-17120  
 Satellite activities of NOAA 1978 --- geostationary and polar orbiting systems [PB80-112782] p0119 N80-21002

**SATELLITE ORBITS**

Study for a project for a European high precision laser network p0084 N80-20704  
 Geodyn program systems development p0085 N80-20747

**SATELLITE PERTURBATION**

Unexplained Lageos perturbation p0085 N80-20751

**SATELLITE-BORNE INSTRUMENTS**

Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317

**SATELLITE-BORNE PHOTOGRAPHY**

Forest inventory of clearcuts utilizing remote sensing techniques p0061 A80-22473  
 Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511  
 An image registration algorithm using sampled binary correlation --- of satellite-borne photographs p0108 A80-25580

**SCALE (RATIO)**

The synoptic map 1:500,000 (World, Series 1404) p0078 N80-20662  
 A program for the fully automated displacement of point and line features in cartographic generalization p0083 N80-20680

**SCATTERING COEFFICIENTS**

Measurement of soil moisture trends with airborne scatterometers --- Guymon, Oklahoma and Sublett, Kansas [E80-10064] p0069 N80-18514

**SCATTEROMETERS**

Seasat gulf of Alaska workshop report [NASA-CR-182463] p0099 N80-18549

**SCENE ANALYSIS**

Multi-sensor Landsat MSS registration p0115 A80-22390  
 The elimination approach to monitoring urban growth from Landsat data p0076 A80-22492  
 Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577  
 U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429  
 U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430  
 Feature selection and classifier design with applications to remote sensing of mule deer p0069 N80-18505  
 Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521  
 AGRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526  
 LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19588  
 Statistical analysis of terrain and water (ice) backgrounds in a winter scene from northern Michigan [AD-A077554] p0078 N80-19598

- Statistical analysis of terrain and water backgrounds in the vicinity of Port Huene, California  
 [AD-A077025] p0078 N80-19599  
 NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765
- SEA ICE**  
 An evaluation of Landsat-D for Canadian applications p0060 A80-22437  
 IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447  
 Passive radiometry of the ocean from space - An overview p0096 A80-25328  
 Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333  
 The seasonal cycle of snow cover, sea ice and surface albedo p0111 A80-32101  
 The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676  
 Backscatter measurements of sea ice with a helicopter-borne scatterometer [AD-A077614] p0098 N80-18542  
 SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589
- SEA OF JAPAN**  
 Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786
- SEA ROUGHNESS**  
 Radar and ship observations of coastal sea surface roughness patterns in the Gulf of Georgia p0093 A80-22385  
 Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries p0095 A80-22466  
 Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941  
 Spectral distortion inherent in airborne profilometer measurements of ocean wave heights p0095 A80-22942  
 Passive radiometry of the ocean from space - An overview p0096 A80-25328  
 Passive microwave remote sensing of the ocean - A review p0096 A80-25329  
 Oceanographic implications of features in NOAA satellite visible imagery p0096 A80-25337  
 Gulf of Mexico, ocean-color surface-truth measurements p0097 A80-25343  
 SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589
- SEA STATES**  
 Remote sensing of ocean circulation using a satellite-borne radar altimeter p0093 A80-22383  
 Synthetic aperture radar modeling of surface ocean waves p0093 A80-22411  
 Spatial Gauss-Markov models of ocean currents p0095 A80-23286  
 Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330  
 Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407  
 A unique radio oceanographic radar [AD-A077364] p0099 N80-19332  
 An initial assessment of the performance achieved by the Seasat-1 radar altimeter [NASA-TM-73279] p0118 N80-20564  
 The effect of sea state on altimeter measurements p0119 N80-20759  
 Mean sea surface computation using GEOS-3 altimeter data p0099 N80-20760  
 Satellite activities of NOAA 1978 --- geostationary and polar orbiting systems [PB80-112782] p0119 N80-21002
- SEA TRUTH**  
 Radar and ship observations of coastal sea surface roughness patterns in the Gulf of Georgia p0093 A80-22385  
 Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330  
 Gulf of Mexico, ocean-color surface-truth measurements p0097 A80-25343  
 Near-surface bathymetry system p0104 A80-27438  
 Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512
- SEA WATER**  
 A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances p0094 A80-22417  
 Remote sensing of living marine resources p0094 A80-22418  
 Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea p0094 A80-22449  
 Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries p0095 A80-22466  
 Remote sensing of the sea around Singapore p0095 A80-22506  
 Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978, Proceedings. Parts 1, 2 & 3 p0096 A80-25327
- Passive microwave remote sensing of the ocean - A review p0096 A80-25329  
 The aqueous thermal boundary layer p0096 A80-25334  
 Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations p0096 A80-25336  
 In-water and remote measurements of ocean color p0096 A80-25338  
 Applications of a two-flow model for remote sensing of substances in water p0097 A80-25340  
 An algorithm for remote sensing of water color from space p0097 A80-25342  
 Remote sensing of ocean waters p0098 A80-29389  
 Seasat Gulf of Alaska Workshop report. Volume 1: Panel reports [NASA-CR-162759] p0118 N80-17535  
 Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512  
 Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786
- SEASAT PROGRAM**  
 Seasat Gulf of Alaska Workshop report. Volume 1: Panel reports [NASA-CR-162759] p0118 N80-17535
- SEASAT SATELLITES**  
 Preliminary estimates of the resolution capability of the SEASAT radar altimeter p0117 A80-29163  
 Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407  
 Gravity model improvement for SEASAT p0085 N80-20749  
 p0100 N80-21820  
 Monitoring the sea surface p0100 N80-21820
- SEASAT-A SATELLITE**  
 Passive radiometry of the ocean from space - An overview p0096 A80-25328  
 The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676  
 Seasat gulf of Alaska workshop report [NASA-CR-162463] p0099 N80-18549  
 An initial assessment of the performance achieved by the Seasat-1 radar altimeter [NASA-TM-73279] p0118 N80-20564  
 The SEASAT altimeter height bias using four Bermuda overflights p0086 N80-20758
- SECULAR VARIATIONS**  
 Spherical harmonic models of the core field p0084 N80-20727
- SEDIMENT TRANSPORT**  
 The use of remote sensing in the determination of beach sand parameters p0075 A80-22422  
 Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- SEISMIC ENERGY**  
 On the selection of station sites for observing strain steps and earthquake fore-runners in California p0090 N80-20740  
 Earthquake and crustal deformation studies --- San Francisco and Fort Ross, California p0091 N80-20743
- SEISMIC WAVES**  
 GFSC site stability p0085 N80-20741  
 Geodetic stability of the Green Bank, West Virginia VLBI site p0085 N80-20742
- SEISMOGRAPHS**  
 Development of A seismic data collection platform p0091 N80-20745
- SEISMOLOGY**  
 GPS application to seismic oil exploration p0088 A80-25159  
 Mantle convection and subcrustal stress p0085 N80-20752
- SHALES**  
 Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410
- SHALLOW WATER**  
 Shallow-water reflectance modeling with applications to remote sensing of the ocean floor p0093 A80-22410  
 An assessment of electromagnetic remote sensing systems for the detection of perched water tables p0103 A80-26787  
 Near-surface bathymetry system p0104 A80-27438
- SHIPS**  
 Use of satellite navigation by tuna seiners p0095 A80-25153
- SHORELINES**  
 Near-surface bathymetry system p0104 A80-27438
- SIBERIA**  
 Geophysical atlas p0090 N80-20734
- SIDE-LOOKING RADAR**  
 The NIRAD survey of forest resources - An application of SLAR in Nigeria p0066 A80-26752  
 Settlement detection with radar imagery p0077 A80-27430
- SIDELobe REDUCTION**  
 A spectral filter for ESMR's sidelobe errors [NASA-TM-80555] p0118 N80-16402
- SIDELOBES**  
 A spectral filter for ESMR's sidelobe errors [NASA-TM-80555] p0118 N80-16402
- SIDEREAL TIME**  
 Polar motion and Earth rotation results from Lageos p0086 N80-20757
- SIERRA NEVADA MOUNTAINS (CA)**  
 Relationship of physiography and snow area to stream discharge --- Kings River Watershed, California [E80-10046] p0104 N80-16396  
 Investigation of the application of HCMM thermal data to snow hydrology --- Sierra Nevada Mountains, California and the Arizona test site [E80-10049] p0104 N80-16397
- SIGNAL ANALYSIS**  
 Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448
- SIGNAL PROCESSING**  
 Systems of image data acquisition and digitization p0117 A80-31987  
 Development of A seismic data collection platform p0091 N80-20745
- SIGNATURE ANALYSIS**  
 A low cost classification algorithm for developing countries --- for multispectral remote sensor data p0108 A80-22484  
 Multi-temporal classification of winter wheat using a growth state model p0064 A80-25571  
 A spectral method for determining the percentage of green herbage material in clipped samples p0066 A80-26318  
 Large Area Crop Inventory Experiment (LACIE). Detailed description of the wheat acreage estimation procedure used in the Large Area Crop Inventory Experiment [E80-10051] p0068 N80-16399  
 Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506  
 Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507  
 Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510  
 Measurement of soil moisture trends with airborne scatterometers --- Guymon, Oklahoma and Sublett, Kansas [E80-10064] p0069 N80-18514  
 Large Area Crop Inventory Experiment (LACIE). Bibliographic addenda, technical reports, papers, and memorandums published under supporting research and technology and other research, test, and evaluation contracts for the Earth observations division [E80-10070] p0070 N80-18519  
 AgrISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526  
 NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765
- SILVICULTURE**  
 Remote sensing and the agricultural zoning of lands p0064 A80-24069
- SIMULATORS**  
 SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589
- SINGAPORE**  
 Remote sensing of the sea around Singapore p0095 A80-22506
- SITES**  
 GFSC site stability p0085 N80-20741  
 Geodetic stability of the Green Bank, West Virginia VLBI site p0085 N80-20742
- SKYLAB PROGRAM**  
 The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676
- SLOPES**  
 Error detection and rectification in digital terrain models p0110 A80-27432  
 A digital terrain model for large surfaces and direct storage access p0083 N80-20681  
 The problem of obtaining data for the Digital Height Model p0113 N80-20707  
 High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- SNOW**  
 A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-26750  
 Application of HCMM data to soil moisture snow and estuarine current studies [E80-10068] p0104 N80-18517  
 SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589
- SNOW COVER**  
 Digital processing of Landsat data of ice and snow areas at Vatnajökull, Iceland - A possibility for improved morphological tectonic interpretation p0087 A80-21839  
 On the penetration of microwaves in snow and soil p0101 A80-22461  
 Investigations on snow parameters by radiometry in the 3- to 60-mm wavelength region p0103 A80-24827

- Microwave approaches in hydrology p0104 A80-30920
- The seasonal cycle of snow cover, sea ice and surface albedo p0111 A80-32101
- Relationship of physiography and snow area to stream discharge --- Kings River Watershed, California [E80-10046] p0104 N80-16396
- Investigation of the application of HCMM thermal data to snow hydrology --- Sierra Nevada Mountains, California and the Arizona test site [E80-10049] p0104 N80-16397
- Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360
- NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977 p0105 N80-19594
- Snow and ice mapping: Norwegian examples for run-off prediction p0105 N80-21816
- SOIL EROSION**
- Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450
- Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana p0065 A80-25583
- Method for the photometric interpretation of multispectral aerial photographs p0111 A80-32266
- Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Oscoda, and Wexford counties, Michigan [E80-10085] p0078 N80-19592
- High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- SOIL MAPPING**
- Precision of crop-area estimates p0059 A80-22386
- Terrain evaluation for environmental inventory and impact assessment p0075 A80-22426
- CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite p0087 A80-22443
- Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450
- Study of the Argentine Pampa's lowland by means of interpretation of Landsat satellite information p0102 A80-22478
- Mapping New Zealand's moisture rich soils from Landsat p0061 A80-22485
- Integrated survey of natural resources of the low lands of Bolivia using Landsat images p0108 A80-22488
- Wombats detected from space --- Landsat satellite imagery application p0063 A80-23296
- Remote sensing and resources management; Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Universite de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings p0121 A80-24051
- Remote sensing and soils - An application p0063 A80-24052
- Remote sensing applied to soils p0063 A80-24053
- Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana p0065 A80-25583
- Extraction of soil information from a vegetated area p0065 A80-25584
- Extension of laboratory-measured soil spectra to field conditions p0065 A80-25585
- Predictability of change in soil reflectance on wetting p0065 A80-25586
- Comparison of registograms in the microphotometric interpretation of multispectral photographs p0111 A80-32267
- Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshiak and Buzachi peninsulas p0111 A80-32279
- The use of multispectral photographs for soil cover studies p0067 A80-32280
- Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs p0067 A80-32283
- Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521
- Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522
- HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524
- Effect of soil texture on the microwave emission from soils [NASA-TM-80632] p0070 N80-18530
- Satellite contribution to the study of the physical properties of soils. Utilization in the water and agricultural domains p0073 N80-21817
- SOIL MOISTURE**
- Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- Radar discrimination of crops p0060 A80-22424
- Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442
- CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite p0087 A80-22443
- On the penetration of microwaves in snow and soil p0101 A80-22461
- Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures p0063 A80-23295
- Remote sensing applied to soils p0063 A80-24053
- The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources p0102 A80-24060
- Pasture/wheat surface temperature differences Indicator of relative soil moisture differences p0065 A80-25582
- Predictability of change in soil reflectance on wetting p0065 A80-25586
- An assessment of electromagnetic remote sensing systems for the detection of perched water tables p0103 A80-26787
- Microwave approaches in hydrology p0104 A80-30920
- The use of microwave radiometry for the operational mapping of soil moisture p0067 A80-32281
- Thermography for estimating near-surface soil moisture under developing crop canopies p0067 A80-32518
- L-band radar sensing of soil moisture --- Kern County, California [NASA-TM-80628] p0068 N80-16404
- Radar target for remotely sensing hydrological phenomena [NASA-CASE-LAR-12344-1] p0104 N80-18498
- Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513
- Measurement of soil moisture trends with airborne scatterometers --- Guymon, Oklahoma and Sublett, Kansas [E80-10064] p0069 N80-18514
- HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516
- Application of HCMM data to soil moisture snow and estuarine current studies [E80-10068] p0104 N80-18517
- Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523
- HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524
- Effect of soil texture on the microwave emission from soils [NASA-TM-80632] p0070 N80-18530
- Application of statistical correlation in the study of available water in layers of Cerrado soil [INPE-1607-TD/L/014] p0070 N80-18531
- LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19588
- SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722
- Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723
- Remote sensing of leaf water content in the near infrared p0071 N80-20769
- Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771
- Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils p0072 N80-20776
- Agrometeorological applications p0073 N80-21818
- SOIL SCIENCE**
- Remote sensing and soils - An application p0063 A80-24052
- Remote sensing applied to soils p0063 A80-24053
- SOILS**
- Assessment of the fertilizer requirement of improved pasture from remote sensing information p0066 A80-26315
- Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433
- Landsat wildland mapping accuracy p0067 A80-30921
- Investigation of landscapes of the Turgay steppe using multispectral aerial photography p0078 A80-32278
- SOLAR POSITION**
- Measuring ecological changes in multitemporal Landsat data using principal components p0076 A80-22452
- Optimum Landsat sun angles for extreme contrasts of terrain p0087 A80-22458
- On spectral signatures in central perspective representation p0112 N80-20665
- Time of day effects on wheat reflectance in fifteen selected bands --- Phoenix, Arizona p0072 N80-20774
- Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777
- SOUTH AMERICA**
- Geophysical atlas p0090 N80-20734
- Gravity model development p0085 N80-20748
- SOUTH CAROLINA**
- Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263
- Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738
- SOUTH DAKOTA**
- Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433
- HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- SOUTHERN CALIFORNIA**
- Statistical analysis of terrain and water backgrounds in the vicinity of Port Huemene, California [AD-A077025] p0078 N80-19599
- Plate boundary deformation in California --- Southern California: Elsinore, Earthquake Valley, and San Felipe Faults p0090 N80-20739
- On the selection of station sites for observing strain strips and earthquake forerunners in California p0090 N80-20740
- SOYBEANS**
- Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391
- Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394
- Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600
- Large Area Crop Inventory Experiment (LACIE). Evaluation of three-category classification [E80-10058] p0069 N80-18509
- Implementation of Badhwar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511
- Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775
- Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils p0072 N80-20776
- Thematic mapper versus multispectral scanner for crop monitoring p0072 N80-20778
- Spectra of isolated vegetational constituents p0072 N80-20779
- SPACEBORNE PHOTOGRAPHY**
- Research project Mauretania: Satellites as development aids [NASA-TM-76054] p0078 N80-17120
- SPATIAL DISTRIBUTION**
- Spatial quantification of maps or images - Cell size or pixel size implications p0110 A80-27429
- SPATIAL FILTERING**
- Thematic adaptive spatial filtering of Landsat landuse classification results p0075 A80-22444
- Texture analysis by space filter and application to foresttype classification p0066 A80-25598
- SPECTRAL BANDS**
- Shallow-water reflectance modeling with applications to remote sensing of the ocean floor p0093 A80-22410
- SPECTRAL REFLECTANCE**
- The use of remote sensing in the determination of beach sand parameters p0075 A80-22422
- Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea p0094 A80-22449
- Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries p0095 A80-22466
- The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah p0101 A80-22467
- Coniferous tree species mapping using Landsat data p0062 A80-23294
- Estimation of grain yields by remote sensing of crop senescence rates p0063 A80-23299
- In-water and remote measurements of ocean color p0096 A80-25338
- Atmospheric effects in the remote sensing of phytoplankton pigments p0097 A80-25345
- Landsat MSS coordinate transformations p0116 A80-25567
- Multi-temporal classification of winter wheat using a growth state model p0064 A80-25571

- Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana p0085 A80-25583
- Extraction of soil information from a vegetated area p0065 A80-25584
- Extension of laboratory-measured soil spectra to field conditions p0065 A80-25585
- Predictability of change in soil reflectance on wetting p0065 A80-25586
- Assessment of the fertilizer requirement of improved pasture from remote sensing information p0066 A80-26315
- A spectral method for determining the percentage of green herbage material in clipped samples p0066 A80-26318
- Crop emergence date determination from spectral data p0067 A80-27458
- Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado [E80-10041] p0068 N80-16391
- Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10050] p0089 N80-16398
- An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon p0068 N80-18500
- Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587
- Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766
- Remote sensing of leaf water content in the near infrared p0071 N80-20768
- Plant stress and relationships to spectral responses --- cotton and tomato plants p0071 N80-20769
- Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771
- Off-nadir viewing effects on spectral assessment of green biomass p0072 N80-20772
- Time of day effects on wheat reflectance in fifteen selected bands --- Phoenix, Arizona p0072 N80-20774
- Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775
- Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils p0072 N80-20776
- Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777
- Thematic mapper versus multispectral scanner for crop monitoring p0072 N80-20778
- Spectra of isolated vegetational constituents p0072 N80-20779
- Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples --- Texas p0073 N80-20781
- SPECTRAL RESOLUTION**
- Signature evaluation of natural targets using high spectral resolution techniques p0115 A80-22409
- Temporal resolution for crop discrimination estimated using J-M distance p0062 A80-22502
- A design study for an advanced ocean color scanner system --- spaceborne equipment p0097 A80-25346
- Study for the determination of geometric and spectral resolution requirements of optical imaging instruments for Earth resources satellites, volume 1 [CM/PR/3384-VOL-1] p0118 N80-17855
- SPECTRAL SENSITIVITY**
- L-band radar sensing of soil moisture --- Kern County, California [NASA-TM-80628] p0068 N80-16404
- Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591
- Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771
- Off-nadir viewing effects on spectral assessment of green biomass p0072 N80-20772
- Thermal anisotropy of vegetation canopies --- Phoenix, Arizona p0072 N80-20773
- Time of day effects on wheat reflectance in fifteen selected bands --- Phoenix, Arizona p0072 N80-20774
- Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils p0072 N80-20776
- Thematic mapper versus multispectral scanner for crop monitoring p0072 N80-20778
- LANDSAT-D assessment system p0122 N80-20782
- SPECTRAL SIGNATURES**
- Karhunen-Loeve analysis of multispectral data from landscapes p0075 A80-22138
- The role of phenology in statistical crop acreage measurement p0059 A80-22388
- Multi-sensor Landsat MSS registration p0115 A80-22390
- Signature evaluation of natural targets using high spectral resolution techniques p0115 A80-22409
- Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413
- Assessment of tidal wetland habitat and productivity p0094 A80-22416
- Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah p0115 A80-22425
- On the penetration of microwaves in snow and soil p0101 A80-22461
- A low cost classification algorithm for developing countries --- for multispectral remote sensor data p0108 A80-22484
- Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22490
- Remote sensing and soils - An application p0063 A80-24052
- Gulf of Mexico, ocean-color surface-truth measurements p0097 A80-25343
- Computer-aided processing of LANDSAT MSS data for classification of forestlands --- San Juan Mountains, Colorado [E80-10043] p0068 N80-16393
- Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394
- Large Area Crop Inventory Experiment (LACIE). Detailed description of the wheat acreage estimation procedure used in the Large Area Crop Inventory Experiment [E80-10051] p0068 N80-16399
- Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study p0068 N80-16400
- Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600
- Feature selection and classifier design with applications to remote sensing of mule deer p0069 N80-18505
- Development of LANDSAT-based technology for crop inventories p0069 N80-18506
- Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507
- Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota [E80-10059] p0069 N80-18510
- Implementation of Badhwar classification of corn/soybean segments --- Illinois, Indiana, Iowa, and Missouri [E80-10060] p0069 N80-18511
- Large Area Crop Inventory Experiment (LACIE). Bibliographic addenda, technical reports, papers, and memorandums published under supporting research and technology and other research, test, and evaluation contracts for the Earth observations division [E80-10070] p0070 N80-18519
- Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-met data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525
- AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526
- The easy remote sensing problem [REPT-20] p0070 N80-18528
- The Cramer-Rao lower bound as a criteria for evaluating a large data reduction system such as LACIE [REPT-21] p0070 N80-18529
- LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19588
- A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass [E80-10082] p0071 N80-19590
- Statistical analysis of terrain and water (ice) backgrounds in a winter scene from northern Michigan [AD-A077554] p0078 N80-19598
- Statistical analysis of terrain and water backgrounds in the vicinity of Port Huene, California [AD-A077025] p0078 N80-19599
- On spectral signatures in central perspective representation p0112 N80-20665
- A method for examining relationships between multispectral data p0113 N80-20708
- Geobotanical exploration --- Mineral, Virginia p0090 N80-20724
- Remote monitoring of forest cover conditions --- deciduous tree defoliation in Pennsylvania p0071 N80-20763
- NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765
- Spectra of isolated vegetational constituents p0072 N80-20779
- A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780
- Linear array pushbroom radiometer data analysis p0119 N80-20784
- Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787
- Computer processing of multispectral scanner data over coal strip mines [PB80-111877] p0091 N80-20803
- SPECTROPHOTOGRAPHY**
- The Landsat-D Assessment System p0121 A80-22419
- SPECTRUM ANALYSIS**
- The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413
- SPHERICAL HARMONICS**
- The RGST chain program for the determination of potential coefficients and station coordinates p0084 N80-20702
- Spherical harmonic models of the core field p0084 N80-20727
- Gravity model development p0085 N80-20748
- The gravity field in the central pacific from satellite-to-satellite tracking and implications for mantle convection p0085 N80-20750
- Information theory density distribution --- Earth Mantle p0085 N80-20753
- The enhanced nodal equilibrium ocean tide and polar motion p0085 N80-20754
- Starlette orbit analyses for ocean tidal studies p0100 N80-20762
- STATISTICAL ANALYSIS**
- Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410
- The Cramer-Rao lower bound as a criteria for evaluating a large data reduction system such as LACIE [REPT-21] p0070 N80-18529
- Statistical analysis of terrain and water backgrounds in the vicinity of Port Huene, California [AD-A077025] p0078 N80-19599
- STATISTICAL CORRELATION**
- Application of statistical correlation in the study of available water in layers of Cerrado soil [INPE-1607-TD/L/014] p0070 N80-18531
- STEPPE**
- Investigation of landscapes of the Turgay steppe using multispectral aerial photography p0078 A80-32278
- STEREOPHOTOGRAPHY**
- Terrain modeling and geometric corrections using the Spot satellite p0081 A80-22407
- SPOT - First French remote sensing satellite geometrical performance p0121 A80-22429
- Stereosat - A new astrodynamics challenge --- satellite-borne stereo imaging for geoscience, cartography and earth resource exploration [AIAA PAPER 80-0237] p0108 A80-22744
- A comparative study of various remote sensing techniques applied to geomorphology p0102 A80-24058
- Error detection and rectification in digital terrain models p0110 A80-27432
- Different considerations in coastal mapping p0110 A80-30922
- What is an analytical plotter --- stereophotogrammetric system design and operation p0110 A80-31977
- Compatibility of analytical plotters with digital imagery in the plotting of variable spaces p0110 A80-31980
- Digital map bases from photogrammetric measurements p0113 N80-20671
- STEREOSCOPY**
- The utilization of a stereotransferecope and very-small-scale photography for the acquisition of forest maps at a scale of 1:20,000 p0064 A80-24066
- STRATIFICATION**
- A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing p0059 A80-22389
- Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506
- Large Area Crop Inventory Experiment (LACIE). Evaluation of three-category classification [E80-10058] p0069 N80-18509
- STRATIGRAPHY**
- Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317
- High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- STRESS (BIOLOGY)**
- Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587
- Remote sensing of leaf water content in the near infrared p0071 N80-20768
- Plant stress and relationships to spectral responses --- cotton and tomato plants p0071 N80-20769
- Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771
- STRESS-STRAIN RELATIONSHIPS**
- Earthquake and crustal deformation studies --- San Francisco and Fort Ross, California p0091 N80-20743

**STRIP MINING**

An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands p0087 A80-22435

Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577

Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787

Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803

**STRUCTURAL BASINS**

Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489

HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516

Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEA SAT SAR [E80-10083] p0105 N80-19591

Comparative planetology/crustal evolution p0090 N80-20735

Snow and ice mapping: Norwegian examples for run-off prediction p0105 N80-21816

**STRUCTURAL PROPERTIES (GEOLOGY)**

Digital processing of Landsat data of ice and snow areas at Vatnajokull, Iceland - A possibility for improved morphological tectonic interpretation p0087 A80-21839

Some application of Landsat imagery interpretation for petroleum targeting in India p0087 A80-22433

Oil and gas exploration by pattern recognition of lineament assemblages associated with bends in wrench faults p0087 A80-22441

Urban environmental survey by remote sensing p0076 A80-22488

Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489

The applicability of remote sensing technique for geological and mineral exploration in Nepal p0088 A80-22491

An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508

Study of geological and geophysical manifestations of horizontal stresses in the crust based on satellite imagery p0088 A80-26727

Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/26] p0089 N80-16410

HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516

Study of oceanic lithosphere using GEOS-3 radar altimeter data [AD-A077344] p0099 N80-18673

Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725

Regional Modeling: The Kentucky anomaly p0090 N80-20730

Regional modeling: The Ivrea zone --- Northern Italy p0085 N80-20731

Interpretation of geoid anomalies in the vicinity of subduction zones --- Tonga-Kermadec and the New Hebrides island arc, North Fiji, South Fiji and Lau-havre p0090 N80-20732

Global geology and geophysics using satellite-derived data p0090 N80-20733

Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738

Plate boundary deformation in California --- Southern California: Elsinore, Earthquake Valley, and San Felipe Faults p0090 N80-20739

GSFC site stability p0085 N80-20741

Geotectonic stability of the Green Bank, West Virginia VLB1 site p0085 N80-20742

Global intra-plate volcanism p0091 N80-20744

High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613

**SUGAR BEETS**

Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770

**SUGAR CANE**

Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1809-NTE/155] p0071 N80-18532

**SULFUR DIOXIDES**

Altitude characteristics of selected air quality analyzers [NASA-CR-159165] p0078 N80-16578

Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-18600

**SURFACE GEOMETRY**

The Surface Contour Radar, a unique remote sensing instrument p0116 A80-26085

**SURFACE ROUGHNESS**

Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360

**SURFACE TEMPERATURE**

Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420

Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442

IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447

Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454

Urban environmental survey by remote sensing p0076 A80-22468

Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures p0063 A80-23295

Remote sensing and soils - An application p0063 A80-24052

Passive radiometry of the ocean from space - An overview p0096 A80-25328

Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330

Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMRR/ p0116 A80-25332

The aqueous thermal boundary layer p0096 A80-25334

Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations p0096 A80-25336

Oceanographic implications of features in NOAA satellite visible imagery p0096 A80-25337

Pasture/wheat surface temperature differences - Indicator of relative soil moisture differences p0065 A80-25582

A calibration procedure for Fourier series thermal inertia models --- surface temperature surveys p0110 A80-30923

Analysis of remote sensing data in oceanography and climatology p0098 A80-31989

The seasonal cycle of snow cover, sea ice and surface albedo p0111 A80-32101

Thermography for estimating near-surface soil moisture under developing crop canopies p0067 A80-32518

Investigation of the application of HCMM thermal data to snow hydrology --- Sierra Nevada Mountains, California and the Arizona test site [E80-10049] p0104 N80-16397

Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512

Applications of HCMM satellite data --- water quality, hydrology, and energy exchange of Lake Erie and Lake Ontario [E80-10071] p0104 N80-18520

Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521

Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523

HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524

Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585

Thermal anisotropy of vegetation canopies --- Phoenix, Arizona p0072 N80-20773

Sea surface temperature anomaly mapping using the NOAA satellites p0100 N80-21819

**SURFACE WATER**

A laser-fluoresensor technique for water quality assessment p0101 A80-22399

Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577

Microwave approaches in hydrology p0104 A80-30920

HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524

Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301

Airborne laser fluorescence of surface water chlorophyll a --- Lake Mead, Nevada [PB80-113400] p0105 N80-20797

**SWITZERLAND**

Thematic adaptive spatial filtering of Landsat landuse classification results p0075 A80-22444

**SYMBOLS**

Experiences gathered with a symbol disk with interchangeable symbols p0083 N80-20688

**SYNCHRONOUS SATELLITES**

CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite p0087 A80-22443

Satellite activities of NOAA 1978 --- geostationary and polar orbiting systems [PB80-112782] p0119 N80-21002

**SYNTHETIC APERTURE RADAR**

Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391

Synthetic aperture radar modeling of surface ocean waves p0093 A80-22411

Radar discrimination of crops p0060 A80-22424

Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448

The ROS-580 Project --- airborne synthetic aperture radar remote sensing p0116 A80-24075

Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317

**T****TECHNOLOGY ASSESSMENT**

State of the art and needs of the earth platform --- in application of satellite tracking to animals p0060 A80-22405

Enhancement of remote sensing through microwave technology p0116 A80-25770

Meteorological satellites: Status and outlook p0119 N80-21800

**TECHNOLOGY TRANSFER**

Machine processing of remotely sensed data: Proceedings of the Fifth Annual Symposium, Purdue University, West Lafayette, Ind., June 27-29, 1979 p0108 A80-25561

Transfer of remote sensing computer technology to the developing world - Case examples p0109 A80-25587

Conference of Remote Sensing Educators (CORSE-78) [NASA-CP-2102] p0122 N80-20003

**TECHNOLOGY UTILIZATION**

Integration of remote sensing and geographic information systems p0075 A80-22403

Determination of range biomass using Landsat p0060 A80-22414

An evaluation of Landsat-D for Canadian applications p0060 A80-22437

Guidelines for evaluating remote sensing demonstration projects p0121 A80-22455

NCSL remote sensing project --- State Legislature considerations and activities [E80-10053] p0122 N80-16401

Illinois LANDSAT feasibility study [NASA-CR-162760] p0122 N80-16424

Space benefits: The secondary application of aerospace technology in other sectors of the economy [NASA-CR-162697] p0122 N80-16950

NASA authorization, 1981, program review, volume 1 [GPO-53-814] p0122 N80-17913

Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592

Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593

Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722

Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723

Findings of the OPIT study in America --- application of remote sensing information [NASA-TM-76106] p0122 N80-21822

**TECTONICS**

Digital processing of Landsat data of ice and snow areas at Vatnajokull, Iceland - A possibility for improved morphological tectonic interpretation p0087 A80-21839

Study of geological and geophysical manifestations of horizontal stresses in the crust based on satellite imagery p0088 A80-26727

The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas p0088 A80-32276

Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725

Regional modeling: The Ivrea zone --- Northern Italy p0085 N80-20731

Interpretation of geoid anomalies in the vicinity of subduction zones --- Tonga-Kermadec and the New Hebrides island arc, North Fiji, South Fiji and Lau-havre p0090 N80-20732

Global geology and geophysics using satellite-derived data p0090 N80-20733

Geophysical atlas p0090 N80-20734

Comparative planetology/crustal evolution p0090 N80-20735

Crustal deformation: Crustal dynamics project p0090 N80-20736

Investigation of crustal dynamics using VLB1 p0090 N80-20737

Plate boundary deformation in California --- Southern California: Elsinore, Earthquake Valley, and San Felipe Faults p0090 N80-20739

On the selection of station sites for observing strain steps and earthquake forerunners in California p0090 N80-20740

Geotectonic stability of the Green Bank, West Virginia VLB1 site p0085 N80-20742

Global intra-plate volcanism p0091 N80-20744

- Crustal motion measurements in California (SAFE)  
p0091 N80-20746
- Mantle convection and subcrustal stress  
p0085 N80-20752
- Information theory density distribution --- Earth Mantle  
p0085 N80-20753
- Tectonics, volume 2. Citations from the NTIS data base  
[PB80-804529] p0091 N80-21925
- TEMPERATURE DISTRIBUTION**
- Thermal anisotropy of vegetation canopies --- Phoenix, Arizona  
p0072 N80-20773
- TENNESSEE**
- Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs  
[PB-300460/3] p0068 N80-16600
- Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky  
p0090 N80-20738
- TENSILE STRESS**
- Global intra-plate volcanism p0091 N80-20744
- TERRAIN**
- Statistical analysis of terrain and water (ice) backgrounds in a winter scene from northern Michigan  
[AD-A077554] p0078 N80-19598
- Statistical analysis of terrain and water backgrounds in the vicinity of Port Hueneme, California  
[AD-A077025] p0078 N80-19599
- A digital terrain model for large surfaces and direct storage access  
p0083 N80-20681
- Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766
- TERRAIN ANALYSIS**
- Karhunen-Loeve analysis of multispectral data from landscapes  
p0075 A80-22138
- Terrain modeling and geometric corrections using the Spot satellite  
p0081 A80-22407
- Terrain evaluation for environmental inventory and impact assessment  
p0075 A80-22426
- SPOT - First French remote sensing satellite geometrical performance  
p0121 A80-22429
- Remote sensing as a source of land cover information utilized in the universal soil loss equation  
p0061 A80-22450
- Optimum Landsat sun angles for extreme contrasts of terrain  
p0087 A80-22458
- Landsat applications to land use mapping of the Cul de Sac Plain of Haiti  
p0076 A80-22479
- Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data  
p0062 A80-22486
- Integrated survey of natural resources of the low lands of Bolivia using Landsat images  
p0108 A80-22488
- An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy  
p0081 A80-22508
- Remote sensing and soils - An application  
p0063 A80-24052
- Landsat MSS coordinate transformations  
p0116 A80-25567
- Analyzing accuracy attributes of Landsat and digital terrain tape data in the context of a digital geobase information system  
p0108 A80-25579
- 90 GHz radiometric imaging through clouds  
p0117 A80-26807
- Error detection and rectification in digital terrain models  
p0110 A80-27432
- An evaluation of landscape units --- geological surveys by photographic imaging techniques  
p0088 A80-27456
- Investigation of landscapes of the Turgay steppe using multispectral aerial photography  
p0078 A80-32278
- Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain  
p0081 N80-19360
- The problem of obtaining data for the Digital Height Model  
p0113 N80-20707
- TERRESTRIAL RADIATION**
- The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources  
p0102 A80-24060
- TEXAS**
- Estimated winter wheat yields from Landsat MSS using spectral techniques  
p0060 A80-22412
- Determination of range biomass using Landsat  
p0060 A80-22414
- Geometric correction of satellite data using curvilinear features and virtual control points  
p0116 A80-22472
- Landsat-2 data for inventorying rangelands in south Texas  
p0065 A80-25573
- Monitoring man's impact in the coastal zone  
p0104 A80-27436
- An evaluation of landscape units --- geological surveys by photographic imaging techniques  
p0088 A80-27456
- Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas  
[E80-10072] p0070 N80-18521
- Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas  
[E80-10073] p0104 N80-18522
- Geological/geophysical resource assessment --- Rio Grande rift  
p0090 N80-20725
- NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia  
p0079 N80-20765
- Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples --- Texas  
p0073 N80-20781
- TEXTURES**
- Texture analysis by space filter and application to foresttype classification  
p0066 A80-25598
- Effect of soil texture on the microwave emission from soils  
[NASA-TM-80632] p0070 N80-18530
- THAILAND**
- Transfer of remote sensing computer technology to the developing world - Case examples  
p0109 A80-25587
- THEMATIC MAPPING**
- International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979. Proceedings. Volumes 1, 2 & 3  
p0121 A80-22376
- Precision of crop-area estimates  
p0059 A80-22386
- A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing  
p0059 A80-22389
- Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables  
p0060 A80-22415
- The Landsat-D Assessment System  
p0121 A80-22419
- Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah  
p0115 A80-22425
- Possibilities of optimal planning of multipurpose survey from space --- oceanography, hydrology, geology, forestry and agriculture  
p0121 A80-22432
- Temporal study on Paddy /rice/ using X-band scatterometer  
p0061 A80-22438
- Thematic adaptive spatial filtering of Landsat landuse classification results  
p0075 A80-22444
- Land use/cover changes in the Kaijiji Reservoir area /Nigeria/  
p0075 A80-22445
- Estimation of primary production of vegetation in agricultural and forested areas using Landsat data  
p0061 A80-22456
- Forest inventory of clearcuts utilizing remote sensing techniques  
p0061 A80-22473
- Sampling techniques to monitor forest area change  
p0061 A80-22474
- Landsat applications to land use mapping of the Cul de Sac Plain of Haiti  
p0076 A80-22479
- Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data  
p0062 A80-22486
- The applicability of remote sensing technique for geological and mineral exploration in Nepal  
p0088 A80-22491
- Forest stand classification in western Washington using Landsat and computer-based resource data  
p0062 A80-22497
- Production of small-scale maps and inventories using Landsat data  
p0081 A80-22503
- An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy  
p0081 A80-22508
- Coniferous tree species mapping using Landsat data  
p0062 A80-23294
- Wombats detected from space --- Landsat satellite imagery application  
p0063 A80-23296
- Remote sensing studies of vegetation  
p0063 A80-24055
- Remote sensing and forestry in Quebec  
p0063 A80-24056
- Vegetation mapping in the Caniapiscau-Koksoak corridor using the automatic classification of Landsat images  
p0063 A80-24063
- Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm  
p0064 A80-24065
- The utilization of a stereotransflescope and very-small-scale photography for the acquisition of forest maps at a scale of 1:20,000  
p0064 A80-24066
- Remote sensing and the agricultural zoning of lands  
p0064 A80-24069
- The ROS-580 Project --- airborne synthetic aperture radar remote sensing  
p0116 A80-24075
- Machine processing of remotely sensed data: Proceedings of the Fifth Annual Symposium, Purdue University, West Lafayette, Ind., June 27-29, 1979  
p0108 A80-25561
- California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames  
p0076 A80-25568
- Landsat-2 data for inventorying rangelands in south Texas  
p0065 A80-25573
- An approach to nonlinear mapping for pattern recognition --- in Landsat multispectral scanner data  
p0116 A80-25592
- American Society of Photogrammetry and American Congress on Surveying and Mapping. Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979. Joint Proceedings  
p0117 A80-27426
- Data acquisition and projected applications of the observations from Landsat-D  
p0117 A80-27427
- Remote sensing inputs to National Model Implementation Program for water resources quality improvement  
p0103 A80-27433
- Aspects of the spaceborne remote sensing of the earth  
p0117 A80-31121
- An interactive software for plotting thematic maps  
p0111 A80-31996
- Cartography and remote sensing  
p0117 A80-31998
- Space photography and thematic mapping - A method for processing multichannel photography --- Russian book  
p0111 A80-32262
- Comparison of registograms in the microphotometric interpretation of multispectral photographs  
p0111 A80-32267
- Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs  
p0077 A80-32273
- Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas  
p0111 A80-32279
- The use of microwave radiometry for the operational mapping of soil moisture  
p0067 A80-32281
- Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs  
p0067 A80-32283
- Crop identification using space photographs taken at different times /A study of the lower Volga Basin used as an example/  
p0067 A80-32285
- The use of ordinary and multispectral aerial and space photographs for the mapping of population centers  
p0078 A80-32285
- Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado  
[E80-10041] p0068 N80-16391
- Illinois LANDSAT feasibility study  
[NASA-CR-162760] p0122 N80-16424
- Research project Mauritania: Satellites as development aids  
[NASA-TM-76064] p0078 N80-17120
- An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon  
p0068 N80-18500
- Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR  
[E80-10083] p0105 N80-19591
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl  
[E80-10086] p0122 N80-19593
- The topographic synoptic map 1:200,000  
p0078 N80-20661
- The synoptic map 1:500,000 (World, Series 1404)  
p0078 N80-20662
- The international world map 1:1,000,000 (IWK)  
p0079 N80-20663
- Obtaining surface information for topography and town and country planning from remote sensing  
p0079 N80-20668
- Digital map bases from photogrammetric measurements  
p0113 N80-20671
- Tasks and possibilities of digital image data processing in photogrammetry  
p0113 N80-20672
- Computer-assisted thematic mapping for federal planning  
p0083 N80-20686
- Application of LANDSAT imagery to monitor sand dunes movement in the Sahara Desert  
p0113 N80-20719
- Remote monitoring of forest cover conditions --- deciduous tree defoliation in Pennsylvania  
p0071 N80-20763
- NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia  
p0079 N80-20765
- Monitoring drought in Colorado with LANDSAT MSS  
p0071 N80-20770
- Radiometric resolution for monitoring vegetation: How many bits are needed?  
p0072 N80-20777
- Thematic mapper versus multispectral scanner for crop monitoring  
p0072 N80-20778
- LANDSAT-D assessment system  
p0122 N80-20782
- THERMAL EMISSION**
- Passive microwave remote sensing of the ocean - A review  
p0096 A80-25329
- THERMAL MAPPING**
- International Symposium on Remote Sensing of Environment, 13th, Ann Arbor, Mich., April 23-27, 1979. Proceedings. Volumes 1, 2 & 3  
p0121 A80-22376
- Surface temperature variations as measured by the Heat Capacity Mapping Mission  
p0115 A80-22420
- Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah  
p0115 A80-22425
- Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data  
p0115 A80-22442
- CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite  
p0087 A80-22443
- IR enhancement techniques to delineate surface temperature and sea-ice distributions  
p0094 A80-22447
- Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing  
p0101 A80-22454
- Main aspects of two Chilean remote sensing projects developed under extreme severe environmental conditions - Desert North and Antarctic South  
p0116 A80-22513
- Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures  
p0063 A80-23295

- Remote sensing and resources management; Congress, 1st. Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Universite de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings p0121 A80-24051
- Remote sensing and soils - An application p0063 A80-24052
- The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources p0102 A80-24060
- Utilization of a portable thermograph in the Ministere des Terres et Forets p0064 A80-24067
- Remote sensing and the agricultural zoning of lands p0064 A80-24069
- Pasture/wheat surface temperature differences Indicator of relative soil moisture differences p0065 A80-25582
- A calibration procedure for Fourier series thermal inertia models --- surface temperature surveys p0110 A80-30923
- Analysis of remote sensing data in oceanography and climatology p0098 A80-31989
- The seasonal cycle of snow cover, sea ice and surface albedo p0111 A80-32101
- Thermography for estimating near-surface soil moisture under developing crop canopies p0067 A80-32518
- Investigation of the application of HCMM thermal data to snow hydrology --- Sierra Nevada Mountains, California and the Arizona test site [E80-10049] p0104 N80-16397
- Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10050] p0089 N80-16398
- Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651
- Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512
- Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513
- Measurement of soil moisture trends with airborne scatterometers --- Guymon, Oklahoma and Sublett, Kansas [E80-10064] p0069 N80-18514
- HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516
- Application of HCMM data to soil moisture snow and estuarine current studies [E80-10068] p0104 N80-18517
- Applications of HCMM satellite data --- water quality, hydrology, and energy exchange of Lake Erie and Lake Ontario [E80-10071] p0104 N80-18520
- Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521
- Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523
- HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524
- Coastal water temperatures in the southeastern portion of Brazil from oceanographic data and NOAA satellite observations, volume 1 [INPE-1569-RPE/070] p0099 N80-18671
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- Heat Capacity Mapping Mission (HCMM) --- Australia [E80-10066] p0079 N80-20721
- Thermal anisotropy of vegetation canopies --- Phoenix, Arizona p0072 N80-20773
- Sea surface temperature anomaly mapping using the NOAA satellites p0100 N80-21819
- THERMAL POLLUTION**
- Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454
- TIDAL FLATS**
- The production of photomaps from tidal flat areas p0083 N80-20682
- TIDES**
- Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries p0095 A80-22466
- Application of HCMM data to soil moisture snow and estuarine current studies [E80-10068] p0104 N80-18517
- The production of photomaps from tidal flat areas p0083 N80-20682
- TIMBER IDENTIFICATION**
- Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423
- Coniferous tree species mapping using Landsat data p0062 A80-23294
- Machine processing of Landsat MSS data and DMA topographic data for forest cover type mapping p0065 A80-25597
- Texture analysis by space filter and application to foresttype classification p0066 A80-25598
- Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado [E80-10041] p0068 N80-16391
- TIMBER INVENTORY**
- Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables p0060 A80-22415
- An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- Small forest cuttings mapped with Landsat digital data p0061 A80-22439
- Estimation of primary production of vegetation in agricultural and forested areas using Landsat data p0061 A80-22456
- Forest inventory of clearcuts utilizing remote sensing techniques p0061 A80-22473
- Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486
- Forest stand classification in western Washington using Landsat and computer-based resource data p0062 A80-22497
- Remote sensing studies of vegetation p0063 A80-24055
- Remote sensing and forestry in Quebec p0063 A80-24056
- Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064
- The NIRAD survey of forest resources - An application of SLAR in Nigeria p0066 A80-26752
- Computer-aided processing of LANDSAT MSS data for classification of forestlands --- San Juan Mountains, Colorado [E80-10043] p0068 N80-16393
- An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon p0068 N80-18500
- Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592
- TIMBER VIGOR**
- Urban environmental survey by remote sensing p0076 A80-22468
- Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501
- Remote sensing and resources management; Congress, 1st. Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Universite de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings p0121 A80-24051
- Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- Remote monitoring of forest cover conditions --- deciduous tree defoliation in Pennsylvania p0071 N80-20763
- TIROS N SATELLITE**
- Operational data collection and platform location by satellite --- Tiros-N technology assessment p0107 A80-22404
- TOPOGRAPHY**
- Terrain modeling and geometric corrections using the Spot satellite p0081 A80-22407
- Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables p0060 A80-22415
- National land use and settlement assessment - An areal data base model for Landsat information for Bangladesh p0076 A80-22493
- An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508
- Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511
- Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064
- Machine processing of Landsat MSS data and DMA topographic data for forest cover type mapping p0065 A80-25597
- Space photography and thematic mapping - A method for processing multichannel photography --- Russian book p0111 A80-32282
- Investigation of landscapes of the Turgay steppe using multispectral aerial photography p0078 A80-32278
- Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas p0111 A80-32279
- Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado [E80-10041] p0068 N80-16391
- Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591
- The data bank in the cartographic automation system p0082 N80-20660
- The topographic synoptic map 1:200,000 p0078 N80-20661
- The international world map 1:1,000,000 (IWK) p0079 N80-20663
- Orthophoto techniques and photomaps p0082 N80-20666
- Aerial and space-borne photographic maps p0082 N80-20667
- Obtaining surface information for topography and town and country planning from remote sensing p0079 N80-20668
- On the displacement problem as part of a process in generalizing topographical maps. Proposition for hierarchical order and the search for EDP assisted solutions p0082 N80-20675
- Twenty-five years of aerial photography by the Institute of Applied Geodesy p0083 N80-20676
- A program for the fully automated displacement of point and line features in cartographic generalization p0083 N80-20680
- Locational characteristics and the sequence of computer assisted processes of cartographic generalization p0083 N80-20685
- Reports on cartography and topographical measurements. Series 1: Original reports [REPT-77] p0113 N80-20705
- Possibilities of application of LANDSAT and Skylab data to small scale cartography p0084 N80-20710
- Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722
- Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723
- Gravity model development p0085 N80-20748
- The effect of sea state on altimeter measurements p0119 N80-20759
- Mean sea surface computation using GEOS-3 altimeter data p0089 N80-20760
- Ocean circulation p0089 N80-20761
- Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766
- TRANSIT SATELLITES**
- The role of navigation satellites in oil exploration p0088 A80-25152
- TREES (PLANTS)**
- Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391
- Forest stand classification in western Washington using Landsat and computer-based resource data p0062 A80-22497
- Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501
- Texture analysis by space filter and application to foresttype classification p0066 A80-25598
- Urban residential ground cover using Landsat digital data p0077 A80-30925
- Forest resource information system --- Baker County, Florida and Picyune, Mississippi sites; St. Regis Paper Company [E80-10065] p0069 N80-18515
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- TRIANGULATION**
- The triangulation network in West Germany p0111 N80-20651
- TROPICAL REGIONS**
- Land use/cover changes in the Kainji Reservoir area /Nigeria/ p0075 A80-22445
- Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501
- The NIRAD survey of forest resources - An application of SLAR in Nigeria p0066 A80-26752
- TROPOSPHERE**
- Remote sensing of regional air pollution from satellites p0075 A80-22400
- TUNDRA**
- LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19588
- TWO FLUID MODELS**
- Applications of a two-flow model for remote sensing of substances in water p0097 A80-25340

- Study of geological and geophysical manifestations of horizontal stresses in the crust based on satellite imagery p0088 A80-26727
- Aspects of the spaceborne remote sensing of the earth p0117 A80-31121
- Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs p0077 A80-32273
- The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas p0088 A80-32276
- Investigation of landscapes of the Turgay steppe using multispectral aerial photography p0078 A80-32278
- Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas p0111 A80-32279
- Crop identification using space photographs taken at different times / A study of the lower Volga Basin used as an example/ p0067 A80-32284
- UNITED STATES OF AMERICA**
- Advances in earth resources management p0059 A80-21896
- LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086
- Effects of interpretation techniques on land-use mapping accuracy p0077 A80-27457
- Landsat wildland mapping accuracy p0067 A80-30921
- NCSL remote sensing project --- State Legislature considerations and activities [E80-10053] p0122 N80-16401
- Crustal deformation: Crustal dynamics project p0090 N80-20736
- Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738
- Mantle convection and subcrustal stress p0085 N80-20752
- Findings of the OPIT study in America --- application of remote sensing information [NASA-TM-78106] p0122 N80-21822
- UNIVERSAL TIME**
- Polar motion and Earth rotation results from Lageos p0086 N80-20757
- UPWELLING WATER**
- A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances p0094 A80-22417
- URANIUM**
- Video processing of remote sensor data applied to uranium exploration in Wyoming [CJ8X-171179] p0089 N80-19603
- URBAN DEVELOPMENT**
- The elimination approach to monitoring urban growth from Landsat data p0076 A80-22492
- The use of ordinary and multispectral aerial and space photographs for the mapping of population centers p0078 A80-32285
- URBAN PLANNING**
- Obtaining surface information for topography and town and country planning from remote sensing p0079 N80-20668
- URBAN RESEARCH**
- Urban environmental survey by remote sensing p0076 A80-22468
- A non-interactive approach to land use determination p0077 A80-25572
- NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765
- USER MANUALS (COMPUTER PROGRAMS)**
- Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392
- USER REQUIREMENTS**
- An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- Guidelines for evaluating remote sensing demonstration projects p0121 A80-22455
- LACIE evaluation and outlook panel transcript: The LACIE Symposium [E80-10069] p0070 N80-18518
- UTAH**
- Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah p0115 A80-22425
- The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah p0101 A80-22467
- Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651
- Plate boundary deformation in California --- Southern California: Elsinore, Earthquake Valley, and San Felipe Faults p0090 N80-20739
- VECTOR ANALYSIS**
- A method for examining relationships between multispectral data p0113 N80-20708
- VEGETATION**
- Karhunen-Loeve analysis of multispectral data from landscapes p0075 A80-22138
- Signature evaluation of natural targets using high spectral resolution techniques p0115 A80-22409
- Terrain evaluation for environmental inventory and impact assessment p0075 A80-22426
- Land cover classification of Segemi River basin using Landsat data - An operational research p0075 A80-22431
- Land use/cover changes in the Kainji Reservoir area /Nigeria/ p0075 A80-22445
- Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450
- Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan p0101 A80-22451
- Measuring ecological changes in multitemporal Landsat data using principal components p0076 A80-22452
- Estimation of primary production of vegetation in agricultural and forested areas using Landsat data p0081 A80-22456
- An evaluation of Michigan land cover/use inventories derived from remote sensing - Characteristics and costs p0076 A80-22462
- Forest inventory of clearcuts utilizing remote sensing techniques p0061 A80-22473
- Landsat applications to land use mapping of the Cul de Sac Plain of Haiti p0076 A80-22479
- Mapping New Zealand's moisture rich soils from Landsat p0061 A80-22485
- Integrated survey of natural resources of the low lands of Bolivia using Landsat images p0108 A80-22488
- Remote sensing and resources management: Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Université de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings p0121 A80-24051
- Remote sensing studies of vegetation p0063 A80-24055
- The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources p0102 A80-24060
- Vegetation mapping in the Caniapiscau-Koksoak corridor using the automatic classification of Landsat images p0063 A80-24063
- The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants p0077 A80-25575
- Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576
- Extraction of soil information from a vegetated area p0065 A80-25584
- Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0066 A80-26313
- A spectral method for determining the percentage of green herbage material in clipped samples p0066 A80-26318
- Wetland flow resistance determination using Landsat data p0103 A80-27431
- Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433
- An evaluation of landscape units --- geological surveys by photographic imaging techniques p0088 A80-27456
- Landsat wildland mapping accuracy p0067 A80-30921
- Urban residential ground cover using Landsat digital data p0077 A80-30925
- Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs p0077 A80-32273
- Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas p0111 A80-32279
- Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- San Juan Mountains, Colorado [E80-10041] p0068 N80-16391
- Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600
- Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522
- Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360
- Geobotanical exploration --- Mineral, Virginia p0090 N80-20724
- Surface mine monitoring --- Pennsylvania p0091 N80-20764
- Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766
- A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780
- Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787
- High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- VEGETATION GROWTH**
- A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing p0059 A80-22389
- An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508
- Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data --- from surface mining of coal p0088 A80-25577
- The use of multispectral photographs for soil cover studies p0067 A80-32280
- Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions --- Rio Grande Valley, Texas [E80-10072] p0070 N80-18521
- Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587
- LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska p0071 N80-19588
- A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass [E80-10082] p0071 N80-19590
- Thermal anisotropy of vegetation canopies --- Phoenix, Arizona p0072 N80-20773
- Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777
- VERY LONG BASE INTERFEROMETRY**
- Investigation of crustal dynamics using VLBI p0090 N80-20737
- VIEW EFFECTS**
- Off-nadir viewing effects on spectral assessment of green biomass p0072 N80-20772
- VIRGINIA**
- Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane [NASA-TM-80146] p0078 N80-16575
- Geobotanical exploration --- Mineral, Virginia p0090 N80-20724
- Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738
- NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765
- Sources of variations in LANDSAT autocorrelation --- Richmond, Virginia and Denver, Colorado p0114 N80-20767
- VOLCANOES**
- HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516
- Comparative planetology/crustal evolution p0090 N80-20735
- VOLCANOLOGY**
- Geological/geophysical resource assessment --- Rio Grande rift p0090 N80-20725
- Global geology and geophysics using satellite-derived data p0090 N80-20733
- Geophysical atlas p0090 N80-20734
- Global intra-plate volcanism p0091 N80-20744
- Development of A seismic data collection platform p0091 N80-20745
- W**
- WARM FRONTS**
- Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data p0093 A80-21454
- WASHINGTON**
- Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- Forest stand classification in western Washington using Landsat and computer-based resource data p0062 A80-22497
- NASA-census Application Pilot Test (APT) and urban area delineation studies --- Seattle, Washington; Austin, Texas; Orlando, Florida; Boston, Massachusetts, and Richmond, Virginia p0079 N80-20765
- WASTE DISPOSAL**
- Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592
- Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- V**
- VALLEYS**
- Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591

- WATER BALANCE**  
Improvements in lake water budget computations using Landsat data p0103 A80-27434
- WATER CIRCULATION**  
Remote sensing of living marine resources p0094 A80-22418  
Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263  
Gravity model development p0085 N80-20748
- WATER COLOR**  
Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22490  
Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978, Proceedings, Parts 1, 2 & 3 p0096 A80-25327  
Passive radiometry of the ocean from space - An overview p0096 A80-25328  
In-water and remote measurements of ocean color p0096 A80-25338  
An algorithm for remote sensing of water color from space p0097 A80-25342  
Gulf of Mexico, ocean-color surface-truth measurements p0097 A80-25343  
A design study for an advanced ocean color scanner system --- spaceborne equipment p0097 A80-25346  
Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512
- WATER CURRENTS**  
Use of satellite navigation by tuna seiners p0095 A80-25153
- WATER DEPTH**  
Shallow-water reflectance modeling with applications to remote sensing of the ocean floor p0093 A80-22410  
Landsat bathymetric mapping by multitemporal processing p0094 A80-22464  
Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imagery p0095 A80-22466  
Remote sensing of the sea around Singapore p0095 A80-22506
- WATER FLOW**  
Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images --- water rise and ecology of French reservoir p0103 A80-24061  
Gulf stream ring trajectories p0095 A80-24546  
Wetland flow resistance determination using Landsat data p0103 A80-27431
- WATER MANAGEMENT**  
Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433  
Improvements in lake water budget computations using Landsat data p0103 A80-27434
- WATER POLLUTION**  
Marine pollution analysis in Tokyo Bay by Landsat 1 and 2 p0095 A80-22496  
The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants p0077 A80-25575  
Monitoring man's impact in the coastal zone p0104 A80-27436  
Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263  
Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512  
HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota, p0105 N80-18524  
Remote sensing applied to pollution monitoring. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0732/2] p0079 N80-20952
- WATER QUALITY**  
Impacts of land use on estuarine water quality p0101 A80-22398  
A laser-fluoresensor technique for water quality assessment p0101 A80-22399  
A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances p0094 A80-22417  
An evaluation of Landsat-D for Canadian applications p0060 A80-22437  
Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea p0094 A80-22449  
The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah p0101 A80-22467  
A regression technique for evaluation and quantification for water quality parameters from remote sensing data p0102 A80-22470  
Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22490  
Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolitan p0102 A80-24059  
Applications of a two-flow model for remote sensing of substances in water p0097 A80-25340  
Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433  
Applications of HCMM satellite data --- water quality, hydrology, and energy exchange of Lake Erie and Lake Ontario [E80-10071] p0104 N80-18520
- Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18678  
Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786  
Airborne laser fluorosensing of surface water chlorophyll a --- Lake Mead, Nevada [PB80-113400] p0105 N80-20797  
Biological applications including pollution monitoring --- ocean surface monitoring p0100 N80-21821
- WATER RESOURCES**  
Terrain evaluation for environmental inventory and impact assessment p0075 A80-22426  
Remote sensing and resources management; Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Universite de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings p0121 A80-24051  
Remote sensing and water resources in Quebec p0102 A80-24054  
Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573  
Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433  
NCSL remote sensing project --- State Legislature considerations and activities p0122 N80-16401  
[E80-10053] p0122 N80-16401  
Radar target for remotely sensing hydrological phenomena [NASA-CASE-LAR-12344-1] p0104 N80-18498  
Statistical analysis of terrain and water backgrounds in the vicinity of Port Hueneme, California [AD-A077025] p0078 N80-19599  
The production of photomaps from tidal flat areas p0083 N80-20682  
Experiences gathered with a symbol disk with interchangeable symbols p0083 N80-20688  
Snow and ice mapping; Norwegian examples for run-off prediction p0105 N80-21816  
Satellite contribution to the study of the physical properties of soils. Utilization in the water and agricultural domains p0073 N80-21817.
- WATER RUNOFF**  
Relationship of physiography and snow area to stream discharge --- Kings River Watershed, California [E80-10046] p0104 N80-16396  
Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522  
Snow and ice mapping; Norwegian examples for run-off prediction p0105 N80-21816
- WATER TABLES**  
An assessment of electromagnetic remote sensing systems for the detection of perched water tables p0103 A80-26787  
HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution --- Big Sioux River Basin, South Dakota [E80-10075] p0105 N80-18524
- WATER TEMPERATURE**  
Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data p0093 A80-21454  
Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah p0115 A80-22425  
Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454  
Colloquium on Passive Radiometry of the Ocean, 6th, Patricia Bay, British Columbia, Canada, June 14-21, 1978, Proceedings, Parts 1, 2 & 3 p0096 A80-25327  
Passive radiometry of the ocean from space - An overview p0096 A80-25328  
Passive microwave remote sensing of the ocean - A review p0096 A80-25329  
Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330  
Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMMR/ p0116 A80-25332  
The aqueous thermal boundary layer p0096 A80-25334  
Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations p0096 A80-25336  
Coastal water temperatures in the southeastern portion of Brazil from oceanographic data and NOAA satellite observations, volume 1 [INPE-1569-RPE/070] p0099 N80-18671  
Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585  
SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589  
Sea surface temperature anomaly mapping using the NOAA satellites p0100 N80-21819
- WATER WAVES**  
Synthetic aperture radar modeling of surface ocean waves p0093 A80-22411  
Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448
- Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941  
Spectral distortion inherent in airborne profilometer measurements of ocean wave heights p0095 A80-22942  
Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations p0096 A80-25336  
The Surface Contour Radar, a unique remote sensing instrument p0116 A80-26085  
The relationship between ocean surface structure and the synthetic aperture radar imagery of ocean waves p0097 A80-28256  
A unique radio oceanographic radar [AD-A077364] p0099 N80-19332  
An initial assessment of the performance achieved by the Seasat-1 radar altimeter [NASA-TM-73279] p0118 N80-20564  
Wave sensor survey [PB80-118581] p0100 N80-21010
- WATERFOWL**  
Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- WATERSHEDS**  
Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450  
A non-interactive approach to land use determination p0077 A80-25572  
Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433  
Relationship of physiography and snow area to stream discharge --- Kings River Watershed, California [E80-10046] p0104 N80-16396  
Investigation of the application of HCMM thermal data to snow hydrology --- Sierra Nevada Mountains, California and the Arizona test site [E80-10049] p0104 N80-16397  
Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas [E80-10063] p0069 N80-18513  
Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers --- Texas [E80-10073] p0104 N80-18522  
Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma [E80-10074] p0070 N80-18523  
Remote sensing applications to resource problems in South Dakota --- Chamberlain, Rapid City; Watertown; Spink County; Lake Herman and Six-Mile Creek Watersheds; and Missouri River waterfowl [E80-10086] p0122 N80-19593
- WAVE PROPAGATION**  
Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations p0096 A80-25336
- WEATHER FORECASTING**  
Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407  
Meteorological satellites: Status and outlook p0119 N80-21800
- WELLS**  
Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410
- WEST VIRGINIA**  
Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
Crustal structure and dynamics of southeastern US --- Maryland, Virginia, North Carolina, South Carolina, West Virginia, Georgia, Tennessee, and Kentucky p0090 N80-20738  
Geodetic stability of the Green Bank, West Virginia VLBI site p0085 N80-20742
- WETLANDS**  
Assessment of tidal wetland habitat and productivity p0094 A80-22416  
Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan p0101 A80-22451  
Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573  
Wetland flow resistance determination using Landsat data p0103 A80-27431  
Monitoring man's impact in the coastal zone p0104 A80-27436  
Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan [E80-10085] p0078 N80-19592
- WETTING**  
Predictability of change in soil reflectance on wetting p0065 A80-25586
- WHEAT**  
Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387

## WILDERNESS

Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391  
 Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412  
 The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413  
 An evaluation of Landsat-D for Canadian applications p0060 A80-22437  
 Area estimates by Landsat - Kansas 1976 winter wheat p0062 A80-22500  
 Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach --- from classifications of Landsat data p0064 A80-25570  
 Multi-temporal classification of winter wheat using a growth state model p0064 A80-25571  
 Pasture/wheat surface temperature differences - Indicator of relative soil moisture differences p0065 A80-25582

LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086  
 Crop identification in a parkland environment using aerial photography p0066 A80-26312  
 Crop emergence date determination from spectral data p0067 A80-27458  
 Large Area Crop Inventory Experiment (LACIE). Detailed description of the wheat acreage estimation procedure used in the Large Area Crop Inventory Experiment [E80-10051] p0068 N80-16399  
 Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study [E80-10052] p0068 N80-16400  
 Development of LANDSAT-based technology for crop inventories p0069 N80-18506  
 Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507  
 Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery --- North Dakota p0069 N80-18510  
 Correlation of spacecraft passive microwave system data with soil moisture indices (API) --- Southern Great Plains States: Oklahoma and Kansas p0069 N80-18513  
 Dryland pasture and crop conditions as seen by HCMM --- Colby, Kansas and the Washita River watershed near Chickasha, Oklahoma p0070 N80-18523  
 Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-met data base for spring and winter wheat. volume 2 [E80-10076] p0070 N80-18525

AGRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures --- large area crop inventories [E80-10079] p0070 N80-18526  
 The easy remote sensing problem [REPT-20] p0070 N80-18528  
 Use of remote sensing for land use policy formulation --- Kalamazoo, Lake, Mecosta, Newaygo, Osceola, and Wexford counties, Michigan p0078 N80-19592  
 Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722  
 Effects of wheat irrigation frequency on reflectance in selected spectral bands --- Phoenix, Arizona p0072 N80-20771  
 Off-nadir viewing effects on spectral assessment of green biomass p0072 N80-20772  
 Thermal anisotropy of vegetation canopies --- Phoenix, Arizona p0072 N80-20773  
 Time of day effects on wheat reflectance in fifteen selected bands --- Phoenix, Arizona p0072 N80-20774  
 Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777  
 Spectra of isolated vegetational constituents p0072 N80-20779

## WILDERNESS

A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing p0059 A80-22389  
 Landsat wildland mapping accuracy p0067 A80-30921

## WILDLIFE

Wombats detected from space --- Landsat satellite imagery application p0063 A80-23296

## WILDLIFE RADIOLOCATION

State of the art and needs of the earth platform --- in application of satellite tracking to animals p0060 A80-22405

## WIND MEASUREMENT

Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407

## WIND VELOCITY

Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941  
 Spectral distortion inherent in airborne profilometer measurements of ocean wave heights p0095 A80-22942

Passive microwave remote sensing of the ocean - A review p0096 A80-25329  
 Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMMR/ p0116 A80-25332  
 Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407

## WINTER

NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977 p0105 N80-19594

## WORMS

Remote sensing and forestry in Quebec p0063 A80-24056  
 Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065

## WYOMING

Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10050] p0089 N80-16398  
 U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429  
 Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591  
 Video processing of remote sensor data applied to uranium exploration in Wyoming [GJBX-171(79)] p0089 N80-19603  
 Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803

## X

## X-Y PLOTTERS

Testing the accuracy of cartographic equipment: First results p0083 N80-20683

## Y

## YELLOWSTONE NATIONAL PARK (ID-MT-WY)

U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429

## YIELD

Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412  
 The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413  
 Possible future directions in crop yield forecasting p0062 A80-22505  
 Estimation of grain yields by remote sensing of crop senescence rates p0063 A80-23299  
 Development of LANDSAT-based technology for crop inventories p0069 N80-18506  
 Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507  
 Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587  
 A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass [E80-10082] p0071 N80-19590  
 Assessing soybean leaf area and leaf biomass by spectral measurements --- Beltsville, Maryland Agricultural Research Center p0072 N80-20775

## Z

## ZENITH

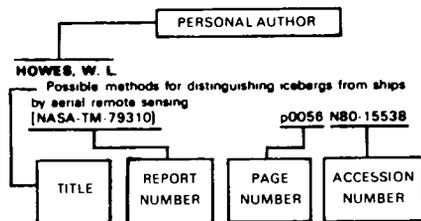
Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777

# PERSONAL AUTHOR INDEX

Earth Resources/ A Continuing Bibliography (Issue 26)

JULY 1980

## Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title, e.g., p0056 N80-15538. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

## A

- ABDEL HADY, M. A.**  
Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation p0081 A80-22509
- ABOTTEEN, K. M.**  
Large Area Crop Inventory Experiment (LACIE). Evaluation of three-category classification [E80-10058] p0069 N80-18509
- ACKERSON, V. B.**  
An evaluation of landscape units p0088 A80-27456
- AGGARWAL, J. K.**  
Computer recognition of citrus infestations p0066 A80-25599
- AHLERS, C.**  
Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387
- AHLNAS, K.**  
IR enhancement techniques to delineate surface temperature and sea-ice distributions p0094 A80-22447
- ALANIZ, M. A.**  
Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573
- ALBUISSON, M.**  
Sea surface temperature anomaly mapping using the NOAA satellites p0100 N80-21819
- ALGAZI, V. R.**  
Geometric correction of satellite data using curvilinear features and virtual control points p0116 A80-22472  
A non-interactive approach to land use determination p0077 A80-25572
- ALGER, L. H.**  
An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands p0087 A80-22435  
Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data p0088 A80-25577
- ALLAN, J. A.**  
The NIRAD survey of forest resources - An application of SLAR in Nigeria p0066 A80-26752
- ALLAN, T. D.**  
Monitoring the sea surface p0100 N80-21820
- ALLENBY, R. J.**  
Crustal deformation: Crustal dynamics project p0090 N80-20736  
Crustal structure and dynamics of southeastern US p0090 N80-20738  
GSFC site stability p0085 N80-20741  
Geodetic stability of the Green Bank, West Virginia VLBI site p0085 N80-20742  
Development of A seismic data collection platform p0091 N80-20745
- AMANN, V.**  
Remote sensing of ocean waters p0098 A80-29389
- ANDERSEN, T.**  
Snow and ice mapping: Norwegian examples for run-off prediction p0105 N80-21816
- ANUTA, M. A.**  
Settlement detection with radar imagery p0077 A80-27430
- ANUTA, P. E.**  
Synthetic aperture radar/LANDSAT MSS image registration [NASA-RP-1039] p0111 N80-16405
- ARAYA F., M.**  
Main aspects of two Chilean remote sensing projects developed under extreme severe environmental conditions - Desert North and Antarctic South p0116 A80-22513
- ARTLEY, J. A.**  
Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587
- ASANUMA, I.**  
Extraction of soil information from a vegetated area p0065 A80-25584
- ASAOKA, O.**  
Marine pollution analysis in Tokyo Bay by Landsat 1 and 2 p0095 A80-22496
- ATANASIAN, S. V.**  
The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas p0088 A80-32276
- ATKINSON, R.**  
Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392
- ATWATER, S.**  
L-band radar sensing of soil moisture [NASA-TM-80628] p0068 N80-16404
- AUDET, H.**  
Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images p0103 A80-24061  
Utilization of a portable thermograph in the Ministere des Terres et Forêts p0064 A80-24067
- AUDIRAC, H.**  
Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064
- AULDS, R. E.**  
Forest stand classification in western Washington using Landsat and computer-based resource data p0062 A80-22497
- AUMANN, J. B.**  
Large Area Crop Inventory Experiment (LACIE). Bibliographic addenda, technical reports, papers, and memorandums published under supporting research and technology and other research, test, and evaluation contracts for the Earth observations division [E80-10070] p0070 N80-18519
- AUSTIN, R. W.**  
Gulf of Mexico, ocean-color surface-truth measurements p0097 A80-25343
- AUSTIN, W. W.**  
Large Area Crop Inventory Experiment (LACIE). Detailed description of the wheat acreage estimation procedure used in the Large Area Crop Inventory Experiment [E80-10051] p0068 N80-16399  
Implementation of Badhwar classification of corn/soybean segments [E80-10060] p0069 N80-18511
- AVERINTSEV, M. B.**  
Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs p0077 A80-32273
- BABER, J. J., JR.**  
Use of low altitude aerial biosensing with color infrared photography as a crop management service p0067 A80-27437
- BACHAND, A.**  
Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images p0103 A80-24061
- BADHWAR, G.**  
Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387
- BADHWAR, G. D.**  
Crop emergence date determination from spectral data p0067 A80-27458
- BAHETHI, O.**  
A design study for an advanced ocean color scanner system p0097 A80-25346
- BAKER, J.**  
Airborne laser fluorosensing of surface water chlorophyll a [PB80-113400] p0105 N80-20797
- BARAN, J. W.**  
Temporal resolution for crop discrimination estimated using J-M distance p0062 A80-22502
- BARNES, J. C.**  
Investigation of the application of HCMM thermal data to snow hydrology [E80-10049] p0104 N80-16397
- BARNETT, T. L.**  
The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413
- BARNEY, T. W.**  
Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576
- BARRETO, J. N.**  
Application of statistical correlation in the study of available water in layers of Cerrado soil [INPE-1607-TDL/014] p0070 N80-18531
- BARTHMAIER, E. W.**  
Forest stand classification in western Washington using Landsat and computer-based resource data p0062 A80-22497
- BARTLETT, D. S.**  
Assessment of tidal wetland habitat and productivity p0094 A80-22416
- BARTOLUCCI, L. A.**  
Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types [E80-10041] p0068 N80-16391
- BASHARINOV, A. E.**  
Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330  
The use of microwave radiometry for the operational mapping of soil moisture p0067 A80-32281
- BATE, E. S.**  
Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489
- BAUDOIN, A.**  
Terrain modeling and geometric corrections using the Spot satellite p0081 A80-22407
- BAUER, M. E.**  
Sampling for area estimation - A comparison of full-frame sampling with the stample segment approach p0064 A80-25570
- BAUMGARDNER, M. F.**  
Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana p0065 A80-25583  
Extension of laboratory-measured soil spectra to field conditions p0065 A80-25585
- BAUSSART, N.**  
Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea p0094 A80-22449
- BEAUBIEN, J.**  
Remote sensing and forestry in Quebec p0063 A80-24056  
Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064  
Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065
- BECK, R. H.**  
Predictability of change in soil reflectance on wetting p0065 A80-25586
- BECKER, F.**  
Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454
- BEDI, N.**  
Larger perspective for geomorphic studies on Landsat imagery - A case study: Andhra Pradesh, India p0088 A80-22510
- BELCHER, R. C.**  
Geological/geophysical resource assessment p0090 N80-20725
- BELIAVSKII, A. I.**  
Possibilities of optimal planning of multipurpose survey from space p0121 A80-22432

## B

## BELL, R.

- BELL, R.**  
Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils  
p0072 N80-20776
- BELSHER, D. R.**  
High resolution sensing techniques for slope stability studies  
[PB80-124621] p0073 N80-21613
- BELZNER, H.**  
Photogrammetry in IFAG from 1952 to 1977  
p0079 N80-20664
- BENTON, A. R., JR.**  
Monitoring man's impact in the coastal zone  
p0104 A80-27436
- BESSIS, J. L.**  
Operational data collection and platform location by satellite  
p0107 A80-22404
- BEST, R. G.**  
Remote sensing applications to resource problems in South Dakota  
[E80-10086] p0122 N80-19593
- BHATTARAI, K. D.**  
The applicability of remote sensing technique for geological and mineral exploration in Nepal  
p0088 A80-22491
- BIEHL, L. L.**  
Extension of laboratory-measured soil spectra to field conditions  
p0065 A80-25585
- BILLINGSLEY, J. B.**  
The Landsat-D Assessment System  
p0121 A80-22419
- BINA, R. T.**  
Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries  
p0095 A80-22466
- BISHOP, J. A.**  
Illinois LANDSAT feasibility study  
[NASA-CR-162760] p0122 N80-16424
- BLACKWELL, R. J.**  
Integration of Landsat, Seasat, and other geo-data sources  
p0107 A80-22392
- BLANCHARD, A. J.**  
Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers  
[E80-10073] p0104 N80-18522
- BLANCHARD, B. J.**  
Pasture/wheat surface temperature differences  
Indicator of relative soil moisture differences  
p0065 A80-25582  
Correlation of spacecraft passive microwave system data with soil moisture indices (API)  
[E80-10063] p0069 N80-18513  
Measurement of soil moisture trends with airborne scatterometers  
[E80-10064] p0069 N80-18514  
Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers  
[E80-10073] p0104 N80-18522  
Dryland pasture and crop conditions as seen by HCMM  
[E80-10074] p0070 N80-18523
- BLUMENROEDER, D.**  
Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing  
p0101 A80-22454
- BODECHTEL, J.**  
Digital processing of Landsat data of ice and snow areas at Vatnajökull, Iceland - A possibility for improved morphological tectonic interpretation  
p0087 A80-21839
- BOEHME, R.**  
The topographic synoptic map 1:200,000  
p0078 N80-20661  
The synoptic map 1:500,000 (World, Series 1404)  
p0078 N80-20662
- BONARIUS, H.**  
Research project Mauritania: Satellites as development aids  
[NASA-TM-76064] p0078 N80-17120
- BONN, F.**  
Remote sensing and soils - An application  
p0063 A80-24052  
A comparative study of various remote sensing techniques applied to geomorphology  
p0102 A80-24058
- BONN, F. J.**  
Remote sensing and resources management: Congress, 1st, Ecole Polytechnique, Montreal, Canada, November 1977 and Congress, 2nd, Université de Sherbrooke, Sherbrooke, Quebec, Canada, May 3, 4, 1979, Proceedings  
p0121 A80-24051
- BONNER, J.**  
U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park  
[PB-301333/1] p0089 N80-16429  
U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park  
[PB-301334/9] p0089 N80-16430
- BONNER, K. G.**  
A stratified-cluster sampling procedure applied to a wetland vegetation inventory using remote sensing  
p0059 A80-22389
- BORN, G. H.**  
Seasat gulf of Alaska workshop report  
[NASA-CR-162463] p0099 N80-18549
- BOWDEN, L. W.**  
Textbooks and technical references for remote sensing  
p0122 N80-20014

- BOYD, W. E.**  
Determination of range biomass using Landsat  
p0060 A80-22414
- BOYLAN, M.**  
Use of remote sensing for land use policy formulation  
[E80-10085] p0078 N80-19592
- BRACKEN, P. A.**  
The Massively Parallel Processor and its applications  
p0115 A80-22380  
The Landsat-D Assessment System  
p0121 A80-22419
- BRACONNE, S.**  
Production of small-scale maps and inventories using Landsat data  
p0081 A80-22503
- BRÄKKE, T. W.**  
Estimated winter wheat yields from Landsat MSS using spectral techniques  
p0060 A80-22412
- BRAMMER, R. F.**  
Preliminary estimates of the resolution capability of the SEASAT radar altimeter  
p0117 A80-29163
- BREIN, R.**  
A survey of the geodetical work of the IFAG from 1952-1977  
p0082 N80-20640
- BRERA, A. M.**  
Application of LANDSAT imagery to monitor sand dunes movement in the Sahara Desert  
p0113 N80-20719
- BRISTOW, M.**  
A laser-fluoresensor technique for water quality assessment  
p0101 A80-22399  
Airborne laser fluoresensing of surface water chlorophyll a  
[PB80-113400] p0105 N80-20797
- BROWN, J.**  
LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska  
[E80-10080] p0071 N80-19588
- BROWN, O. B.**  
Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations  
p0096 A80-25336
- BRYAN, M. L.**  
L-band radar sensing of soil moisture  
[NASA-TM-80628] p0068 N80-16404
- BRYANT, E.**  
Small forest cuttings mapped with Landsat digital data  
p0061 A80-22439
- BRYANT, J.**  
The easy remote sensing problem  
[REPT-20] p0070 N80-18528
- BRYANT, N. A.**  
California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames  
p0076 A80-25568  
Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory  
p0110 A80-29978
- BUJA-BIJUNAS, L.**  
Field performance of a laser fluoresensor for the detection of oil spills  
p0097 A80-27331
- BUSHNELL, M.**  
Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data  
p0093 A80-21454
- BUTENKO, I. M.**  
The use of microwave radiometry for the operational mapping of soil moisture  
p0067 A80-32281
- BUTIVSHCHENKO, T. P.**  
Experience with the use of synthesized color images for the interpretation of agricultural objects  
p0067 A80-32270  
Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs  
p0067 A80-32283
- BUTLIN, T. J.**  
The geometric correction of Landsat images at the Canada Centre for Remote Sensing  
p0109 A80-26311

## C

- CARDENAS, M.**  
Area estimates by Landsat - Kansas 1976 winter wheat  
p0062 A80-22500
- CARLYLE, S. M.**  
Multi-temporal classification of winter wheat using a growth state model  
p0064 A80-25571
- CARPENTER, L.**  
Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior  
[E80-10087] p0084 N80-20723
- CARTER, P.**  
The elimination approach to monitoring urban growth from Landsat data  
p0076 A80-22492
- CASSANET, G.**  
Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM)  
[E80-10057] p0099 N80-19585
- CASTRUCCIO, P. A.**  
The role of phenology in statistical crop acreage measurement  
p0059 A80-22388
- CATE, R. B.**  
Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature  
[E80-10078] p0071 N80-19587
- CAZAUX, J. C.**  
Terrain modeling and geometric corrections using the Spot satellite  
p0081 A80-22407  
SPOT - First French remote sensing satellite geometrical performance  
p0121 A80-22429
- CEHLSKY, M.**  
Enhancement of remote sensing through microwave technology  
p0116 A80-25770
- CHANG, A. T. C.**  
L-band radar sensing of soil moisture  
[NASA-TM-80628] p0068 N80-16404  
Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain  
p0081 N80-19360
- CHAPPELLE, E. W.**  
Effects of wheat irrigation frequency on reflectance in selected spectral bands  
p0072 N80-20771  
Time of day effects on wheat reflectance in fifteen selected bands  
p0072 N80-20774  
Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils  
p0072 N80-20776  
Spectra of isolated vegetational constituents  
p0072 N80-20779
- CHAVEZ, P. S., JR.**  
Digital image processing techniques of integrated images and non-image data sets  
p0107 A80-22401
- CHEM, D. T.**  
Gulf stream ground truth project - Results of the NRL airborne sensors  
p0095 A80-22941
- CHEM, S. C.**  
Significant results from a project on agricultural statistics, 1975 - 1978  
[INPE-1609-NTE/155] p0071 N80-18532
- CHENEY, R. E.**  
Ocean circulation  
p0099 N80-20761
- CHESTERS, D.**  
A spectral filter for ESMR's sidelobe errors  
[NASA-TM-80555] p0118 N80-16402
- CHHIKARA, R.**  
Accuracy assessment in the Large Area Crop Inventory Experiment  
p0059 A80-22387
- CHICAMI, L.**  
Use of satellite navigation by tuna seiners  
p0095 A80-25153
- CHIU, H.-Y.**  
Signature evaluation of natural targets using high spectral resolution techniques  
p0115 A80-22409
- CHONG, Y. J.**  
Remote sensing of the sea around Singapore  
p0095 A80-22506
- CHOWDHURY, M. I.**  
National land use and settlement assessment - An area data base model for Landsat information for Bangladesh  
p0076 A80-22493
- CHRIST, F.**  
Computer based generalization for the elaboration and extension of topographic maps  
p0112 N80-20658  
A program for the fully automated displacement of point and line features in cartographic generalization  
p0083 N80-20680
- CICONE, R. C.**  
Development of LANDSAT-based technology for crop inventories  
[E80-10054] p0069 N80-18506  
Development of LANDSAT-based technology for crop inventories: Appendices  
[E80-10055] p0069 N80-18507
- CHILAR, J.**  
Remote sensing applied to soils  
p0063 A80-24053
- CLARK, C. A.**  
Monitoring man's impact in the coastal zone  
p0104 A80-27436
- CLARK, D. K.**  
Atmospheric effects in the remote sensing of phytoplankton pigments  
p0097 A80-25345
- CLEMENT, P.**  
A comparative study of various remote sensing techniques applied to geomorphology  
p0102 A80-24058

- COHEN, S. C.**  
Earthquake and crustal deformation studies  
p0091 N80-20743
- COLEMAN, G.**  
Pasture/wheat surface temperature differences  
Indicator of relative soil moisture differences  
p0065 A80-25582
- COLLINS, W.**  
Signature evaluation of natural targets using high spectral resolution techniques  
p0115 A80-22409
- COLWELL, J. E.**  
Possible future directions in crop yield forecasting  
p0062 A80-22505
- COLWELL, R. N.**  
Textbooks and technical references for remote sensing  
p0122 N80-20014  
The reduction of remote sensing data by visual means  
p0118 N80-20017
- CONRAD, J. C., JR.**  
Temporal resolution for crop discrimination estimated using J-M distance  
p0062 A80-22502
- COOK, P.**  
Crop-area estimates from Landsat - Transition from research and development to timely results  
p0064 A80-25569
- CORDAN, E. W., JR.**  
An image registration algorithm using sampled binary correlation  
p0108 A80-25580
- COUZY, A.**  
Findings of the OPIT study in America  
[NASA-TM-76106]  
p0122 N80-21822
- COWSBERT, J.**  
American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Technical Meeting, Sioux Falls, S. Dak., September 17-21, 1979, Joint Proceedings  
p0117 A80-27426
- CRAIG, M.**  
Crop-area estimates from Landsat - Transition from research and development to timely results  
p0064 A80-25569
- CRAIG, M. W.**  
Area estimates by Landsat - Kansas 1976 winter wheat  
p0062 A80-22500
- CRAIG, R. G.**  
Autocorrelation in Landsat data  
p0107 A80-22483
- CRISSMAN, B. W.**  
Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data  
p0093 A80-21454
- CROCKETT, F.**  
Video processing of remote sensor data applied to uranium exploration in Wyoming  
[GJBX-171179]  
p0089 N80-19603
- CROWN, P. H.**  
Crop identification in a parkland environment using aerial photography  
p0066 A80-26312
- D**
- DALSTED, K. J.**  
Remote sensing applications to resource problems in South Dakota  
[E80-10086]  
p0122 N80-19593
- DALTON, J. T.**  
Quadratic image destriping  
p0108 A80-22498
- DANAHER, J.**  
Landsat-D sensor data product generation  
p0110 A80-27428
- DAVIS, B. J.**  
Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach  
p0064 A80-25570
- DAVIS, C. F.**  
The use of remote sensing in the determination of beach sand parameters  
p0075 A80-22422
- DAVIS, S. M.**  
Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types  
[E80-10041]  
p0068 N80-16391
- DAY, D.**  
Radar discrimination of crops  
p0060 A80-22424
- DE JESUS, B. R., JR.**  
Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data  
p0062 A80-22501
- DEBRULE, P.**  
Field study of pollutant migration in the vicinity of a coastal front  
p0098 A80-28263
- DECHAMBENOY, C.**  
Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing  
p0101 A80-22454
- DEERING, D.**  
LANDSAT-D assessment system  
p0122 N80-20782
- DEERING, D. W.**  
Determination of range biomass using Landsat  
p0060 A80-22414  
Monitoring drought in Colorado with LANDSAT MSS  
p0071 N80-20770  
Off-nadir viewing effects on spectral assessment of green biomass  
p0072 N80-20772  
Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils  
p0072 N80-20776
- Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples  
p0073 N80-20781
- DEJACE, J.**  
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data  
p0115 A80-22442
- DEL RIO, J. L.**  
Applying contrast, filtering and smoothing techniques to Landsat images  
p0107 A80-22471
- DELKER, C. V.**  
Backscatter measurements of sea ice with a helicopter-borne scatterometer  
[AD-A077614]  
p0098 N80-18542
- DELLANO, R.**  
Snow and ice mapping: Norwegian examples for run-off prediction  
p0105 N80-21816
- DEMASTER, D. P.**  
State of the art and needs of the earth platform  
p0060 A80-22405
- DESCHAMPS, P. Y.**  
An algorithm for remote sensing of water color from space  
p0097 A80-25342  
Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM)  
[E80-10057]  
p0099 N80-19585
- DETERING, R.**  
A digital terrain model for large surfaces and direct storage access  
p0083 N80-20681
- DEY, B.**  
The use of models for predicting ice floes in Baffin Bay  
p0094 A80-22434
- DIANA, E.**  
A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances  
p0094 A80-22417
- DIEZ P., J. A.**  
A methodology for a national coverage land use study by computer  
p0077 A80-25574
- DODGE, A. G.**  
Small forest cuttings mapped with Landsat digital data  
p0061 A80-22439
- DOERFFER, R.**  
Applications of a two-flow model for remote sensing of substances in water  
p0097 A80-25340
- DOOLEY, J. T.**  
Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring  
[NASA-TM-79268]  
p0091 N80-20787
- DOUGLAS, B. C.**  
Remote sensing of ocean circulation using a satellite-borne radar altimeter  
p0093 A80-22383
- DOYLE, M.**  
SMRR simulator radiative transfer calibration model. 1: Derivation  
[E80-10081]  
p0118 N80-19589
- DRIVER, J. M.**  
Stereosat - A new astrodynamics challenge  
[AIAA PAPER 80-0237]  
p0108 A80-22744
- DROLET, B.**  
Utilization of a portable thermograph in the Ministère des Terres et Forêts  
p0064 A80-24067
- DUBUISSON, B.**  
Compatibility of analytical plotters with digital imagery in the plotting of variable spaces  
p0110 A80-31980
- DUGGIN, M. J.**  
Assessment of the fertilizer requirement of improved pasture from remote sensing information  
p0066 A80-26315
- DUONG, N.**  
An approach to nonlinear mapping for pattern recognition  
p0116 A80-25592
- DUVERNOY, J.**  
Karhunen-Loeve analysis of multispectral data from landscapes  
p0075 A80-22138
- E**
- EGER, M. J. E.**  
Small forest cuttings mapped with Landsat digital data  
p0061 A80-22439
- EHLERT, D.**  
A survey of the geodetical work of the IFAG from 1952-1977  
The triangulation network in West Germany  
p0111 N80-20651
- EHRSBERGER, W.**  
Study for a project for a European high precision laser network  
p0084 N80-20704
- EIDENSHINK, J. C.**  
Remote sensing inputs to National Model Implementation Program for water resources quality improvement  
p0103 A80-27433
- EIDENSHINK, J. E.**  
Remote sensing applications to resource problems in South Dakota  
[E80-10086]  
p0122 N80-19593
- EL GHAWABY, M. A.**  
Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation  
p0081 A80-22509
- EL KASSAB, I. A.**  
Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation  
p0081 A80-22509
- EL RAKAIBY, M. M.**  
Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation  
p0081 A80-22509
- EL SHAZLY, E. M.**  
Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation  
p0081 A80-22509
- EL SHAZLY, M. M.**  
Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation  
p0081 A80-22509
- ELACHI, C.**  
Remote sensing data of SP mountain and SP lava flow in north-central Arizona  
p0088 A80-26316  
Observation of the Grand Canyon wall structure with an airborne imaging radar  
p0117 A80-26317
- ELEFAN, E. S.**  
Application of Landsat in evaluation of selected earthquake prone areas  
p0087 A80-22489
- ELIASON, E.**  
Digital image processing techniques of integrated images and non-image data sets  
p0107 A80-22401
- ELLYETT, C. D.**  
A calibration procedure for Fourier series thermal inertia models  
p0110 A80-30923
- EMORI, Y.**  
Extraction of soil information from a vegetated area  
p0065 A80-25584
- ENGEL, M. F.**  
A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing  
p0059 A80-22389
- ENSLIN, W. R.**  
An evaluation of Michigan land cover/use inventories derived from remote sensing - Characteristics and costs  
p0076 A80-22462
- ESTES, J. E.**  
Integration of remote sensing and geographic information systems  
p0075 A80-22403  
Analyzing accuracy attributes of Landsat and digital terrain tape data in the context of a digital geobase information system  
p0108 A80-25579  
An assessment of electromagnetic remote sensing systems for the detection of perched water tables  
p0103 A80-26787  
L-band radar sensing of soil moisture  
[NASA-TM-80628]  
p0068 N80-16404  
Textbooks and technical references for remote sensing  
p0122 N80-20014
- ESTES, R. H.**  
Spherical harmonic models of the core field  
p0084 N80-20727
- EVANS, D. D.**  
The relationship between ocean surface structure and the synthetic aperture radar imagery of ocean waves  
p0097 A80-28256
- EVANS, R. H.**  
Evidence for zonally-trapped propagating waves in the eastern Atlantic from satellite sea surface temperature observations  
p0096 A80-25336
- EVERETTE, J. M.**  
As-built design specifications of the LANDSAT imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices  
[E80-10077]  
p0111 N80-19586
- EVERITT, J. H.**  
Landsat-2 data for inventing rangelands in south Texas  
p0065 A80-25573
- EZRA, C. E.**  
An assessment of electromagnetic remote sensing systems for the detection of perched water tables  
p0103 A80-26787
- F**
- FAN, C.**  
Assessing soybean leaf area and leaf biomass by spectral measurements  
p0072 N80-20775
- FARR, T. G.**  
Remote sensing data of SP mountain and SP lava flow in north-central Arizona  
p0088 A80-26316  
Observation of the Grand Canyon wall structure with an airborne imaging radar  
p0117 A80-26317
- FABLER, F.**  
Thematic adaptive spatial filtering of Landsat landuse classification results  
p0075 A80-22444
- FAUST, N. L.**  
Georgia's operational Landsat processing system  
p0109 A80-25590
- FAVARD, J.-C.**  
CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite  
p0087 A80-22443  
The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources  
p0102 A80-24060
- FEIVESH, A. H.**  
Accuracy assessment in the Large Area Crop Inventory Experiment  
p0059 A80-22387
- FELSENTREGER, T. L.**  
Starlette orbit analyses for ocean tidal studies  
p0100 N80-20762
- FERGUSON, M.**  
Accuracy assessment in the Large Area Crop Inventory Experiment  
p0059 A80-22387

- FIELDER, G.**  
Satellite monitoring of sea surface pollution  
[E80-10062] p0098 N80-18512
- FISCHER, J. R.**  
The Massively Parallel Processor and its applications  
p0115 A80-22380
- FISH, E. B.**  
An evaluation of landscape units p0088 A80-27456
- FLEMING, M. D.**  
Machine processing of Landsat MSS data and DMA  
topographic data for forest cover type mapping  
p0065 A80-25597
- Digital processing of LANDSAT MSS and topographic  
data to improve capabilities for computerized mapping of  
forest cover types  
[E80-10041] p0068 N80-16391
- FLOWERDAY, A. D.**  
Use of low altitude aerial biosensing with color infrared  
photography as a crop management service  
p0067 A80-27437
- FOERSTNER, R.**  
The 25 years at the Institute for Applied Geodesy  
p0082 N80-20639
- FORD, G. E.**  
Geometric correction of satellite data using curvilinear  
features and vertical control points  
p0116 A80-22472
- A non-interactive approach to land use determination  
p0077 A80-25572
- FORSTER, B. C.**  
Urban residential ground cover using Landsat digital  
data  
p0077 A80-30925
- FOSTEL, H. F.**  
The use of Landsat multispectral data to derive land cover  
information for the location and quantification of non-point  
source water pollutants  
p0077 A80-25575
- FOSTER, J. L.**  
Multisensor analysis of hydrologic features in the Wind  
River Range, Wyoming with emphasis on the SEASAT  
SAR  
[E80-10083] p0105 N80-19591
- FOSTER, S. J.**  
A calibration procedure for Fourier series thermal inertia  
models  
p0110 A80-30923
- FOWLER, R.**  
Remote sensing applications to resource problems in  
South Dakota  
[E80-10086] p0122 N80-19593
- FOX, L., III**  
Using guided clustering techniques to analyze Landsat  
data for mapping forest land cover in northern California  
p0065 A80-25595
- FRASER, R. S.**  
A design study for an advanced ocean color scanner  
system  
p0097 A80-25346
- FRAYESSE, G.**  
Agrometeorological applications p0073 N80-21818
- FREY, M.**  
Global geology and geophysics using satellite-derived  
data  
p0090 N80-20733
- Comparative planetology/crustal evolution  
p0090 N80-20735
- Crustal deformation: Crustal dynamics project  
p0090 N80-20736
- FRIEDMAN, E.**  
Remote sensing of regional air pollution from satellites  
p0075 A80-22400
- FROSCH, R. A.**  
NASA policy issues p0121 A80-22379
- FROUIN, R.**  
Sea surface temperature of the coastal zones of France.  
Heat Capacity Mapping Mission (HCMM)  
[E80-10057] p0099 N80-19585
- FUCHIMOTO, M.**  
Urban environmental survey by remote sensing  
p0076 A80-22468
- FUHS, N.**  
An evaluation of several different classification schemes  
- Their parameters and performance  
p0061 A80-22453
- FUKUHARA, M.**  
Extraction of soil information from a vegetated area  
p0065 A80-25584
- FURTEK, R.**  
A laser-fluorosensor technique for water quality  
assessment  
p0101 A80-22399
- Airborne laser fluorosensing of surface water chlorophyll  
a  
[B80-113400] p0105 N80-20797
- G**
- GABORSKI, P. D.**  
Remote sensing of ocean circulation using a  
satellite-borne radar altimeter  
p0093 A80-22383
- GAGGINI, B.**  
Evaluation of registration, compression, and classification  
algorithms. Volume 2: Documentation  
[E80-10042] p0111 N80-16392
- GAGNON, H.**  
Remote sensing and the agricultural zoning of lands  
p0064 A80-24069
- GAUSMAN, H. W.**  
Plant cover, soil temperature, freeze, water stress, and  
evapotranspiration conditions  
[E80-10072] p0070 N80-18521
- GEHRING, D. G.**  
Landsat wildland mapping accuracy  
p0067 A80-30921
- GERBERMANN, A. H.**  
Landsat-2 data for inventorying rangelands in south  
Texas  
p0065 A80-25573
- GERVIN, J. C.**  
Wetland flow resistance determination using Landsat  
data  
p0103 A80-27431
- Improvements in lake water budget computations using  
Landsat data  
p0103 A80-27434
- GIGNAC, P.**  
Radiometric correction of topographic effects on Landsat  
images of forest lands  
p0063 A80-24064
- The utilization of a stereotransfereoscope and  
very-small-scale photography for the acquisition of forest  
maps at a scale of 1:20,000  
p0064 A80-24066
- GLOERSEN, P.**  
Arctic sea-ice variations from time-lapse passive  
microwave imagery  
p0096 A80-25333
- GLUSHKO, E. V.**  
Results of a preliminary complex geographic  
interpretation of multiregion survey data obtained by Soyuz  
22 in the joint USSR-GDR Raduga experiment  
p0077 A80-32275
- GOLIZDRA, G. IA.**  
Study of geological and geophysical manifestations of  
horizontal stresses in the crust based on satellite imagery  
p0088 A80-26727
- GONZALEZ, F. I.**  
The feasibility of measurement of ocean surface currents  
using synthetic aperture radar  
p0093 A80-22384
- GOOD, J.**  
As-built design specifications of the LANDSAT Imagery  
Verification and Extraction System (LIVES). Volume 1:  
Test and appendices  
[E80-10077] p0111 N80-19586
- GOODENOUGH, D. G.**  
The CCRS Image Analysis Processor  
p0115 A80-22381
- Correction of synthetic aperture radar and multispectral  
scanner data sets  
p0115 A80-22391
- GOODFELLOW, L. C.**  
New earth resource monitoring techniques  
p0076 A80-24074
- GORDON, H. R.**  
Atmospheric effects in the remote sensing of  
phytoplankton pigments  
p0097 A80-25345
- GORNITZ, V.**  
Detection of hydrothermal alteration with 24-channel  
multispectral scanner data and quantitative analyses of  
linear features, Monroe geothermal area, Utah  
p0115 A80-22425
- Geological/geophysical resource assessment  
p0090 N80-20725
- GOURLEY, S. F.**  
The CCRS Image Analysis Processor  
p0115 A80-22381
- GOWER, J. F. R.**  
Radar and ship observations of coastal sea surface  
roughness patterns in the Gulf of Georgia  
p0093 A80-22385
- Colloquium on Passive Radiometry of the Ocean, 6th,  
Patricia Bay, British Columbia, Canada, June 14-21, 1978.  
Proceedings. Parts 1, 2 & 3  
p0096 A80-25327
- Oceanographic implications of features in NOAA satellite  
visible imagery  
p0096 A80-25337
- GRABER, M. A.**  
Polar motion research  
p0085 N80-20755
- GRAFAREND, E.**  
Free Doppler network adjustment  
p0081 A80-24810
- GREEN, W. B.**  
Analysis of multiple imagery at Jet Propulsion  
Laboratory's Image Processing Laboratory  
p0110 A80-29978
- GREGG, T. W. D.**  
Forest stand classification in western Washington using  
Landsat and computer-based resource data  
p0062 A80-22497
- GREGORY, A. F.**  
The use of models for predicting ice floes in Baffin Bay  
p0094 A80-22434
- GREGORY, G. L.**  
Summary of aircraft results for 1978 southeastern  
Virginia urban plume measurement study of ozone, nitrogen  
oxides, and methane  
[NASA-TM-80146] p0078 N80-16575
- GRENON, A.**  
Analysis of numerical data handling systems in remote  
sensing  
p0108 A80-24073
- GROETSCH, H. P.**  
Production of color composites from multispectral data  
records  
p0119 N80-20712
- GUERRERO, D. R.**  
Application of Landsat in evaluation of selected  
earthquake prone areas  
p0087 A80-22489
- GUERTIN, F. E.**  
New earth resource monitoring techniques  
p0076 A80-24074
- The geometric correction of Landsat images at the Canada  
Centre for Remote Sensing  
p0109 A80-26311
- GUINDON, B.**  
Correction of synthetic aperture radar and multispectral  
scanner data sets  
p0115 A80-22391
- GUPTA, J.**  
Remote sensing of regional air pollution from satellites  
p0075 A80-22400
- GUSEMAN, L. F., JR.**  
AgRISTARS: A joint program for agriculture and  
resources inventory surveys through aerospace remote  
sensing. Development and evaluation of clustering  
procedures  
[E80-10079] p0070 N80-18526
- The easy remote sensing problem  
[REPT-20] p0070 N80-18528
- The Cramer-Rao lower bound as a criteria for evaluating a  
large data reduction system such as LACIE  
[REPT-21] p0070 N80-18529
- H**
- HAAS, G.**  
Geostationary and orbiting satellites applied to remote  
ocean buoy data acquisition  
p0093 A80-22406
- HAAS, R. H.**  
Determination of range biomass using Landsat  
p0060 A80-22414
- HABERAECKER, P.**  
Computation of a data structure for a topographic map  
using multispectral Landsat scenes  
p0108 A80-22511
- HAKE, G.**  
The production of photomaps from tidal flat areas  
p0083 N80-20682
- HALL, D. K.**  
LANDSAT digital analysis of the initial recovery of the  
Kokolik River tundra fire area, Alaska  
[E80-10080] p0071 N80-19588
- Multisensor analysis of hydrologic features in the Wind  
River Range, Wyoming with emphasis on the SEASAT  
SAR  
[E80-10083] p0105 N80-19591
- HAMAN, J. F.**  
Landsat wildland mapping accuracy  
p0067 A80-30921
- HAMMOND, D. L.**  
Gulf stream ground truth project - Results of the NRL  
airborne sensors  
p0095 A80-22941
- Spectral distortion inherent in airborne profilometer  
measurements of ocean wave heights  
p0095 A80-22942
- HANNAH, M. J.**  
Error detection and rectification in digital terrain  
models  
p0110 A80-27432
- HANUSCHAK, G.**  
Crop-area estimates from Landsat - Transition from  
research and development to timely results  
p0064 A80-25569
- HANUSCHAK, G. A.**  
Precision of crop-area estimates  
p0059 A80-22386
- HARALICK, R. M.**  
Multi-temporal classification of winter wheat using a  
growth state model  
p0064 A80-25571
- HARLAN, J. C.**  
Determination of range biomass using Landsat  
p0080 A80-22414
- Pasture/wheat surface temperature differences -  
Indicator of relative soil moisture differences  
p0065 A80-25582
- Dryland pasture and crop conditions as seen by HCMM  
[E80-10074] p0070 N80-18523
- HARROW, R. A.**  
Cartography with combined Landsat and navigational  
satellite data  
p0081 A80-22440
- HARTMANN, B.**  
Tests of laser induced fluorescence from algae at sea  
[FOA-C-30171-E1] p0099 N80-18678
- HASHIMOTO, S.**  
Microwave remote sensing technology for the marine  
oil pollution surveillance  
[REPT-202] p0100 N80-20786
- HAVENS, K. A.**  
Large Area Crop Inventory Experiment (LACIE).  
Evaluation of three-category classification  
[E80-10058] p0069 N80-18509
- HAWLEY, D. L.**  
Forest inventory of clearcuts utilizing remote sensing  
techniques  
p0061 A80-22473
- HAYASHI, S.**  
Extraction of soil information from a vegetated area  
p0065 A80-25584
- HAYDN, R.**  
Research project Mauretania: Satellites as development  
aids  
[NASA-TM-76064] p0078 N80-17120
- HECHINGER, E.**  
Measurement and mapping of the absolute surface  
temperature of water surfaces by remote sensing  
p0101 A80-22454
- HEDGES, D. A.**  
Assessment of the fertilizer requirement of improved  
pasture from remote sensing information  
p0066 A80-26315
- HEILMAN, J. L.**  
Thermography for estimating near-surface soil moisture  
under developing crop canopies  
p0067 A80-32518
- HCMM energy budget data as a model input for assessing  
regions of high potential groundwater pollution  
[E80-10075] p0105 N80-18524
- B-4**

- Remote sensing applications to resource problems in South Dakota [E80-10086] p0122 N80-19593
- HENDERSON, F. M.**  
Settlement detection with radar imagery p0077 A80-27430  
Effects of interpretation techniques on land-use mapping accuracy p0077 A80-27457
- HERNANDEZ V. M.**  
Applying contrast, filtering and smoothing techniques to Landsat images p0107 A80-22471
- HERNER, R. R.**  
Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data p0088 A80-25577
- HERTZ, E.**  
A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing p0059 A80-22389
- HERZ, R.**  
Spatial and temporal variations in lagoon and coastal processes of the southern Brazilian Coast p0095 A80-22495
- HIDAKA, T.**  
Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786
- HILL-ROWLEY, R.**  
An evaluation of Michigan land cover/use inventories derived from remote sensing - Characteristics and costs p0076 A80-22462
- HILL, J. D.**  
LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086
- HILL, J. M.**  
Impacts of land use on estuarine water quality p0101 A80-22398
- HIXSON, M.**  
An evaluation of several different classification schemes - Their parameters and performance p0061 A80-22453
- HIXSON, M. M.**  
Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach p0064 A80-25570
- HLAVKA, C. A.**  
Multi-temporal classification of winter wheat using a growth state model p0064 A80-25571
- HODGES, J.**  
Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392
- HOFER, R.**  
On the penetration of microwaves in snow and soil p0101 A80-22461  
Investigations on snow parameters by radiometry in the 3- to 60-mm wavelength region p0103 A80-24827
- HOFFER, R. M.**  
Machine processing of Landsat MSS data and DMA topographic data for forest cover type mapping p0065 A80-25597  
Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types [E80-10041] p0068 N80-16391  
Computer-aided processing of LANDSAT MSS data for classification of forestlands [E80-10043] p0068 N80-16393
- HOLBEN, B. N.**  
Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766  
Assessing soybean leaf area and leaf biomass by spectral measurements p0072 N80-20775
- HOLMES, Q. A.**  
Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506  
Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507
- HOLYER, R. J.**  
Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p0100 N80-20790
- HORD, R. M.**  
The suitability of the ILLIAC IV architecture for image processing p0107 A80-22382
- HORN, B. K. P.**  
Landsat MSS coordinate transformations p0116 A80-25567
- HORTON, C.**  
As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices [E80-10077] p0111 N80-19586
- HORVATH, R.**  
Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506  
Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507
- HOSOMURA, T.**  
Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431
- HOURANI, A.**  
Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454
- HOUSTON, A. G.**  
Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387
- HOWARD, J. F.**  
Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410
- HSU, E.**  
Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387
- HUDDLESTON, H. F.**  
Agricultural and resource assessment in Jamaica using an area sampling frame p0062 A80-22487
- HUGHES, B. A.**  
Radar and ship observations of coastal sea surface roughness patterns in the Gulf of Georgia p0093 A80-22385
- HUNDEMANN, A. S.**  
Tectonics, volume 2. Citations from the NTIS data base [PB80-804529] p0091 N80-21925
- HUYGEN, J.**  
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442
- I**
- IANVAREVA, L. F.**  
Crop identification using space photographs taken at different times /A study of the lower Volga Basin used as an example/ p0067 A80-32284
- ICHIKAWA, A.**  
Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis p0102 A80-24059
- IDBO, S. B.**  
Estimation of grain yields by remote sensing of crop senescence rates p0063 A80-23299
- IISAKA, J.**  
Marine pollution analysis in Tokyo Bay by Landsat 1 and 2 p0095 A80-22496  
Extraction of soil information from a vegetated area p0065 A80-25584  
Texture analysis by space filter and application to foresttype classification p0066 A80-25598
- INSCOE, O. J.**  
Landsat-D sensor data product generation p0110 A80-27428
- IRONS, J. R.**  
Surface mine monitoring p0091 N80-20764  
Linear array pushbroom radiometer data analysis p0119 N80-20784
- ITTEN, K. I.**  
Thematic adaptive spatial filtering of Landsat landuse classification results p0075 A80-22444
- J**
- JACKSON, M. J.**  
The elimination approach to monitoring urban growth from Landsat data p0076 A80-22492
- JACKSON, R. D.**  
Estimation of grain yields by remote sensing of crop senescence rates p0063 A80-23299
- JARA, R. S.**  
Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501
- JAYROE, R.**  
Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392
- JEPSEN, P. L.**  
Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978
- JESCH, R. L.**  
High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- JOHANNSEN, C. J.**  
Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576
- JOHANNSEN, T.**  
Automatic acquisition and processing of cartographic data p0112 N80-20656  
On precision in the gathering and production of cartographic data p0112 N80-20657  
Testing the accuracy of cartographic equipment: First results p0083 N80-20683
- JOHNSON, C.**  
GPS application to seismic oil exploration p0088 A80-25159
- JOHNSON, D. S.**  
Meteorological satellites: Status and outlook p0119 N80-21800
- JOHNSON, G. R.**  
Forest stand classification in western Washington using Landsat and computer-based resource data p0062 A80-22497
- JOHNSON, H. B.**  
California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568
- JOHNSON, L.**  
LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19588
- JOHNSON, R. B.**  
High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- JONES, R. G.**  
The geometric correction of Landsat images at the Canada Centre for Remote Sensing p0109 A80-26311
- JORDAN, L. E.**  
Georgia's operational Landsat processing system p0109 A80-25590
- JORDAN, S. K.**  
Spatial Gauss-Markov models of ocean currents p0095 A80-23286
- JUSTICE, C.**  
Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766
- JUSTICE, C. D.**  
An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508
- K**
- KAHLE, A. B.**  
Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651
- KAHN, W. D.**  
The spaceborne laser ranging system p0086 N80-20785
- KALENSKY, Z. D.**  
Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423
- KANDA, H.**  
Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis p0102 A80-24059
- KANEKO, T.**  
An interactive color display system for labelling crops p0066 A80-25600
- KANEMASU, E. T.**  
Estimated winter wheat yields from Landsat MSS using spectral techniques p0060 A80-22412
- KARPEN, J.**  
Field study of pollutant migration in the vicinity of a coastal front p0098 A80-28263
- KASISCHKE, E. S.**  
Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448
- KATO, Y.**  
Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786
- KATSAROS, K. B.**  
The aqueous thermal boundary layer p0096 A80-25334
- KAUSHIK, O. P.**  
Temporal study on Paddy /rice/ using X-band scatterometer p0061 A80-22438
- KAUTH, R. J.**  
Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506  
Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507
- KEITZ, E.**  
Remote sensing of regional air pollution from satellites p0075 A80-22400
- KEMMERER, A. J.**  
Remote sensing of living marine resources p0094 A80-22418
- KENNEY, J. E.**  
The Surface Contour Radar, a unique remote sensing instrument p0116 A80-26085  
A unique radio oceanographic radar [AD-A077364] p0099 N80-19332
- KERUT, E. G.**  
Geostationary and orbiting satellites applied to remote ocean buoy data acquisition p0093 A80-22406
- KHORRAM, S.**  
Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22490
- KIBLER, J.**  
Enhancement of remote sensing through microwave technology p0116 A80-25770
- KIEFER, R. W.**  
Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450

## KIM, H. H.

## KIM, H. H.

A design study for an advanced ocean color scanner system p0097 A80-25346

## KIMES, D. S.

Thermal anisotropy of vegetation canopies p0072 N80-20773

## KING, G.

Radar discrimination of crops p0060 A80-22424

## KING, H. E.

90 GHz radiometric imaging through clouds p0117 A80-26807

## KING, W. J.

Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data p0093 A80-21454

## KINSLER, M. C.

Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery p0069 N80-18510

Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-met data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525

## KIRCHHOFF, W.

Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511

## KIRSCHNER, F. R.

Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana p0065 A80-25583

## KIRSNER, D.

Terrain modeling and geometric corrections using the Spot satellite p0081 A80-22407

## KITCHO, C. A.

Optimum Landsat sun angles for extreme contrasts of terrain p0087 A80-22458

## KLEMAS, V.

Assessment of tidal wetland habitat and productivity p0094 A80-22416

## KLEUSBERG, A.

Free Doppler network adjustment p0081 A80-24810

## KLEWENO, D.

Crop-area estimates from Landsat - Transition from research and development to timely results p0064 A80-25569

## KLOOSTER, A.

The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384  
Synthetic aperture radar modeling of surface ocean waves p0093 A80-22411  
Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448

## KNIZHNIKOV, I. F.

Space photography and thematic mapping - A method for processing multichannel photography p0111 A80-32262

Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275

## KOHLM, M.

Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442

## KOLENKIEWICZ, R.

The SEASAT altimeter height bias using four Bermuda overflights p0086 N80-20758  
The effect of sea state on altimeter measurements p0119 N80-20759

## KOMAR, C. A.

Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410

## KONDRATEV, K. IA.

Possibilities of optimal planning of multipurpose survey from space p0121 A80-22432

## KONDRATOVA, I. I.

Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275

Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs p0067 A80-32283

## KONG, J. A.

Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360

## KOTOVA, T. V.

Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275

## KOVRIZHNYKH, L. A.

Method for the photometric interpretation of multispectral aerial photographs p0111 A80-32266

## KOZLOVA, E. K.

Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275

## KRAUTH, E.

Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511

## KRAVTSOVA, V. I.

Comparison of registograms in the microphotometric interpretation of multispectral photographs p0111 A80-32267

Application of automatic classification to the interpretation of arid and semi-arid landscapes of western Kazakhstan from Soyuz-12 photographs p0077 A80-32273

Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275

The use of multispectral photographs for soil cover studies p0067 A80-32280

Experiment on the complex interpretation of multispectral scanner aerial photographs of Bulgaria p0111 A80-32282

Crop identification using space photographs taken at different times / A study of the lower Volga Basin used as an example/ p0067 A80-32284

## KRITIKOS, G.

Computation of a data structure for a topographic map using multispectral Landsat scenes p0108 A80-22511

## KRUPP, B.

SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589

## KUECHLE, L. B.

State of the art and needs of the earth platform p0060 A80-22405

## KUMAR, R.

Classification of areas using pixel-by-pixel and sample classifiers p0077 A80-25601

## KUO, C. Y.

A regression technique for evaluation and quantification for water quality parameters from remote sensing data p0102 A80-22470

## KURIOKA, Y.

Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786

## L

## LA VIOLETTE, P. E.

Oceanographic implications of features in NOAA satellite visible imagery p0096 A80-25337

## LABOVITZ, M.

Geobotanical exploration p0090 N80-20724  
Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils p0072 N80-20776

## LABOVITZ, M. L.

Sources of variations in LANDSAT autocorrelation p0114 N80-20767

## LABUTINA, I. A.

Method for the photometric interpretation of multispectral aerial photographs p0111 A80-32266

Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275

Investigation of the state of cotton crops and the features of soil cover on the basis of multispectral aerial photographs p0067 A80-32283

## LAFORTUNE, R.

Landsat applications to land use mapping of the Cul de Sac Plain of Haiti p0076 A80-22479

## LAFRAMBOISE, P.

Fill-up of the LG 2 reservoir - Surveillance aided by Landsat images p0103 A80-24061

Vegetation mapping in the Caniapiscou-Koksoak corridor using the automatic classification of Landsat images p0063 A80-24063

## LAGRAVE, P.

Cartography and remote sensing p0117 A80-31998

## LAHODA, E. J.

Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410

## LAME, D. B.

Seasat gulf of Alaska workshop report [NASA-CR-162463] p0099 N80-18549

## LANGEL, R. A.

Spherical harmonic models of the core field p0084 N80-20727

Crustal anomaly representation p0084 N80-20728

## LAROCCA, A. J.

Statistical analysis of terrain and water (ice) backgrounds in a winter scene from northern Michigan [AD-A077554] p0078 N80-19598

Statistical analysis of terrain and water backgrounds in the vicinity of Port Huene, California [AD-A077025] p0078 N80-19599

## LARRIVEE, A.

Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064

## LAURIN, R.

Landsat applications to land use mapping of the Cul de Sac Plain of Haiti p0076 A80-22479

## LE TOAN, T.

A study of digitized radar images p0107 A80-22430

## LEAMER, R. W.

Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions [E80-10072] p0070 N80-18521

## LEDUC, S. K.

LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086

## LEE, D. C.

Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532

## LEGER, J.

Karhunen-Loeve analysis of multispectral data from landscapes p0075 A80-22138

## LELGEMANN, D.

A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640

## LENNINGTON, R. K.

Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery [E80-10059] p0069 N80-18510

## LERCH, F. J.

Gravity model development p0085 N80-20748  
Gravity model improvement for SEASAT p0085 N80-20749

## LESNICHAI, N. I.

Experience with the use of synthesized color images for the interpretation of agricultural objects p0067 A80-32270

## LEUNG, K. C.

A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596

## LEVASSEUR, J.-M.

Vegetation mapping in the Caniapiscou-Koksoak corridor using the automatic classification of Landsat images p0063 A80-24063

## LEVINSON, R. A.

Video processing of remote sensor data applied to uranium exploration in Wyoming [GJBX-171(79)] p0089 N80-19603

## LI, R.-M.

An approach to nonlinear mapping for pattern recognition p0116 A80-25592

## LIANG, T. Y.

Remote sensing of the sea around Singapore p0095 A80-22506

## LICHTNER, W.

Locational characteristics and the sequence of computer assisted processes of cartographic generalization p0083 N80-20685

## LIM, J. B. R.

Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489

## LINDIG, G.

Digital height model with ITEK correlator p0112 N80-20669

The problem of obtaining data for the Digital Height Model p0113 N80-20707

## LINK, S.

SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589

## LIU, H. S.

On the selection of station sites for observing strain streps and earthquake forerunners in California p0090 N80-20740

Global intra-plate volcanism p0091 N80-20744

Mantle convection and subcrustal stress p0085 N80-20752

## LODWICK, G. D.

Measuring ecological changes in multitemporal Landsat data using principal components p0076 A80-22452

## LOEFFLER, E.

Wombats detected from space p0063 A80-23296

## LOGAN, T. L.

Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486

## LORENZO, E. N.

Assessment of mangrove forest deterioration in Zamboanga Peninsula, Philippines using Landsat MSS data p0062 A80-22501

## LOWMAN, P. D.

Geophysical atlas p0090 N80-20734

Geodetic stability of the Green Bank, West Virginia VLBI site p0085 N80-20742

## LOWMAN, P. D., JR.

Comparative planetology/crustal evolution p0090 N80-20735

Crustal deformation: Crustal dynamics project p0090 N80-20736

Plate boundary deformation in California p0090 N80-20739

## LOWRY, R. T.

The ROS-580 Project p0116 A80-24075

## LUCHT, L. A. M.

Classification of areas using pixel-by-pixel and sample classifiers p0077 A80-25601

## LUEBBE, R.

Crop-area estimates from Landsat - Transition from research and development to timely results p0064 A80-25569

- LUMMAUX, J. C.**  
Production of small-scale maps and inventories using Landsat data p0081 A80-22503
- LUSE, J. D.**  
Use of satellite navigation by tuna seiners p0095 A80-25153
- LYNCH, T. J.**  
The Landsat-D Assessment System p0121 A80-22419
- LYON, J. G.**  
Remote sensing analyses of coastal wetland characteristics - The St. Clair flats, Michigan p0101 A80-22451
- LYONS, K. J.**  
Terrain evaluation for environmental inventory and impact assessment p0075 A80-22426
- LYZENGA, D. R.**  
Shallow-water reflectance modeling with applications to remote sensing of the ocean floor p0093 A80-22410  
Landsat bathymetric mapping by multitemporal processing p0094 A80-22464
- M**
- MA, C.**  
Investigation of crustal dynamics using VLBI p0090 N80-20737
- MACRITCHIE, S.**  
Different considerations in coastal mapping p0110 A80-30922
- MADISON, P. J.**  
An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands p0087 A80-22435
- MADURA, D. P.**  
Processing of multispectral thermal IR data for geologic application [NASA-CR-162682] p0089 N80-16651
- MAETZLER, C.**  
Investigations on snow parameters by radiometry in the 3- to 60-mm wavelength region p0103 A80-24827
- MAFFETT, A. L.**  
Synthetic aperture radar modeling of surface ocean waves p0093 A80-22411
- MALLA, W. A.**  
Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506  
Development of LANDSAT-based technology for crop inventories - Appendices [E80-10055] p0069 N80-18507
- MANLEY, J. E.**  
The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants p0077 A80-25575
- MANSO, A. P.**  
Classification of areas using pixel-by-pixel and sample classifiers p0077 A80-25601
- MARACCI, G.**  
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442
- MARCOLONGO, B.**  
Use of satellite imagery for the derivation of the hydrogeologic characteristics of a test area in semiarid climates p0105 N80-18545
- MARGULES, C.**  
Wombats detected from space p0063 A80-23296
- MARKHAM, B. L.**  
Thematic mapper versus multispectral scanner for crop monitoring p0072 N80-20778
- MARLENKO, N.**  
Study of the Argentine Pampa's lowland by means of interpretation of Landsat satellite information p0102 A80-22478
- MARQUINA, N. E.**  
Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery [E80-10059] p0069 N80-18510
- MARRS, R. W.**  
Video processing of remote sensor data applied to uranium exploration in Wyoming [GJBX-171(79)] p0089 N80-19603
- MARSH, J. G.**  
The gravity field in the central Pacific from satellite-to-satellite tracking and implications for mantle convection p0085 N80-20750  
Mean sea surface computation using GEOS-3 altimeter data p0099 N80-20760  
Starlette orbit analyses for ocean tidal studies p0100 N80-20762
- MASRY, S. E.**  
Different considerations in coastal mapping p0110 A80-30922
- MASUOKA, E.**  
Geobotanical exploration p0090 N80-20724  
Geological/geophysical resource assessment p0090 N80-20725
- MATHIS, J. J., JR.**  
Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane [NASA-TM-80146] p0078 N80-16575
- MATSON, M.**  
Application of HCMM data to soil moisture snow and estuarine current studies [E80-10068] p0104 N80-18517  
NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977 p0105 N80-19594
- MATZLER, C.**  
On the penetration of microwaves in snow and soil p0101 A80-22461
- MAURER, H. E.**  
Synthetic aperture radar/LANDSAT MSS image registration [NASA-RP-1039] p0111 N80-16405
- MAUSEL, P. W.**  
An evaluation of parametric and non-parametric algorithms for unsupervised classification of surface disturbed lands p0087 A80-22435  
Identification of surface-disturbed features through ISURSL non-parametric analysis of Landsat MSS data p0088 A80-25577
- MAYER, K. E.**  
Using guided clustering techniques to analyze Landsat data for mapping forest land cover in northern California p0065 A80-25595
- MAYHEW, M. A.**  
Regional Modeling: The Kentucky anomaly p0090 N80-20730  
Regional modeling: The Ivrea zone p0085 N80-20731  
Crustal structure and dynamics of southeastern US p0090 N80-20738
- MCADOO, D. C.**  
Interpretation of geoid anomalies in the vicinity of subduction zones p0090 N80-20732
- MCCARLEY, D.**  
As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices [E80-10077] p0111 N80-19586
- MCCLAIN, C. R.**  
Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941  
Spectral distortion inherent in airborne profilometer measurements of ocean wave heights p0095 A80-22942
- MCCLAIN, E. P.**  
Passive radiometry of the ocean from space - An overview p0096 A80-25328
- MCCRACKEN, K. G.**  
Heat Capacity Mapping Mission (HCMM) [E80-10066] p0079 N80-20721
- MCCUEN, R. H.**  
Relationship of physiography and snow area to stream discharge [E80-10046] p0104 N80-16396
- MCFARLAND, W. D.**  
Computer aided assessment of revegetation on surface mine land utilizing color infrared aerial photography p0065 A80-25576
- MCGINNIS, D. F.**  
Application of HCMM data to soil moisture snow and estuarine current studies [E80-10068] p0104 N80-18517  
NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977 p0105 N80-19594
- MCLEOD, R. G.**  
California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568  
Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978
- MCMACKEN, D. K.**  
Digital image processing techniques of integrated images and non-image data sets p0107 A80-22401
- MCQUILLAN, A. K.**  
An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- MEAD, G. D.**  
Magnetic field modeling and crustal studies p0084 N80-20726  
Spherical harmonic models of the core field p0084 N80-20727
- MEDINA, G., M.**  
A methodology for a national coverage land use study by computer p0077 A80-25574
- MEEHAN, K. T.**  
Geological/geophysical resource assessment p0090 N80-20725  
LANDSAT-D assessment system p0122 N80-20782
- MEGIER, J.**  
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442
- MENDONCA, F. J.**  
Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532
- MERRY, C. J.**  
The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah p0101 A80-22467
- MEYER, D. I.**  
Geometric correction of satellite data using curvilinear features and virtual control points p0116 A80-22472  
A non-interactive approach to land use determination p0077 A80-25572
- MICHEL, J. A.**  
Integrated survey of natural resources of the low lands of Bolivia using Landsat images p0108 A80-22488
- MILLER, C.**  
Crop-area estimates from Landsat - Transition from research and development to timely results p0064 A80-25569
- MILLER, C. L. P.**  
Study for the determination of geometric and spectral resolution requirements of optical imaging instruments for Earth resources satellites, volume 1 [CM/PR/3384-VOL-1] p0118 N80-17855
- MILLER, L. D.**  
Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables p0060 A80-22415
- MILLER, S. H.**  
Geologic application of thermal-inertia mapping from satellite [E80-10050] p0089 N80-16398
- MILLER, W. A.**  
A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing p0059 A80-22389
- MISHEVA, E. K.**  
Experiment on the complex interpretation of multispectral scanner aerial photographs of Bulgaria p0111 A80-32282
- MOCCIA, A.**  
An interactive software for plotting thematic maps p0111 A80-31996
- MONGET, J. M.**  
Analysis of remote sensing data in oceanography and climatology p0098 A80-31989  
Sea surface temperature anomaly mapping using the NOAA satellites p0100 N80-21819
- MONUKI, A. T.**  
Multi-sensor Landsat MSS registration p0115 A80-22390
- MOORE, D. G.**  
Thermography for estimating near-surface soil moisture under developing crop canopies p0067 A80-32518  
HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution [E80-10075] p0105 N80-18524
- MOORE, L. K.**  
An interactive color display system for labelling crops p0066 A80-25600
- MOORE, R. K.**  
Backscatter measurements of sea ice with a helicopter-borne scatterometer [AD-A077614] p0098 N80-18542
- MOORE, W. C.**  
Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423
- MOREL, A.**  
In-water and remote measurements of ocean color p0096 A80-25338
- MOREL, P.**  
European remote sensing activities p0121 A80-22377
- MORGAN, J. G.**  
The role of navigation satellites in oil exploration p0088 A80-25152
- MORGAN, K. M.**  
Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450
- MORLEY, L. W.**  
The Canadian remote sensing program p0121 A80-22378
- MORRIS-JONES, D. R.**  
Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450
- MORRISON, D. B.**  
Machine processing of remotely sensed data: Proceedings of the Fifth Annual Symposium, Purdue University, West Lafayette, Ind., June 27-29, 1979 p0108 A80-25561
- MOSHER, J. A.**  
Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978
- MROCYNSKI, R. P.**  
Forest resource information system [E80-10065] p0069 N80-18515
- MUENZER, U.**  
Digital processing of Landsat data of ice and snow areas at Vatnajökull, Iceland - A possibility for improved morphological tectonic interpretation p0087 A80-21839
- MUKAI, Y.**  
Estimation of primary production of vegetation in agricultural and forested areas using Landsat data p0061 A80-22456
- MUNIER, P.**  
What is an analytical plotter p0110 A80-31977
- MURAI, S.**  
Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431

**MURANO, K.**  
Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431

**MURILLO, L. I.**  
Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301

**MYERS, V. I.**  
Remote sensing applications to resource problems in South Dakota [E80-10086] p0122 N80-19593

## N

**NAEBAUER, M.**  
Study for a project for a European high precision laser network p0084 N80-20704

**NAKANO, H.**  
Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786

**NAMKEN, L. N.**  
Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions [E80-10072] p0070 N80-18521

**NARIGASAWA, K.**  
Urban environmental survey by remote sensing p0076 A80-22468

**NAZARE, C. V.**  
Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study [E80-10052] p0068 N80-16400

**NELSON, R.**  
Remote monitoring of forest cover conditions p0071 N80-20763

**NELSON, R. F.**  
Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types [E80-10041] p0068 N80-16391

Computer-aided processing of LANDSAT MSS data for classification of forestlands [E80-10043] p0068 N80-16393

**NENOTO, T.**  
Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786

**NEUBAUER, H. G.**  
Digital map bases from photogrammetric measurements p0113 N80-20671

**NEWCOMB, W. W.**  
Effects of wheat irrigation frequency on reflectance in selected spectral bands p0072 N80-20771  
Time of day effects on wheat reflectance in fifteen selected bands p0072 N80-20774

**NIEBER, J. L.**  
Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers [E80-10073] p0104 N80-18522

**NIELSEN, D.**  
A laser-fluorosensor technique for water quality assessment p0101 A80-22399

**NIELSEN, F.**  
Airborne laser fluorosensing of surface water chlorophyll a [PB80-113400] p0105 N80-20797

**NIEMZ, K.**  
Obtaining surface information for topography and town and country planning from remote sensing p0079 N80-20668

Possibilities of application of LANDSAT and Skylab data to small scale cartography p0084 N80-20710

**NIERO, M.**  
Classification of areas using pixel-by-pixel and sample classifiers p0077 A80-25601

**NIEVES, M.**  
As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices [E80-10077] p0111 N80-19586

**NIHOUS, G.**  
Sea surface temperature anomaly mapping using the NOAA satellites p0100 N80-21819

**NIKOLAEV, V. A.**  
Investigation of landscapes of the Turgay steppe using multispectral aerial photography p0078 A80-32278

**NIKOLAEVA, S. A.**  
The use of multispectral photographs for soil cover studies p0067 A80-32280

**NIXON, P. R.**  
Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions [E80-10072] p0070 N80-18521

**NJOKU, E. G.**  
Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMMR/ p0116 A80-25332

**NOTTARP, K.**  
A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640

**NOVAES, R. A.**  
Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532

## O

**OBERTHOLTZER, J. D.**  
Synthetic aperture radar/LANDSAT MSS image registration [NASA-RP-1039] p0111 N80-16405

**OCANNOR, J. T.**  
Digital image processing techniques of integrated images and non-image data sets p0107 A80-22401

**ODEGAARD, H.**  
Snow and ice mapping: Norwegian examples for run-off prediction p0105 N80-21816

**ODELL, P. L.**  
The Camer-Rao lower bound as a criteria for evaluating a large data reduction system such as LACIE [REPT-21] p0070 N80-18529

**OESTREM, G.**  
Snow and ice mapping: Norwegian examples for run-off prediction p0105 N80-21816

**OFFIELD, T. W.**  
Geologic application of thermal-inertia mapping from satellite [E80-10050] p0089 N80-16398

**OKOYE, F. E.**  
Land use/cover changes in the Kainji Reservoir area /Nigeria/ p0075 A80-22445

**OLACH, R.**  
Orthophoto techniques and photomaps p0082 N80-20666

**OMBAC, E. R.**  
Effects of tidal fluctuations on the spectral patterns of Landsat coral reef imageries p0095 A80-22466

**ONA, A. L.**  
Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394

**ONEIL, R. A.**  
Field performance of a laser fluorosensor for the detection of oil spills p0097 A80-27331

**ONSTOTT, R. G.**  
Backscatter measurements of sea ice with a helicopter-borne scatterometer [AD-A077614] p0098 N80-18542

**ORMSBY, J. P.**  
The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants p0077 A80-25575  
LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19588

**OZGA, M.**  
Crop-area estimates from Landsat - Transition from research and development to timely results p0064 A80-25569

## P

**PARASHAR, S.**  
Radar discrimination of crops p0060 A80-22424

**PARSONS, C. L.**  
The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676

**PATEL, J. S.**  
Backscatter measurements of sea ice with a helicopter-borne scatterometer [AD-A077614] p0098 N80-18542

**PATZ, B. W.**  
An image registration algorithm using sampled binary correlation p0108 A80-25580

**PAUL, C. K.**  
Transfer of remote sensing computer technology to the developing world - Case examples p0109 A80-25587

**PEARL, P. R.**  
IMAGENET - An image analysis network p0109 A80-25588

**PEEPLES, T. O.**  
Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0066 A80-26313

**PELLEGRIN, A.**  
Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454

**PETERHERYCH, S.**  
Oceanographic implications of features in NOAA satellite visible imagery p0096 A80-25337

**PETERSON, J.**  
Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392

**PETERSON, J. B.**  
Predictability of change in soil reflectance on wetting p0065 A80-25586

**PETERSON, R.**  
Oil and gas exploration by pattern recognition of lineament assemblages associated with wrench faults p0087 A80-22441

**PFROMMER, W. L.**  
Development, status, and goals of cartographic automation p0112 N80-20655

**PHINNEY, D. E.**  
Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-met data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525

Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587

**PIERSON, W. J.**  
Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407

**PILLAI, N. S.**  
Temporal study on Paddy /rice/ using X-band scatterometer p0061 A80-22438

**PINTER, P. J., JR.**  
Estimation of grain yields by remote sensing of crop senescence rates p0063 A80-23299

**PITTS, D. E.**  
Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387

**POKROVSKII, O. M.**  
Possibilities of optimal planning of multipurpose survey from space p0121 A80-22432

**POLCYN, F. C.**  
Landsat bathymetric mapping by multitemporal processing p0094 A80-22464

**PONOMAREVA, I. E.**  
Crop identification using space photographs taken at different times /A study of the lower Volga Basin used as an example/ p0067 A80-32284

**POPPIETON, J. E.**  
Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0066 A80-26313

**POTTER, J.**  
Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387

**POULAIN, J.**  
Production of small-scale maps and inventories using Landsat data p0081 A80-22503

**POULTON, C. E.**  
The reduction of remote sensing data by visual means p0118 N80-20017

**PRATT, D. A.**  
A calibration procedure for Fourier series thermal inertia models p0110 A80-30923

**PRESSMAN, A. E.**  
Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p0100 N80-20790

**PRICE, J. C.**  
Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420

**PUNONGBAYAN, R. S.**  
Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489

**PUTNEY, B. H.**  
Geodyn program systems development p0085 N80-20747

## Q

**QUANN, J. J.**  
The Landsat-D Assessment System p0121 A80-22419

## R

**RABII, H. A.**  
An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon p0068 N80-18500

**RADER, M.**  
Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387

**RADO, B. Q.**  
Georgia's operational Landsat processing system p0109 A80-25590

**RAMSEY, B.**  
Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454

**RAMOS, E. G.**  
Application of Landsat in evaluation of selected earthquake prone areas p0087 A80-22489

**RAMSEIER, R. O.**  
Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333

**RASE, W. D.**  
Computer-assisted thematic mapping for federal planning p0083 N80-20686

**RAYNER, D. M.**  
Field performance of a laser fluorosensor for the detection of oil spills p0097 A80-27331

**REGINATO, R. J.**  
Estimation of grain yields by remote sensing of crop senescence rates p0063 A80-23299

**REGISTER, D. T.**  
Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394

## S

- Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery [E80-10059] p0069 N80-18510
- REIGBER, C.**  
The RGST chain program for the determination of potential coefficients and station coordinates p0084 N80-20702
- REINIGER, P.**  
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442
- REUTOV, E. I.**  
The use of microwave radiometry for the operational mapping of soil moisture p0067 A80-32281
- RIBE, R. L.**  
Wave sensor survey [PB80-118581] p0100 N80-21010
- RICH, E. I.**  
HCM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516
- RICHARDSON, A. J.**  
Landsat-2 data for inventorying rangelands in south Texas p0065 A80-25573  
Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions p0070 N80-18521
- RICHARDSON, P. L.**  
Gulf stream ring trajectories p0095 A80-24546
- RICHTER, B.**  
Free Doppler network adjustment p0081 A80-24810  
A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640
- RIFMAN, S. S.**  
Multi-sensor Landsat MSS registration p0115 A80-22390
- RIOS, A.**  
As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices [E80-10077] p0111 N80-19586
- RIVERA R., S. A.**  
A methodology for a national coverage land use study by computer p0077 A80-25574
- ROBERT, D.**  
New earth resource monitoring techniques p0076 A80-24074
- ROBINSON, B. F.**  
Extension of laboratory-measured soil spectra to field conditions p0065 A80-25585  
Predictability of change in soil reflectance on wetting p0065 A80-25586
- ROBOCK, A.**  
The seasonal cycle of snow cover, sea ice and surface albedo p0111 A80-32101
- ROCHON, G.**  
Remote sensing and water resources in Quebec p0102 A80-24054  
Radiometric correction of topographic effects on Landsat images of forest lands p0063 A80-24064
- RODRIGUEZ BEJARANO, D.**  
Land use/cover changes in the Kainji Reservoir area /Nigeria/ p0075 A80-22445
- ROHDE, W. G.**  
A stratified-cluster sampling procedure applied to a wildland vegetation inventory using remote sensing p0059 A80-22389
- ROMEU NEDWED, C.**  
The ocean observed with microwaves p0093 A80-21963
- ROSENTHAL, W. D.**  
Pasture/wheat surface temperature differences - Indicator of relative soil moisture differences p0065 A80-25582  
Dryland pasture and crop conditions as seen by HCM [E80-10074] p0070 N80-18523
- ROUFOSSE, M. C.**  
Study of oceanic lithosphere using GEOS-3 radar altimeter data [AD-A077344] p0099 N80-18673
- RUBINCAM, D. P.**  
Unexplained Lagoes perturbation p0085 N80-20751  
Information theory density distribution p0085 N80-20753
- RUDD, R. D.**  
Textbooks and technical references for remote sensing p0122 N80-20014
- RUFENACH, C. L.**  
The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384
- RUNDQUIST, D. C.**  
A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-26750
- RUSSELL, R.**  
Agricultural and resource assessment in Jamaica using an area sampling frame p0062 A80-22487
- RYAN, J.**  
Radar discrimination of crops p0060 A80-22424
- RYAN, J. W.**  
Investigation of crustal dynamics using VLBI p0090 N80-20737
- SAFIANOV, G. A.**  
Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275
- SAILOR, R. V.**  
Preliminary estimates of the resolution capability of the SEASAT radar altimeter p0117 A80-29163
- SAITOH, S.-I.**  
Marine pollution analysis in Tokyo Bay by Landsat 1 and 2 p0095 A80-22496
- SAKAMOTO, C. M.**  
LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086
- SAKATA, T.**  
Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431
- SALISHCHEV, K. A.**  
Space photography and thematic mapping - A method for processing multichannel photography p0111 A80-32262  
Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Raduga experiment p0077 A80-32275
- SALMAN, A. B.**  
Mapping of Sinai Peninsula by Landsat-1 satellite imagery interpretation p0081 A80-22509
- SALOMONSON, V. V.**  
Data acquisition and projected applications of the observations from Landsat-D p0117 A80-27427  
L-band radar sensing of soil moisture [NASA-TM-80628] p0068 N80-16404
- SAMSON, S. A.**  
A Landsat digital examination of Khumbu glacier, Nepal p0109 A80-26750
- SANCHEZ, B. V.**  
The enhanced nodal equilibrium ocean tide and polar motion p0085 N80-20754
- SANTIAGO BARROS, M. S.**  
Classification of areas using pixel-by-pixel and sample classifiers p0077 A80-25601
- SAPP, C. D.**  
Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600
- SATZINGER, W.**  
Cartography applications and research p0112 N80-20654
- SCARPACE, F. L.**  
Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450
- SCHABER, G. G.**  
Remote sensing data of SP mountain and SP lava flow in north-central Arizona p0088 A80-26316
- SCHAEFER, D. H.**  
The Massively Parallel Processor and its applications p0115 A80-22380
- SCHANDA, E.**  
On the penetration of microwaves in snow and soil p0101 A80-22461
- SCHITTENHELM, R.**  
On the displacement problem as part of a process in generalizing topographical maps. Proposition for hierarchical order and the search for EDP assisted solutions p0082 N80-20675
- SCHLUETER, W.**  
The EROS-Doppler Observation Campaign (EROS-DOC) p0119 N80-20697
- SCHMER, F. A.**  
Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433  
Remote sensing applications to resource problems in South Dakota [E80-10086] p0122 N80-19593
- SCHMIDT-FALKENBERG, H.**  
Aerial and space-borne photographic maps p0082 N80-20667  
Twenty-five years of aerial photography by the Institute of Applied Geodesy p0083 N80-20676  
Contributions to the creation of a conclusive system of concepts of photogrammetry and aerial photograph cartography p0119 N80-20706
- SCHMUGGE, T.**  
Effect of soil texture on the microwave emission from soils [NASA-TM-80632] p0070 N80-18530
- SCHMUGGE, T. J.**  
Microwave approaches in hydrology p0104 A80-30920
- SCHNETZLER, R. C. C.**  
Multispectral linear array sensor development p0119 N80-20783
- SCHOLZ, D.**  
An evaluation of several different classification schemes - Their parameters and performance p0061 A80-22453
- SCHRAMM, M.**  
Research project Mauretania: Satellites as development aids [NASA-TM-76064] p0078 N80-17120
- SCHROEDER, M.**  
Remote sensing of ocean waters p0098 A80-29389
- SCHRUMPF, B. J.**  
The reduction of remote sensing data by visual means p0118 N80-20017
- SCHUERER, K.**  
The future of analytical evaluation equipment p0112 N80-20670  
Setting data from multistage analytical orientation p0119 N80-20709
- SCHULZ, B. S.**  
Tasks and possibilities of digital image data processing in photogrammetry p0113 N80-20672  
A method for examining relationships between multispectral data p0113 N80-20708  
On the writing accuracy of the reproduction unit of the Optronics System P1700 p0113 N80-20711
- SCHUTT, J. B.**  
Plant stress and relationships to spectral responses p0071 N80-20769
- SCHWARZ, G.**  
Near-surface bathymetry system p0104 A80-27438
- SCOTT, A. J.**  
Forest statistics by ARIES classification of Landsat multispectral images in northern Canada p0060 A80-22423
- SEBACHER, D. I.**  
Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane [NASA-TM-80146] p0078 N80-16575
- SEEGER, H.**  
A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640  
The EROS station Wetzell p0082 N80-20641  
The EROS-Doppler Observation Campaign (EROS-DOC) p0119 N80-20697
- SELZER, R. H.**  
Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978
- SEME, F.**  
Landsat applications to land use mapping of the Cul de Sac Plain of Haiti p0076 A80-22479
- SESTAK, M. L.**  
Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-net data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525
- SEUBERT, C. E.**  
Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana p0065 A80-25583
- SHAHIN, A.**  
A study of digitized radar images p0107 A80-22430
- SHAMSUDDIN, S. D.**  
National land use and settlement assessment - An areal data base model for Landsat information for Bangladesh p0076 A80-22493
- SHARLAI, T. G.**  
Investigation of landscapes of the Turgay steppe using multispectral aerial photography p0078 A80-32278
- SHARP, J. M.**  
Guidelines for evaluating remote sensing demonstration projects p0121 A80-22455
- SHELTON, R. L.**  
Integration of remote sensing and geographic information systems p0075 A80-22403
- SHERMAN, G. N.**  
Spatial Gauss-Markov models of ocean currents p0095 A80-23286
- SHERMAN, J. W., III**  
Seasat gulf of Alaska workshop report [NASA-CR-162463] p0099 N80-18549
- SHIM, S. F.**  
Wetland flow resistance determination using Landsat data p0103 A80-27431  
Improvements in lake water budget computations using Landsat data p0103 A80-27434
- SHIMABUKURO, Y. E.**  
Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532
- SHIMODA, H.**  
Land cover classification of Sagami River basin using Landsat data - An operational research p0075 A80-22431
- SHIN, R.**  
Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360
- SHIUE, J. C.**  
Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360
- SHORTWELL, C. P.**  
Multi-sensor Landsat MSS registration p0115 A80-22390
- SHUCHMAN, R. A.**  
The feasibility of measurement of ocean surface currents using synthetic aperture radar p0093 A80-22384  
Synthetic aperture radar modeling of surface ocean waves p0093 A80-22411  
The use of remote sensing in the determination of beach sand parameters p0075 A80-22422

- Verification of synthetic aperture radar focusing algorithms on ocean waves p0094 A80-22448
- SHUEY, A. G.**  
Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0066 A80-26313
- SHULESHKINA, E. A.**  
Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region p0089 A80-32277
- SHUTKO, A. M.**  
Research into the measurement of sea state, sea temperature and salinity by means of microwave radiometry p0096 A80-25330  
The use of microwave radiometry for the operational mapping of soil moisture p0067 A80-32281
- SIEGEL, H. J.**  
A method for classifying multispectral remote sensing data using context p0109 A80-25594
- SIEGRIST, A.**  
Geobotanical exploration p0090 N80-20724
- SIEVERS, J.**  
On spectral signatures in central perspective representation p0112 N80-20665
- SIGMAN, R.**  
Crop-area estimates from Landsat - Transition from research and development to timely results p0064 A80-25569
- SIGMAN, R. S.**  
Area estimates by Landsat - Kansas 1976 winter wheat p0062 A80-22500
- SIMARD, G.**  
Color infrared aerial photography for the assessment of mortality in the wake of the spruce budworm p0064 A80-24065
- SIMONETT, D. S.**  
L-band radar sensing of soil moisture [NASA-TM-80628] p0068 N80-16404
- SIMONS, D. B.**  
An approach to nonlinear mapping for pattern recognition p0116 A80-25592
- SINIFF, D. B.**  
State of the art and needs of the earth platform p0060 A80-22405
- SIVAPRASAD, S.**  
Temporal study on Paddy /rice/ using X-band scatterometer p0081 A80-22438
- SIVERTSON, W. E., JR.**  
Radar target for remotely sensing hydrological phenomena [NASA-CASE-LAR-12344-1] p0104 N80-18498
- SKARIATIN, V. D.**  
The use of different-scale multispectral space photographs of the earth for the geological study of lands with oil and natural gas p0088 A80-32276  
Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region p0089 A80-32277
- SMART, R. T.**  
An interactive color display system for labelling crops p0066 A80-25600
- SMIT, M. K.**  
Preliminary results of an investigation into the potential application of X-band SLR images for crop-type inventory purposes p0059 A80-21446
- SMITH, B. W.**  
A method for classifying multispectral remote sensing data using context p0109 A80-25594
- SMITH, D. E.**  
Crustal motion measurements in California (SAFE) p0091 N80-20746  
A determination of GM p0086 N80-20756  
Polar motion and Earth rotation results from Lageos p0086 N80-20757
- SMITH, G. S.**  
Sampling techniques to monitor forest area change p0061 A80-22474
- SMITH, P. L. JR.**  
Landsat-D data acquisition and processing p0108 A80-25563
- SNELL, W. W.**  
Monitoring man's impact in the coastal zone p0104 A80-27436
- SOER, G. J. R.**  
Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures p0063 A80-23295
- SOHA, J. M.**  
Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651
- SOKOLOVA, V. B.**  
Complex geological interpretation of multispectral scanner photographs of the Ilmen Lake region p0089 A80-32277
- SOLTAU, G.**  
A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640  
Elaborating an astronomical longitude system p0082 N80-20647  
Determination of azimuth and astronomical coordinates p0082 N80-20648  
The EROS-Doppler Observation Campaign (EROS-DOC) p0119 N80-20697
- SPRIDONOV, KH. B.**  
Experiment on the complex interpretation of multispectral scanner aerial photographs of Bulgaria p0111 A80-32282
- SPISZ, E. W.**  
Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787
- STAETTER, R.**  
Remote sensing of ocean waters p0098 A80-29389
- STAUFFER, M. L.**  
A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596
- STECH, J. L.**  
Coastal water temperatures in the southeastern portion of Brazil from oceanographic data and NOAA satellite observations, volume 1 [INPE-1569-RPE/070] p0099 N80-18671
- STEINVALL, O.**  
Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18678
- STEPPE, M. C.**  
High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- STEVENSON, D. K.**  
The suitability of the ILLIAC IV architecture for image processing p0107 A80-22382
- STONER, E. R.**  
Extension of laboratory-measured soil spectra to field conditions p0065 A80-25585
- STOUT, K.**  
Impacts of land use on estuarine water quality p0101 A80-22398
- STOW, D. A.**  
Analyzing accuracy attributes of Landsat and digital terrain tape data in the context of a digital geobase information system p0108 A80-25579
- STRAHLER, A. H.**  
Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486
- STROMBERG, W. D.**  
Integration of Landsat, Seasat, and other geo-data sources p0107 A80-22392  
Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978
- STROME, W. M.**  
The CCRS Image Analysis Processor p0115 A80-22381  
An evaluation of Landsat-D for Canadian applications p0060 A80-22437
- STROMMEN, N. D.**  
LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086
- STRONG, D.**  
Radar discrimination of crops p0060 A80-22424
- STRONG, J. P.**  
The Massively Parallel Processor and its applications p0115 A80-22380
- STRONG, R.**  
Altitude characteristics of selected air quality analyzers [NASA-CR-159165] p0078 N80-16578
- STUFF, R. G.**  
The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413
- STURM, B.**  
A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances p0094 A80-22417
- STURN, B.**  
Biological applications including pollution monitoring p0100 N80-21821
- SUITS, G. H.**  
The use of remote sensing in the determination of beach sand parameters p0075 A80-22422  
A low cost classification algorithm for developing countries p0108 A80-22484
- SWAIN, P. H.**  
A method for classifying multispectral remote sensing data using context p0109 A80-25594
- SWEET, H. C.**  
Vegetation of central Florida's east coast - The distribution of six vegetational complexes of Merritt Island and Cape Canaveral Peninsula p0066 A80-26313
- SWIFT, C. T.**  
Passive microwave remote sensing of the ocean - A review p0096 A80-25329
- SZEKIELDA, K. H.**  
Scales oceanic parameters as monitored from space p0097 A80-26751
- TAMAI, N.**  
Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis p0102 A80-24059
- TANAKA, S.**  
Hydraulic analysis of urbanized river by aerial MSS data - A case study on the Tama River through the Tokyo metropolis p0102 A80-24059
- TANNER, C. E.**  
Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803
- TANRE, D.**  
An algorithm for remote sensing of water color from space p0092 A80-25342
- TARDIN, A. T.**  
Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532
- TASSAN, S.**  
A sensitivity analysis for the retrieval of chlorophyll contents in the sea from remotely sensed radiances p0094 A80-22417
- TASSONE, G.**  
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data p0115 A80-22442
- TAYLOR, P. T.**  
Magnetic field modeling and crustal studies p0084 N80-20726  
Anomaly verification: Comparison of Pogo magnetic data with aeromagnetic measurements p0085 N80-20729
- TEILLET, P. M.**  
Correction of synthetic aperture radar and multispectral scanner data sets p0115 A80-22391
- TELFER, D. J.**  
Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512
- TENDAM, I. M.**  
Machine processing of remotely sensed data: Proceedings of the Fifth Annual Symposium, Purdue University, West Lafayette, Ind., June 27-29, 1979 p0108 A80-25561
- TERRISSON, J. C.**  
Systems of image data acquisition and digitization p0117 A80-31987
- TESSAR, P. A.**  
NCSL remote sensing project [E80-10053] p0122 N80-16401
- THOMAS, H. H.**  
Regional Modeling: The Kentucky anomaly p0090 N80-20730  
Regional modeling: The Ivrea zone p0085 N80-20731
- THOMAS, I. L.**  
Mapping New Zealand's moisture rich soils from Landsat p0061 A80-22485
- THOMAS, R. W.**  
Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435
- THOMPSON, L. L.**  
A design study for an advanced ocean color scanner system p0097 A80-25346
- THOMPSON, K. P. B.**  
The ROS-580 Project p0116 A80-24075
- THONUS, M.**  
Cartography and remote sensing p0117 A80-31998
- TINNEY, L.**  
An assessment of electromagnetic remote sensing systems for the detection of perched water tables p0103 A80-26787
- TINNEY, L. R.**  
Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435
- TODD, W. J.**  
Landsat wildland mapping accuracy p0067 A80-30921
- TOKERUD, R. E.**  
Advances in earth resources management p0059 A80-21896
- TOLL, D.**  
NASA-census Application Pilot Test (APT) and urban area delineation studies p0079 N80-20765
- TOM, C. H.**  
Forest site productivity mapping in the coniferous forests of Colorado with Landsat imagery and landscape variables p0060 A80-22415
- TOMMERDAHL, J. B.**  
Altitude characteristics of selected air quality analyzers [NASA-CR-159165] p0078 N80-16578
- TOWNSEND, W. F.**  
An initial assessment of the performance achieved by the Seasat-1 radar altimeter [NASA-TM-73279] p0118 N80-20564
- TOWNSHEND, J. R. G.**  
An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508
- TRAUTMANN, J.**  
Measurement and mapping of the absolute surface temperature of water surfaces by remote sensing p0101 A80-22454
- TRENCHARD, M. H.**  
Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-net data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525

- TRIPODI, C.**  
An interactive software for plotting thematic maps  
p0111 A80-31996
- TRIVEDI, M. M.**  
Feature selection and classifier design with applications to remote sensing of mule deer  
p0069 N80-18505
- TSANG, L.**  
Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain  
p0081 N80-19360
- TSYPINA, E. M.**  
The use of ordinary and multispectral aerial and space photographs for the mapping of population centers  
p0078 A80-32285
- TUBBS, J. D.**  
Classification results using specially correlated Landsat data  
p0107 A80-22481
- TUCKER, C. J.**  
A spectral method for determining the percentage of green herbage material in clipped samples  
p0066 A80-26318  
A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass  
[E80-10082] p0071 N80-19590  
Remote sensing of leaf water content in the near infrared  
p0071 N80-20768  
Monitoring drought in Colorado with LANDSAT MSS  
p0071 N80-20770  
Assessing soybean leaf area and leaf biomass by spectral measurements  
p0072 N80-20775  
Radiometric resolution for monitoring vegetation: How many bits are needed?  
p0072 N80-20777  
A spectral method for determining the percentage of green herbage material in clipped samples  
p0073 N80-20780
- TUCKER, J.**  
LANDSAT-D assessment system  
p0122 N80-20782
- U**
- UHRIG, H.**  
Graphic production of maps on screens or photocomposition devices  
p0112 N80-20659  
Experiences gathered with a symbol disk with interchangeable symbols  
p0083 N80-20688
- ULIANA, E. A.**  
The Surface Contour Radar, a unique remote sensing instrument  
p0116 A80-26085
- V**
- VACCARI, C.**  
Use of satellite imagery for the derivation of the hydrogeologic characteristics of a test area in semiarid climates  
p0105 N80-18545
- VAN DER PIEPEN, H.**  
Remote sensing of ocean waters  
p0098 A80-29389
- VENKATARAMANAN, D.**  
Some application of Landsat imagery interpretation for petroleum targeting in India  
p0087 A80-22433
- VERGER, F.**  
Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM)  
[E80-10057] p0099 N80-19585
- VETRELLA, S.**  
An interactive software for plotting thematic maps  
p0111 A80-31996
- VICKERY, P. J.**  
Assessment of the fertilizer requirement of improved pasture from remote sensing information  
p0066 A80-26315
- VIELLEFOSSE, M.**  
The measurement of hourly variations in earth temperature and albedo by satellite - Application to the remote sensing of water resources  
p0102 A80-24060
- VIELLEFOSSE, M.**  
CITHARE - Thermal inertia and humidity cartography over Africa by geostationary satellite  
p0087 A80-22443
- VILLAGRA, H. M. I.**  
Coastal water temperatures in the southeastern portion of Brazil from oceanographic data and NOAA satellite observations, volume 1  
[INPE-1569-RPE/070] p0099 N80-18671
- VINCENT, D. K.**  
Cartography with combined Landsat and navigational satellite data  
p0081 A80-22440
- VINCENT, R. K.**  
Cartography with combined Landsat and navigational satellite data  
p0081 A80-22440
- VINOGRADOV, B. V.**  
Aspects of the spaceborne remote sensing of the earth  
p0117 A80-31121
- VIOLLIER, M.**  
Enhancement of Landsat imagery for the monitoring of coastal waters Application to the southern part of the North Sea  
p0094 A80-22449  
An algorithm for remote sensing of water color from space  
p0097 A80-25342
- VONG, V. K.**  
Remote sensing of the sea around Singapore  
p0095 A80-22506
- VORONINA, A. F.**  
Investigation of multispectral space photographs for the construction of a landscape map of the Mangyshlak and Buzachi peninsulas  
p0111 A80-32279
- VOSKRESENSKII, S. S.**  
Results of a preliminary complex geographic interpretation of multiregion survey data obtained by Soyuz 22 in the joint USSR-GDR Ruduga experiment  
p0077 A80-32275
- VUILLAUME, Y.**  
Satellite contribution to the study of the physical properties of soils. Utilization in the water and agricultural domains  
p0073 N80-21817
- VUKOVICH, F. M.**  
Some aspects of the oceanography of the Gulf of Mexico using satellite and in situ data  
p0093 A80-21454
- W**
- WADDELL, E.**  
Field study of pollutant migration in the vicinity of a coastal front  
p0098 A80-28263
- WAGNER, H. L.**  
A low cost classification algorithm for developing countries  
p0108 A80-22484
- WALL, S. L.**  
Landsat-based multiphase estimation of California's irrigated lands  
p0067 A80-27435
- WALLGREN, K. R.**  
The Massively Parallel Processor and its applications  
p0115 A80-22380
- WALSH, E. J.**  
The Surface Contour Radar, a unique remote sensing instrument  
p0116 A80-26085  
A unique radio oceanographic radar  
[AD-A077364] p0099 N80-19332
- WALSH, S. J.**  
Coniferous tree species mapping using Landsat data  
p0062 A80-23294
- WARD, P.**  
GPS application to seismic oil exploration  
p0088 A80-25159
- WASILEWSKI, P. J.**  
Regional Modeling: The Kentucky anomaly  
p0090 N80-20730  
Regional modeling: The Ivrea zone  
p0085 N80-20731
- WATSON, K.**  
Geologic application of thermal-inertia mapping from satellite  
[E80-10050] p0089 N80-16398
- WEBB, W. C.**  
Landsat-D data acquisition and processing  
p0108 A80-25563
- WEBER, W.**  
The data bank in the cartographic automation system  
p0082 N80-20660  
The international world map 1:1,000,000 (IWK)  
p0079 N80-20663
- WEBSTER, W. J., JR.**  
GSFC site stability  
p0085 N80-20741  
Geodetic stability of the Green Bank, West Virginia VLBI site  
p0085 N80-20742  
Development of A seismic data collection platform  
p0091 N80-20745
- WEHDE, M. E.**  
Spatial quantification of maps or images - Cell size or pixel size implications  
p0110 A80-27429
- WEILL, G.**  
SPOT - First French remote sensing satellite geometrical performance  
p0121 A80-22429
- WEISMILLER, R. A.**  
Mapping and estimating areal extent of severely eroded soils of selected sites in northern Indiana  
p0065 A80-25583  
Extension of laboratory-measured soil spectra to field conditions  
p0065 A80-25585
- WHARTON, S.**  
Remote monitoring of forest cover conditions  
p0071 N80-20763  
NASA-census Application Pilot Test (APT) and urban area delineation studies  
p0079 N80-20765  
Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain  
p0114 N80-20786  
Linear array pushbroom radiometer data analysis  
p0119 N80-20784
- WHITE, J. H.**  
Altitude characteristics of selected air quality analyzers  
[NASA-CR-159165] p0078 N80-16578
- WHITLEY, S. L.**  
A system for processing Landsat and other georeferenced data for resource management applications  
p0109 A80-25589
- WHITLOCK, C. H.**  
A regression technique for evaluation and quantification for water quality parameters from remote sensing data  
p0102 A80-22470
- WIDEN, A.**  
Tests of laser induced fluorescence from algae at sea  
[FOA-C-30171-E1] p0099 N80-18678
- WIEGAND, C. L.**  
Landsat-2 data for inventorying rangelands in south Texas  
p0065 A80-25573
- Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions  
[E80-10072] p0070 N80-18521
- WIESNET, D. R.**  
Application of HCMM data to soil moisture snow and estuarine current studies  
[E80-10068] p0104 N80-18517  
NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977  
p0105 N80-19594
- WILKERSON, J. C.**  
Seasat gulf of Alaska workshop report  
[NASA-CR-162463] p0099 N80-18549
- WILLIAMS, D.**  
Remote monitoring of forest cover conditions  
p0071 N80-20763  
LANDSAT-D assessment system  
p0122 N80-20782
- WILLIAMS, D. F.**  
An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy  
p0081 A80-22508
- WILLIAMS, D. H.**  
Computer recognition of citrus infestations  
p0066 A80-25599
- WILLIAMS, D. L.**  
A forester's look at the application of image manipulation techniques to multitemporal Landsat data  
p0065 A80-25596  
Data acquisition and projected applications of the observations from Landsat-D  
p0117 A80-27427
- WILLIAMSON, L. E.**  
Satellite calibration data, annual data report  
[AD-A075602] p0090 N80-20301
- WILSKI, I.**  
Map projection change: Some programs for the transformation of the contents of available maps according to different map projections  
p0084 N80-20690
- WILSON, D. A.**  
Forest statistics by ARIES classification of Landsat multispectral images in northern Canada  
p0060 A80-22423
- WILSON, P.**  
The EROS-Doppler Observation Campaign (EROS-DOC)  
p0119 N80-20697
- WINKERT, G. E.**  
Quadratic image destripping  
p0108 A80-22498
- WINTER, R.**  
Computation of a data structure for a topographic map using multispectral Landsat scenes  
p0108 A80-22511
- WITTGENSTEIN, L. S.**  
Remote sensing studies of vegetation  
p0063 A80-24055
- WOLF, P.**  
The EROS-Doppler Observation Campaign (EROS-DOC)  
p0119 N80-20697
- WOOD, D. B.**  
Temporal resolution for crop discrimination estimated using J-M distance  
p0062 A80-22502
- WOOD, F. W.**  
Effects of wheat irrigation frequency on reflectance in selected spectral bands  
p0072 N80-20771  
Time of day effects on wheat reflectance in fifteen selected bands  
p0072 N80-20774  
Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils  
p0072 N80-20776  
Spectra of isolated vegetational constituents  
p0072 N80-20779
- WOODCOCK, C. E.**  
Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data  
p0062 A80-22486
- WOODHAM, R. J.**  
Landsat MSS coordinate transformations  
p0116 A80-25567
- WORNOM, D. E.**  
Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane  
[NASA-TM-80146] p0078 N80-16575
- WORSFOLD, R.**  
Radar discrimination of crops  
p0060 A80-22424
- WYSSEN, D.**  
On the penetration of microwaves in snow and soil  
p0101 A80-22461
- Y**
- YAGHJIAN, A. D.**  
High resolution sensing techniques for slope stability studies  
[PB80-124621] p0073 N80-21613
- YAGI, G. M.**  
Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory  
p0110 A80-29978
- YAMAGUCHI, M.**  
Microwave remote sensing technology for the marine oil pollution surveillance  
[REPT-202] p0100 N80-20786
- YANAGISAWA, M.**  
Land cover classification of Sagami River basin using Landsat data - An operational research  
p0075 A80-22431

**YASUDA, Y.****YASUDA, Y.**

Extraction of soil information from a vegetated area  
p0065 A80-25584

**YEO, A. C.**

Remote sensing of the sea around Singapore  
p0095 A80-22506

**YOKOSHIMA, I.**

Microwave remote sensing technology for the marine  
oil pollution surveillance  
[REPT-202] p0100 N80-20786

**YOKOTA, M.**

Microwave remote sensing technology for the marine  
oil pollution surveillance  
[REPT-202] p0100 N80-20786

**YOKOYAMA, R.**

Multi-temporal classification of winter wheat using a  
growth state model p0064 A80-25571

**Z****ZIRK, W. E.**

Gas production of Devonian shale wells relative to photo  
lineament locations: A statistical analysis  
[METC/CR-79/28] p0089 N80-16410

**ZOBRIST, A. L.**

Integration of Landsat, Seasat, and other geo-data  
sources p0107 A80-22392  
California desert resource inventory using multispectral  
classification of digitally mosaicked Landsat frames  
p0076 A80-25568  
Analysis of multiple imagery at Jet Propulsion  
Laboratory's Image Processing Laboratory  
p0110 A80-29978

**ZOLLARS, G. F.**

Remote sensing applied to pollution monitoring. Citations  
from the International Aerospace Abstracts data base  
[NTIS/PS-79/0732/2] p0079 N80-20952

**ZUNIGA, M.**

Theoretical modelling and experimental data matching  
for active and passive microwave remote sensing of Earth  
terrain p0081 N80-19360

**ZWALLY, H. J.**

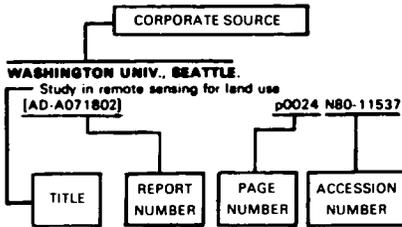
Arctic sea-ice variations from time-lapse passive  
microwave imagery p0096 A80-25333

# CORPORATE SOURCE INDEX

Earth Resources/ A Continuing Bibliography (Issue 26)

JULY 1980

## Typical Corporate Source Index Listing



The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

### A

- ARKANSAS UNIV., FAYETTEVILLE.**  
Classification results using specially correlated Landsat data p0107 A80-22481
- ARMY COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H.**  
The correlation and quantification of airborne spectroradiometer data to turbidity measurements at Lake Powell, Utah p0101 A80-22467
- ARMY ELECTRONICS RESEARCH AND DEVELOPMENT COMMAND, WHITE SANDS MISSILE RANGE, N. MEX.**  
Satellite calibration data, annual data report [AD-A075602] p0090 N80-20301

### B

- BAYERISCHE AKADEMIE DER WISSENSCHAFTEN, MUNICH (WEST GERMANY).**  
The EROS-Doppler Observation Campaign (EROS-DOC) p0119 N80-20697
- The RGST chain program for the determination of potential coefficients and station coordinates p0084 N80-20702
- Study for a project for a European high precision laser network p0084 N80-20704
- BRITISH AEROSPACE DYNAMICS GROUP, BRISTOL (ENGLAND).**  
Coastal Oceans Monitoring Satellite System (COMSS). Volume 1: Executive summary [ESS/SS-930] p0100 N80-21406
- BUREAU OF LAND MANAGEMENT, RIVERSIDE, CALIF.**  
California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568

### C

- CALIFORNIA UNIV., BERKELEY.**  
Remote sensing analysis of water quality in the San Francisco Bay-delta p0102 A80-22490
- Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435
- CALIFORNIA UNIV., DAVIS.**  
Geometric correction of satellite data using curvilinear features and virtual control points p0116 A80-22472
- A non-interactive approach to land use determination p0077 A80-25572
- CALIFORNIA UNIV., SANTA BARBARA.**  
Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486
- Landsat-based multiphase estimation of California's irrigated lands p0067 A80-27435

- CALSPAN ADVANCED TECHNOLOGY CENTER, BUFFALO, N.Y.**  
Applications of HCMM satellite data [E80-10071] p0104 N80-18520
- CITY UNIV. OF NEW YORK, N. Y.**  
Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407
- COLUMBIA UNIV., NEW YORK.**  
Signature evaluation of natural targets using high spectral resolution techniques p0115 A80-22409
- Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah p0115 A80-22425
- COMMITTEE ON SCIENCE AND TECHNOLOGY (U. S. HOUSE).**  
NASA authorization, 1981, program review, volume 1 [GPO-53-814] p0122 N80-17913
- COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, RYDE (AUSTRALIA).**  
Heat Capacity Mapping Mission (HCMM) [E80-10066] p0079 N80-20721
- COMPUTER SCIENCES CORP., SILVER SPRING, MD.**  
A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596
- CONSIGLIO NAZIONALE DELLE RICERCHE, PADUA (ITALY).**  
Use of satellite imagery for the derivation of the hydrogeologic characteristics of a test area in semiarid climates p0105 N80-18545

### D

- DARTMOUTH COLL., HANOVER, N.H.**  
Small forest cuttings mapped with Landsat digital data p0061 A80-22439
- DENVER UNIV., COLO.**  
Space benefits: The secondary application of aerospace technology in other sectors of the economy [NASA-CR-162697] p0122 N80-16950
- Textbooks and technical references for remote sensing p0122 N80-20014
- DEPARTMENT OF AGRICULTURE, WESLACO, TEX.**  
Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions [E80-10072] p0070 N80-18521
- DEPARTMENT OF ENERGY, MORGANTOWN, W. VA.**  
Gas production of Devonian shale wells relative to photo lineament locations: A statistical analysis [METC/CR-79/28] p0089 N80-16410
- DEPARTMENT OF INDUSTRY, LONDON (ENGLAND).**  
Satellite monitoring of sea surface pollution [E80-10062] p0098 N80-18512
- DEPARTMENT OF THE ENVIRONMENT, OTTAWA (ONTARIO).**  
Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333

### E

- ECOSYSTEMS INTERNATIONAL, INC., GAMBRILLS, MD.**  
The role of phenology in statistical crop acreage measurement p0059 A80-22388
- ELECTROTECHNICAL LAB., IBARAKI (JAPAN).**  
Microwave remote sensing technology for the marine oil pollution surveillance [REPT-202] p0100 N80-20786
- ENIGNS MATRA, VELIZY (FRANCE).**  
Coastal Oceans Monitoring Satellite System (COMSS). Volume 1: Executive summary [ESS/SS-930] p0100 N80-21406
- ENVIRONMENTAL MONITORING AND SUPPORT LAB., LAS VEGAS, NEV.**  
Airborne laser fluorosensing of surface water chlorophyll a [PB80-113400] p0105 N80-20797
- ENVIRONMENTAL RESEARCH AND TECHNOLOGY, INC., CONCORD, MASS.**  
Investigation of the application of HCMM thermal data to snow hydrology [E80-10049] p0104 N80-16397

- ENVIRONMENTAL RESEARCH INST. OF MICHIGAN, ANN ARBOR.**  
Possible future directions in crop yield forecasting p0062 A80-22505
- Development of LANDSAT-based technology for crop inventories [E80-10054] p0069 N80-18506
- Development of LANDSAT-based technology for crop inventories: Appendices [E80-10055] p0069 N80-18507
- Statistical analysis of terrain and water (ice) backgrounds in a winter scene from northern Michigan [AD-A077554] p0078 N80-19598
- Statistical analysis of terrain and water backgrounds in the vicinity of Port Hueneme, California [AD-A077025] p0078 N80-19599
- EUROPEAN SPACE AGENCY, PARIS (FRANCE).**  
Satellite contribution to the study of the physical properties of soils. Utilization in the water and agricultural domains p0073 N80-21817
- Sea surface temperature anomaly mapping using the NOAA satellites p0100 N80-21819
- EUROSAT S.A., GENEVA (SWITZERLAND).**  
Study for the determination of geometric and spectral resolution requirements of optical imaging instruments for Earth resources satellites, volume 1 [CM/PR/3384-VOL-1] p0118 N80-17855

### F

- FAIREY SURVEYS LTD., MAIDENHEAD (ENGLAND).**  
An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508

### G

- GENERAL ELECTRIC CO., PHILADELPHIA, PA.**  
Temporal resolution for crop discrimination estimated using J-M distance p0062 A80-22502
- GEOLOGICAL SURVEY, DENVER, COLO.**  
Geologic application of thermal-inertia mapping from satellite [E80-10050] p0089 N80-16398
- GEOLOGICAL SURVEY, FLAGSTAFF, ARIZ.**  
Remote sensing data of SP mountain and SP lava flow in north-central Arizona p0088 A80-26316
- GEOLOGICAL SURVEY, RESTON, VA.**  
Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333
- U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Yellowstone National Park [PB-301333/1] p0089 N80-16429
- U.S. Geological Survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Rocky Mountain National Park [PB-301334/9] p0089 N80-16430

### H

- HUMBOLDT STATE UNIV., ARCATA, CALIF.**  
Using guided clustering techniques to analyze Landsat data for mapping forest land cover in northern California p0065 A80-25595

### I

- ILLINOIS INST. OF NATURAL RESOURCES, SPRINGFIELD.**  
Illinois LANDSAT feasibility study [NASA-CR-162760] p0122 N80-16424
- INSTITUT FUER ANGEWANDTE GEOAESIE, FRANKFURT AM MAIN (WEST GERMANY).**  
Reports on cartography and geodesy. Series 1: Original report no. 73 [REPT-73] p0082 N80-20638
- The 25 years at the Institute for Applied Geodesy p0082 N80-20639
- A survey of the geodetical work of the IFAG from 1952-1977 p0082 N80-20640
- The satellite station Wetzell p0082 N80-20641

J

Elaborating an astronomical longitude system p0082 N80-20647  
 Determination of azimuth and astronomical coordinates p0082 N80-20648  
 The triangulation network in West Germany p0111 N80-20651  
 Cartography applications and research p0112 N80-20654  
 Development, status, and goals of cartographic automation p0112 N80-20655  
 Automatic acquisition and processing of cartographic data p0112 N80-20656  
 On precision in the gathering and production of cartographic data p0112 N80-20657  
 Computer based generalization for the elaboration and extension of topographic maps p0112 N80-20658  
 Graphic production of maps on screens or photocomposition devices p0112 N80-20659  
 The data bank in the cartographic automation system p0082 N80-20660  
 The topographic synoptic map 1:200,000 p0078 N80-20661  
 The synoptic map 1:500,000 (World, Series 1404) p0078 N80-20662  
 The international world map 1:1,000,000 (IWK) p0079 N80-20663  
 Photogrammetry in IFAG from 1952 to 1977 p0079 N80-20664  
 On spectral signatures in central perspective representation p0112 N80-20665  
 Orthophoto techniques and photomaps p0082 N80-20666  
 Aerial and space-borne photographic maps p0082 N80-20667  
 Obtaining surface information for topography and town and country planning from remote sensing p0079 N80-20668  
 Digital height model with ITEK correlator p0112 N80-20669  
 The future of analytical evaluation equipment p0112 N80-20670  
 Digital map bases from photogrammetric measurements p0113 N80-20671  
 Tasks and possibilities of digital image data processing in photogrammetry p0113 N80-20672  
 On the displacement problem as part of a process in generalizing topographical maps. Proposition for hierarchical order and the search for EDP assisted solutions p0082 N80-20675  
 Twenty-five years of aerial photography by the Institute of Applied Geodesy p0083 N80-20676  
 A program for the fully automated displacement of point and line features in cartographic generalization p0083 N80-20680  
 A digital terrain model for large surfaces and direct storage access p0083 N80-20681  
 The production of photomaps from tidal flat areas p0083 N80-20682  
 Testing the accuracy of cartographic equipment: First results p0083 N80-20683  
 Locational characteristics and the sequence of computer assisted processes of cartographic generalization p0083 N80-20685  
 Computer-assisted thematic mapping for federal planning p0083 N80-20686  
 Experiences gathered with a symbol disk with interchangeable symbols p0083 N80-20688  
 Map projection change: Some programs for the transformation of the contents of available maps according to different map projections p0084 N80-20690  
 Reports on cartography and topographical measurements. Series 1: Original reports p0113 N80-20705  
 [REPT-77] p0113 N80-20705  
 Contributions to the creation of a conclusive system of concepts of photogrammetry and aerial photograph cartography p0119 N80-20706  
 The problem of obtaining data for the Digital Height Model p0113 N80-20707  
 A method for examining relationships between multispectral data p0113 N80-20708  
 Setting data from multistage analytical orientation p0119 N80-20709  
 Possibilities of application of LANDSAT and Skylab data to small scale cartography p0084 N80-20710  
 On the writing accuracy of the reproduction unit of the Optronics System P1700 p0113 N80-20711  
 Production of color composites from multispectral data records p0119 N80-20712

**INSTITUTE OF OCEANOGRAPHIC SCIENCES, WORMLEY (ENGLAND).**  
 Monitoring the sea surface p0100 N80-21820

**INSTITUTO DE PESQUISAS ESPACIAIS, SAO JOSE DOS CAMPOS (BRAZIL).**  
 Application of statistical correlation in the study of available water in layers of Cerrado soil [INPE-1607-TDL/014] p0070 N80-18531  
 Significant results from a project on agricultural statistics, 1975 - 1978 [INPE-1609-NTE/155] p0071 N80-18532  
 Coastal water temperatures in the southeastern portion of Brazil from oceanographic data and NOAA satellite observations, volume 1 [INPE-1569-RPE/070] p0099 N80-18671

**JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.**

Integration of Landsat, Seasat, and other geo-data sources p0107 A80-22392  
 Forest Classification and Inventory System using Landsat, digital terrain, and ground sample data p0062 A80-22486  
 Stereosat - A new astrodynamics challenge [AIAA PAPER 80-0237] p0108 A80-22744  
 Antenna pattern correction procedures for the Scanning Multichannel Microwave Radiometer /SMMR/ p0116 A80-25332  
 California desert resource inventory using multispectral classification of digitally mosaicked Landsat frames p0076 A80-25568  
 Remote sensing data of SP mountain and SP lava flow in north-central Arizona p0088 A80-26316  
 Observation of the Grand Canyon wall structure with an airborne imaging radar p0117 A80-26317  
 The relationship between ocean surface structure and the synthetic aperture radar imagery of ocean waves p0097 A80-28256  
 Analysis of multiple imagery at Jet Propulsion Laboratory's Image Processing Laboratory p0110 A80-29978  
 Verification procedures for the SEASAT measurements of the vector wind with the SASS [NASA-CR-162469] p0098 N80-16407  
 Processing of multispectral thermal IR data for geologic applications [NASA-CR-162682] p0089 N80-16651  
 Seasat Gulf of Alaska Workshop report. Volume 1: Panel reports [NASA-CR-162759] p0118 N80-17535  
 Seasat gulf of Alaska workshop report [NASA-CR-162463] p0099 N80-18549

**JOINT RESEARCH CENTRE OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY).**  
 Agrometeorological applications p0073 N80-21818  
 Biological applications including pollution monitoring p0100 N80-21821

K

**KANSAS UNIV. CENTER FOR RESEARCH, INC., LAWRENCE.**  
 Backscatter measurements of sea ice with a helicopter-borne scatterometer [AD-A077614] p0098 N80-18542

**KENT STATE UNIV., OHIO.**  
 Autocorrelation in Landsat data p0107 A80-22483

L

**LILLE UNIV. (FRANCE).**  
 Sea surface temperature of the coastal zones of France. Heat Capacity Mapping Mission (HCMM) [E80-10057] p0099 N80-19585

**LOCKHEED ELECTRONICS CO., HOUSTON, TEX.**  
 Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387  
 Large Area Crop Inventory Experiment (LACIE). The boundary pixel study in Kansas and North Dakota [E80-10044] p0068 N80-16394  
 Large Area Crop Inventory Experiment (LACIE). Detailed description of the wheat acreage estimation procedure used in the Large Area Crop Inventory Experiment [E80-10051] p0068 N80-16399  
 Large Area Crop Inventory Experiment (LACIE). Profile similarity feasibility study [E80-10052] p0068 N80-16400  
 Large Area Crop Inventory Experiment (LACIE). Evaluation of three-category classification [E80-10058] p0069 N80-18509  
 Large Area Crop Inventory Experiment (LACIE). LACIE transition year plan for the direct estimation of wheat from LANDSAT imagery [E80-10059] p0069 N80-18510  
 Implementation of Badhwar classification of corn/soybean segments [E80-10060] p0069 N80-18511  
 Large Area Crop Inventory Experiment (LACIE). Bibliographic addenda, technical reports, papers, and memorandums published under supporting research and technology and other research, test, and evaluation contracts for the Earth observations division [E80-10070] p0070 N80-18519  
 Large Area Crop Inventory Experiment (LACIE). Composition and assembly of a spectral-met data base for spring and winter wheat, volume 2 [E80-10076] p0070 N80-18525

**LOCKHEED ELECTRONICS CO., INC., LAS VEGAS, NEV.**  
 Computer processing of multispectral scanner data over coal strip mines [PB80-111677] p0091 N80-20803

**LOCKHEED ENGINEERING AND MANAGEMENT SERVICES CO., INC., HOUSTON, TEX.**

As-built design specifications of the LANDSAT Imagery Verification and Extraction System (LIVES). Volume 1: Test and appendices [E80-10077] p0111 N80-19586  
 Quantitative estimation of plant characteristics using spectral measurement: A survey of the literature [E80-10078] p0071 N80-19587

**LOGICA LTD., LONDON (ENGLAND).**  
 Coastal Oceans Monitoring Satellite System (COMSS). Volume 1: Executive summary [ESS/SS-930] p0100 N80-21406

M

**MARYLAND UNIV., COLLEGE PARK.**  
 The seasonal cycle of snow cover, sea ice and surface albedo p0111 A80-32101  
 Relationship of physiography and snow area to stream discharge [E80-10046] p0104 N80-16396

**MASSACHUSETTS INST. OF TECH., CAMBRIDGE.**  
 Theoretical modeling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360

**MICHIGAN STATE UNIV., EAST LANSING.**  
 Use of remote sensing for land use policy formulation [E80-10085] p0078 N80-19592

N

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.**  
 NASA policy issues p0121 A80-22379  
 Enhancement of remote sensing through microwave technology p0116 A80-25770  
 Research project Mauretania: Satellites as development aids [NASA-TM-76064] p0078 N80-17120  
 Findings of the OPIT study in America [NASA-TM-76106] p0122 N80-21822

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, AMES RESEARCH CENTER, MOFFETT FIELD, CALIF.**  
 The suitability of the ILIAC IV architecture for image processing p0107 A80-22382  
 Error detection and rectification in digital terrain models p0110 A80-27432  
 Conference of Remote Sensing Educators (CORSE-78) [NASA-CP-2102] p0122 N80-20003  
 The reduction of remote sensing data by visual means p0118 N80-20017

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, EARTH RESOURCES LAB., SLIDELL, LA.**  
 A system for processing Landsat and other georeferenced data for resource management applications p0109 A80-25589

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GODDARD INST. FOR SPACE STUDIES, NEW YORK.**  
 Signature evaluation of natural targets using high spectral resolution techniques p0115 A80-22409  
 Detection of hydrothermal alteration with 24-channel multispectral scanner data and quantitative analyses of linear features, Monroe geothermal area, Utah p0115 A80-22425  
 Small forest cuttings mapped with Landsat digital data p0061 A80-22439

**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GREENBELT, MD.**  
 The Massively Parallel Processor and its applications p0115 A80-22380  
 Determination of range biomass using Landsat p0060 A80-22414  
 The Landsat-D Assessment System p0121 A80-22419  
 Surface temperature variations as measured by the Heat Capacity Mapping Mission p0115 A80-22420  
 Quadratic image destriping p0108 A80-22498  
 Temporal resolution for crop discrimination estimated using J-M distance p0062 A80-22502  
 An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508  
 Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941  
 Spectral distortion inherent in airborne profilometer measurements of ocean wave heights p0095 A80-22942  
 Arctic sea-ice variations from time-lapse passive microwave imagery p0096 A80-25333  
 A design study for an advanced ocean color scanner system p0097 A80-25346  
 Landsat-D data acquisition and processing p0108 A80-25563  
 The use of Landsat multispectral data to derive land cover information for the location and quantification of non-point source water pollutants p0077 A80-25575  
 A forester's look at the application of image manipulation techniques to multitemporal Landsat data p0065 A80-25596

- Enhancement of remote sensing through microwave technology p0116 A80-25770
- A spectral method for determining the percentage of green herbage material in clipped samples p0066 A80-26318
- Data acquisition and projected applications of the observations from Landsat-D p0117 A80-27427
- Wetland flow resistance determination using Landsat data p0103 A80-27431
- Improvements in lake water budget computations using Landsat data p0103 A80-27434
- Microwave approaches in hydrology p0104 A80-30920
- A spectral filter for ESMR's sidelobe errors [NASA-TM-80555] p0118 N80-16402
- L-band radar sensing of soil moisture [NASA-TM-80828] p0068 N80-16404
- Effect of soil texture on the microwave emission from soils [NASA-TM-80632] p0070 N80-18530
- Theoretical modelling and experimental data matching for active and passive microwave remote sensing of Earth terrain p0081 N80-19360
- LANDSAT digital analysis of the initial recovery of the Kokolik River tundra fire area, Alaska [E80-10080] p0071 N80-19588
- SMMR simulator radiative transfer calibration model. 1: Derivation [E80-10081] p0118 N80-19589
- A critical comparison of remote sensing and other methods for nondestructive estimation of standing crop biomass [E80-10082] p0071 N80-19590
- Multisensor analysis of hydrologic features in the Wind River Range, Wyoming with emphasis on the SEASAT SAR [E80-10083] p0105 N80-19591
- Earth Survey Applications Division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10084] p0084 N80-20722
- Earth survey applications division: Research leading to the effective use of space technology in applications relating to the Earth's surface and interior [E80-10087] p0084 N80-20723
- Geobotanical exploration p0090 N80-20724
- Geological/geophysical resource assessment p0090 N80-20725
- Magnetic field modeling and crustal studies p0084 N80-20726
- Spherical harmonic models of the core field p0084 N80-20727
- Crustal anomaly representation p0084 N80-20728
- Anomaly verification: Comparison of Pogo magnetic data with aeromagnetic measurements p0085 N80-20729
- Regional Modeling: The Kentucky anomaly p0090 N80-20730
- Regional modeling: The Ivrea zone p0085 N80-20731
- Interpretation of geoid anomalies in the vicinity of subduction zones p0090 N80-20732
- Global geology and geophysics using satellite-derived data p0090 N80-20733
- Geophysical atlas p0090 N80-20734
- Comparative planetology/crustal evolution p0090 N80-20735
- Crustal deformation: Crustal dynamics project p0090 N80-20736
- Investigation of crustal dynamics using VLBI p0090 N80-20737
- Crustal structure and dynamics of southeastern US p0090 N80-20738
- Plate boundary deformation in California p0090 N80-20739
- On the selection of station sites for observing strain strips and earthquake forerunners in California p0090 N80-20740
- GSFC site stability p0085 N80-20741
- Geotectonic stability of the Green Bank, West Virginia VLBI site p0085 N80-20742
- Earthquake and crustal deformation studies p0091 N80-20743
- Global intra-plate volcanism p0091 N80-20744
- Development of A seismic data collection platform p0091 N80-20745
- Crustal motion measurements in California (SAFE) p0091 N80-20746
- Geodyn program systems development p0085 N80-20747
- Gravity model development p0085 N80-20748
- Gravity model improvement for SEASAT p0085 N80-20749
- The gravity field in the central pacific from satellite-to-satellite tracking and implications for mantle convection p0085 N80-20750
- Unexplained Lageos perturbation p0085 N80-20751
- Mantle convection and subcrustal stress p0085 N80-20752
- Information theory density distribution p0085 N80-20753
- The enhanced nodal equilibrium ocean tide and polar motion p0085 N80-20754
- Polar motion research p0085 N80-20755
- A determination of GM p0086 N80-20756
- Polar motion and Earth rotation results from Lageos p0086 N80-20757
- The SEASAT altimeter height bias using four Bermuda overflights p0086 N80-20758
- The effect of sea state on altimeter measurements p0119 N80-20759
- Mean sea surface computation using GEOS-3 altimeter data p0099 N80-20760
- Ocean circulation p0099 N80-20761
- Starlette orbit analyses for ocean tidal studies p0100 N80-20762
- Remote monitoring of forest cover conditions p0071 N80-20763
- Surface mine monitoring p0091 N80-20764
- NASA-census Application Pilot Test (APT) and urban area delineation studies p0079 N80-20765
- Improvement in classification accuracy of LANDSAT MSS data in areas of mountainous terrain p0114 N80-20766
- Sources of variations in LANDSAT autocorrelation p0114 N80-20767
- Remote sensing of leaf water content in the near infrared p0071 N80-20768
- Plant stress and relationships to spectral responses p0071 N80-20769
- Monitoring drought in Colorado with LANDSAT MSS p0071 N80-20770
- Effects of wheat irrigation frequency on reflectance in selected spectral bands p0072 N80-20771
- Off-nadir viewing effects on spectral assessment of green biomass p0072 N80-20772
- Thermal anisotropy of vegetation canopies p0072 N80-20773
- Time of day effects on wheat reflectance in fifteen selected bands p0072 N80-20774
- Assessing soybean leaf area and leaf biomass by spectral measurements p0072 N80-20775
- Relative sensitivity of fifteen spectral bands to changes in soybean canopy cover for wet and dry soils p0072 N80-20776
- Radiometric resolution for monitoring vegetation: How many bits are needed? p0072 N80-20777
- Thematic mapper versus multispectral scanner for crop monitoring p0072 N80-20778
- Spectra of isolated vegetational constituents p0072 N80-20779
- A spectral method for determining the percentage of green herbage material in clipped samples p0073 N80-20780
- Evaluation of a spectral method for percentage green determination using clipped rangeland forage samples p0073 N80-20781
- LANDSAT-D assessment system p0122 N80-20782
- Multispectral linear array sensor development p0119 N80-20783
- Linear array pushbroom radiometer data analysis p0119 N80-20784
- The spaceborne laser ranging system p0086 N80-20785
- NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.**
- Accuracy assessment in the Large Area Crop Inventory Experiment p0059 A80-22387
- The use of spectral data in wheat yield estimation - An assessment of techniques explored in LACIE p0060 A80-22413
- LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086
- Crop emergence date determination from spectral data p0067 A80-27458
- LACIE evaluation and outlook panel transcript: The LACIE Symposium [E80-10069] p0070 N80-18518
- NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LANGLEY RESEARCH CENTER, LANGLEY STATION, VA.**
- A regression technique for evaluation and quantification for water quality parameters from remote sensing data p0102 A80-22470
- Passive microwave remote sensing of the ocean - A review p0096 A80-25329
- Summary of aircraft results for 1978 southeastern Virginia urban plume measurement study of ozone, nitrogen oxides, and methane [NASA-TM-80146] p0078 N80-16575
- Radar target for remotely sensing hydrological phenomena [NASA-CASE-LAR-12344-1] p0104 N80-18498
- NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. LEWIS RESEARCH CENTER, CLEVELAND, OHIO.**
- Assessment of satellite and aircraft multispectral scanner data for strip-mine monitoring [NASA-TM-79268] p0091 N80-20787
- NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALA.**
- Evaluation of registration, compression, and classification algorithms. Volume 2: Documentation [E80-10042] p0111 N80-16392
- NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. WALLOPS FLIGHT CENTER, WALLOPS ISLAND, VA.**
- The Surface Contour Radar, a unique remote sensing instrument p0116 A80-26085
- Synthetic aperture radar/LANDSAT MSS image registration [NASA-RP-1039] p0111 N80-16405
- The role of satellite altimetry in climate studies [NASA-TP-1570] p0118 N80-16676
- An initial assessment of the performance achieved by the Seasat-1 radar altimeter [NASA-TM-73279] p0118 N80-20564
- NATIONAL BUREAU OF STANDARDS. BOULDER, COLO.**
- High resolution sensing techniques for slope stability studies [PB80-124621] p0073 N80-21613
- NATIONAL CONFERENCE OF STATE LEGISLATURES, DENVER, COLO.**
- NCSL remote sensing project [E80-10053] p0122 N80-16401
- NATIONAL ENVIRONMENTAL SATELLITE CENTER, WASHINGTON, D. C.**
- Satellite activities of NOAA 1978 [PB80-112782] p0119 N80-21002
- NATIONAL ENVIRONMENTAL SATELLITE SERVICE, WASHINGTON, D. C.**
- Atmospheric effects in the remote sensing of phytoplankton pigments p0097 A80-25345
- NOAA satellite monitoring of snow cover in the Northern Hemisphere during the winter of 1977 p0105 N80-19594
- Meteorological satellites: Status and outlook p0119 N80-21800
- NATIONAL OCEAN SURVEY, ROCKVILLE, MD.**
- Wave sensor survey [PB80-118581] p0100 N80-21010
- NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, COLUMBIA, MO.**
- LACIE - An application of meteorology for United States and foreign wheat assessment p0066 A80-26086
- NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, D. C.**
- Application of HCMM data to soil moisture snow and estuarine current studies [E80-10068] p0104 N80-18517
- NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VA.**
- Tectonics, volume 2. Citations from the NTIS data base [PB80-804529] p0091 N80-21925
- NAVAL OCEAN RESEARCH AND DEVELOPMENT ACTIVITY, BAY ST. LOUIS, MISS.**
- Interactive digital satellite image processing system for oceanographic applications [AD-A079697] p0100 N80-20790
- NAVAL RESEARCH LAB., WASHINGTON, D. C.**
- Gulf stream ground truth project - Results of the NRL airborne sensors p0095 A80-22941
- Spectral distortion inherent in airborne profilometer measurements of ocean wave heights p0095 A80-22942
- The Surface Contour Radar, a unique remote sensing instrument [AD-A077384] p0116 A80-26085
- A unique radio oceanographic radar [AD-A077384] p0099 N80-19332
- NEVADA UNIV., LAS VEGAS.**
- Airborne laser fluorosensing of surface water chlorophyll a [PB80-113400] p0105 N80-20797
- NEW HAMPSHIRE UNIV., DURHAM.**
- Small forest cuttings mapped with Landsat digital data p0061 A80-22439
- NEW MEXICO UNIV., ALBUQUERQUE.**
- Remote sensing applied to pollution monitoring. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0732/2] p0079 N80-20952
- NORWEGIAN WATER RESOURCES AND ELECTRICITY BOARD, OSLO.**
- Snow and ice mapping: Norwegian examples for run-off prediction p0105 N80-21816
- O**
- OLD DOMINION UNIV., NORFOLK, VA.**
- A regression technique for evaluation and quantification for water quality parameters from remote sensing data p0102 A80-22470
- OREGON STATE UNIV., CORVALLIS.**
- An investigation of the utility of LANDSAT 2 MSS data to the fire-danger rating area, and forest fuel analysis within Crater Lake National Park, Oregon p0068 N80-18500
- P**
- PURDUE UNIV., LAFAYETTE, IND.**
- An evaluation of several different classification schemes - Their parameters and performance p0061 A80-22453
- Sampling for area estimation - A comparison of full-frame sampling with the sample segment approach p0064 A80-25570
- A method for classifying multispectral remote sensing data using context p0109 A80-25594
- Machine processing of Landsat MSS data and DMA topographic data for forest cover type mapping p0065 A80-25597

**READING UNIV. (ENGLAND).**

- Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types  
 [E80-10041] p0068 N80-16391  
 Computer-aided processing of LANDSAT MSS data for classification of forestlands  
 [E80-10043] p0068 N80-16393  
 Forest resource information system  
 [E80-10065] p0069 N80-18515

**R****READING UNIV. (ENGLAND).**

- An evaluation of Landsat 3 RBV imagery for an area of complex terrain in Southern Italy p0081 A80-22508

**RESEARCH INST. OF NATIONAL DEFENCE, STOCKHOLM (SWEDEN).**

- Tests of laser induced fluorescence from algae at sea [FOA-C-30171-E1] p0099 N80-18678

**RESEARCH TRIANGLE INST., RESEARCH TRIANGLE PARK, N. C.**

- Altitude characteristics of selected air quality analyzers [NASA-CR-159165] p0078 N80-16578

**S****SIRA INST. LTD., CHISLEHURST (ENGLAND).**

- Coastal Oceans Monitoring Satellite System (COMSS). Volume 1: Executive summary [ESS/SS-930] p0100 N80-21406

**SMITHSONIAN ASTROPHYSICAL OBSERVATORY, CAMBRIDGE, MASS.**

- Study of oceanic lithosphere using GEOS-3 radar altimeter data [AD-A077344] p0099 N80-18673

**SOUTH DAKOTA STATE UNIV., BROOKINGS.**

- Spatial quantification of maps or images - Cell size or pixel size implications p0110 A80-27429

- Remote sensing inputs to National Model Implementation Program for water resources quality improvement p0103 A80-27433

- Thermography for estimating near-surface soil moisture under developing crop canopies p0067 A80-32518

- HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution [E80-10075] p0105 N80-18524

- Remote sensing applications to resource problems in South Dakota [E80-10086] p0122 N80-19593

**STANFORD UNIV., CALIF.**

- HCMM: Soil moisture in relation to geologic structure and lithology, northern California [E80-10067] p0089 N80-18516

**T****TECHNICAL UNIV. OF DENMARK, COPENHAGEN.**

- Coastal Oceans Monitoring Satellite System (COMSS). Volume 1: Executive summary [ESS/SS-930] p0100 N80-21406

**TENNESSEE UNIV., KNOXVILLE.**

- Application of LANDSAT imagery to monitor sand dunes movement in the Sahara Desert p0113 N80-20719

**TENNESSEE VALLEY AUTHORITY, CHATTANOOGA.**

- Remote sensing of sulfur dioxide effects on vegetation - photometric analysis of aerial photographs [PB-300460/3] p0068 N80-16600

**TEXAS A&M UNIV., COLLEGE STATION.**

- Determination of range biomass using Landsat p0060 A80-22414

- Pasture/wheat surface temperature differences - Indicator of relative soil moisture differences p0065 A80-25582

- Correlation of spacecraft passive microwave system data with soil moisture indices (API) [E80-10063] p0069 N80-18513

- Measurement of soil moisture trends with airborne scatterometers [E80-10064] p0069 N80-18514

- Continuation of measurement of hydrologic soil-cover complex with airborne scatterometers [E80-10073] p0104 N80-18522

- Dryland pasture and crop conditons as seen by HCMM [E80-10074] p0070 N80-18523

- AgRISTARS: A joint program for agriculture and resources inventory surveys through aerospace remote sensing. Development and evaluation of clustering procedures [E80-10079] p0070 N80-18526

- The easy remote sensing problem [REPT-20] p0070 N80-18528

- The Cramer-Rao lower bound as a criteria for evaluating a large data reduction system such as LACIE [REPT-21] p0070 N80-18529

- 

**U****UTAH STATE UNIV., LOGAN.**

- Feature selection and classifier design with applications to remote sensing of mule deer p0069 N80-18505

**W****WISCONSIN UNIV., MADISON.**

- Remote sensing as a source of land cover information utilized in the universal soil loss equation p0061 A80-22450

**WYOMING UNIV., LARAMIE.**

- Video processing of remote sensor data applied to uranium exploration in Wyoming [GJBX-171(79)] p0089 N80-19603

# CONTRACT NUMBER INDEX

Earth Resources/ A Continuing Bibliography (Issue 26)

JULY 1980

## Typical Contract Number Index Listing

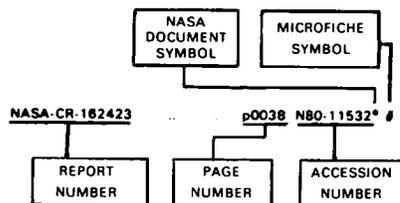


Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession number denotes the number by which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

AF PROJ. 2309 .....	p0099	N80-18673	p0069	N80-18506
BLM-AA550-CT7-59 .....	p0098	A80-28263	p0069	N80-18507
CNEXO-77/1695 .....	p0096	A80-25338	p0068	N80-16391
CNR-76.0015 .....	p0111	A80-31996	p0068	N80-16393
CNR-76.00518.07 .....	p0111	A80-31996	p0068	N80-16394
CNRS-ERA-278 .....	p0096	A80-25338	p0068	N80-16400
CNRS-RCP-247 .....	p0096	A80-25338	p0069	N80-18509
DA PROJ. 1L1-62111-AH-71 .....	p0090	N80-20301	p0069	N80-18510
DI PROJECT B-206-TEX .....	p0088	A80-27456	p0069	N80-18511
DI-CX-702960143 .....	p0088	A80-27456	p0070	N80-18525
EG-77-C-05-5444 .....	p0093	A80-21454	p0111	N80-19586
EPA-G-005139-01 .....	p0061	A80-22450	p0071	N80-19587
EPA-88-03-2636 .....	p0091	N80-20803	p0107	A80-22481
ESA-3529/78-F-HS(SC) .....	p0118	N80-17855	p0095	A80-22941
ESA-3632/78-F-CG .....	p0100	N80-21406	p0095	A80-22942
EY-76-C-13-1648 .....	p0089	N80-19603	p0078	N80-19592
F(05-1)-1648 .....	p0089	N80-19603	p0110	A80-27429
FWHA ORDER 7-3-0001 .....	p0073	N80-21613	p0103	A80-27433
F19628-78-C-0003 .....	p0099	N80-18673	p0122	N80-19593
JPL-954411 .....	p0098	N80-16407	p0061	A80-22450
NASA ORDER L-17098-A .....	p0099	N80-19332	p0066	A80-26313
NASA ORDER L-96783-A .....	p0078	N80-16578	p0104	N80-16396
NASA ORDER P-62257-G .....	p0095	A80-22941	p0093	A80-22384
NASA ORDER S-40198-B .....	p0095	A80-22942	p0094	A80-22448
NASA ORDER W-08619 .....	p0070	N80-18521	p0094	A80-22447
NASA ORDER W-13130 .....	p0088	A80-26316	p0097	A80-25343
NASW-3113 .....	p0122	N80-16950	p0101	A80-22451
NASW-3198 .....	p0078	N80-17120	p0095	A80-24546
NASW-3199 .....	p0122	N80-21822	p0096	A80-25336
NASW-3230 .....	p0122	N80-16401	p0095	A80-24546
NAS5-20969 .....	p0067	A80-27435	p0095	A80-24546
NAS5-22963 .....	p0097	A80-25345	p0067	A80-27435
NAS5-23412 .....	p0062	A80-22502	p0065	A80-25595
NAS5-24206 .....	p0067	A80-32518	p0065	A80-25595
NAS5-24263 .....	p0105	N80-18524	p0101	A80-22467
NAS5-24383 .....	p0104	N80-18520	p0116	A80-22472
NAS5-24479 .....	p0065	A80-25582	p0077	A80-25572
NAS6-2816 .....	p0070	N80-18523	p0069	N80-18514
NAS6-2827 .....	p0089	N80-18516	p0104	N80-18522
NAS7-100 .....	p0111	N80-16405	p0115	A80-22425
NAS8-32408 .....	p0111	N80-16405	p0069	N80-18513
NAS9-13406 .....	p0107	A80-22392	p0111	A80-32101
NAS9-14016 .....	p0108	A80-22744	p0102	A80-22490
NAS9-14689 .....	p0076	A80-25568	p0075	A80-22422
NAS9-14970 .....	p0088	A80-26316	p0095	A80-24546
NAS9-15200 .....	p0117	A80-26317	p0096	A80-25334
NAS9-15325 .....	p0097	A80-28256	p0096	A80-25336
NAS9-15466 .....	p0110	A80-29978	p0093	A80-22411
NAS9-15476 .....	p0089	N80-16651	p0098	N80-18542
	p0059	A80-22388	p0098	N80-16407
	p0107	A80-22483	p0093	A80-22410
	p0065	A80-25597	p0078	N80-19599
	p0070	N80-18526	p0078	N80-19599
	p0064	A80-25570	p0069	N80-18506
	p0068	N80-16399	p0069	N80-18507
	p0070	N80-18519	p0071	N80-19587
	p0069	N80-18515	p0078	N80-16578
	p0061	A80-22453	p0059	A80-22389
	p0109	A80-25594	p0062	A80-22487
	p0062	A80-22505	p0067	A80-30921
			p0078	N80-16575
			p0091	N80-20787
			p0122	N80-20003
NAS9-15508 .....				
NAS9-15800 .....				
NAS13-1608 .....				
NAVAIR TASK A370/370C/0588 .....				
NGL-23-004-083 .....				
NGL-42-003-007 .....				
NGL-50-002-127 .....				
NGR-10-122-006 .....				
NGR-21-002-399 .....				
NOAA-A01-78-00-4822 .....				
NOAA-7-35328 .....				
NOAA-03-5-022-56 .....				
NOAA-04-6-158-44033 .....				
NOAA-04-8-M01-134 .....				
NR PROJECT 083-004 .....				
NSF OCD-73-00214 .....				
NSF OCE-75-08765 .....				
NSF OCE-76-B2059 .....				
NSG-2207 .....				
NSG-2244 .....				
NSG-2341 .....				
NSG-5014 .....				
NSG-5092 .....				
NSG-5134 .....				
NSG-5156 .....				
NSG-5163 .....				
NSG-5193 .....				
NSG-5209 .....				
NSG-5256 .....				
NO014-74-C-0273 .....				
NO0014-74-C-0262 .....				
NO0014-75-C-0502 .....				
NO0014-75-00173 .....				
NO0014-76-C-1048 .....				
NO0014-76-C-1105 .....				
NO0014-77-C-0206 .....				
NO0014-78-C-0458 .....				
N60530-78-C-0009 .....				
N60530-79-R-0036 .....				
PROJ. AGRISTARS .....				
RTI PROJ. 43U-1833 .....				
USGS-14-08-001-06439 .....				
USGS-14-08-0001-16439 .....				
146-20-10-07 .....				
663-01 .....				
663-04-00 .....				

# REPORT/ACCESSION NUMBER INDEX

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Listings in this index are arranged alphanumerically by report number. The page number indicates the page on which the citation is located. The accession number denotes the number by which the citation is identified. An asterisk (\*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

E80-10067	p0089 N80-18516* #	NASA-CR-160423	p0070 N80-18519* #
E80-10068	p0104 N80-18517* #	NASA-CR-160425	p0069 N80-18511* #
E80-10069	p0070 N80-18518* #	NASA-CR-160426	p0069 N80-18510* #
E80-10070	p0070 N80-18519* #	NASA-CR-160427	p0070 N80-18528* #
E80-10071	p0104 N80-18520* #	NASA-CR-160435	p0069 N80-18515* #
E80-10072	p0070 N80-18521* #	NASA-CR-160436	p0069 N80-18509* #
E80-10073	p104 N80-18522* #	NASA-CR-160437	p0070 N80-18525* #
E80-10074	p0070 N80-18523* #	NASA-CR-160460	p0071 N80-18587* #
E80-10075	p105 N80-18524* #	NASA-CR-160461	p0111 N80-19586* #
E80-10076	p0070 N80-18525* #	NASA-CR-162463	p0099 N80-18549* #
E80-10077	p0111 N80-19586* #	NASA-CR-162469	p0098 N80-16407* #
E80-10078	p0071 N80-19587* #	NASA-CR-162506	p0104 N80-16396* #
E80-10079	p0070 N80-18526* #	NASA-CR-162521	p0104 N80-16397* #
E80-10080	p0071 N80-19588* #	NASA-CR-162522	p0089 N80-16398* #
E80-10081	p0118 N80-19589* #	NASA-CR-162523	p0122 N80-16401* #
E80-10082	p0071 N80-19590* #	NASA-CR-162584	p0098 N80-18512* #
E80-10083	p105 N80-19591* #	NASA-CR-162585	p0069 N80-18513* #
E80-10084	p0084 N80-20722* #	NASA-CR-162586	p0069 N80-18514* #
E80-10085	p0078 N80-19592* #	NASA-CR-162587	p0079 N80-20721* #
E80-10086	p0122 N80-19593* #	NASA-CR-162588	p0089 N80-18516* #
E80-10087	p0084 N80-20723* #	NASA-CR-162639	p0104 N80-18517* #
FHWA/RD-79/32	p0073 N80-21613 #	NASA-CR-162641	p0070 N80-18518* #
FOA-C-30171-E1	p0099 N80-18678 #	NASA-CR-162642	p0104 N80-18520* #
FR-3496	p0104 N80-18522* #	NASA-CR-162643	p0070 N80-18521* #
GJBX-171(79)	p0089 N80-19603 #	NASA-CR-162644	p0104 N80-18522* #
GPO-53-814	p0122 N80-17913 #	NASA-CR-162645	p0070 N80-18523* #
ILLDOE-79/13	p0122 N80-16424* #	NASA-CR-162646	p105 N80-18524* #
INPE-1569-RPE/070	p0099 N80-18671 #	NASA-CR-162682	p0089 N80-16651* #
INPE-1607-TDL/014	p0070 N80-18531 #	NASA-CR-162697	p0122 N80-16950* #
INPE-1609-NTE/155	p0071 N80-18532 #	NASA-CR-162753	p0099 N80-19585* #
ISSN-0469-4236	p0113 N80-20705 #	NASA-CR-162759	p0118 N80-17535* #
JPL-PUB-79-89	p0089 N80-16651* #	NASA-CR-162760	p0122 N80-16424* #
JPL-662-101	p0099 N80-18549* #	NASA-CR-162783	p0078 N80-19592* #
JSC-13769	p0070 N80-18518* #	NASA-CR-162784	p0122 N80-19593* #
JSC-14278	p0070 N80-18519* #	NASA-RP-1039	p0111 N80-16405* #
JSC-14553	p0069 N80-18510* #	NASA-TM-73279	p0118 N80-20564* #
JSC-14563	p0068 N80-16394* #	NASA-TM-76064	p0078 N80-17120* #
JSC-14634-VOL-1	p0111 N80-19586* #	NASA-TM-76106	p0122 N80-21822* #
JSC-14901-VOL-2	p0070 N80-18525* #	NASA-TM-78227	p0111 N80-16392* #
JSC-16012	p0069 N80-18509* #	NASA-TM-79268	p0091 N80-20787* #
JSC-16246	p0068 N80-16400* #	NASA-TM-80146	p0078 N80-16575* #
JSC-16274	p0069 N80-18511* #	NASA-TM-80244	p0118 N80-19589* #
JSC-16298	p0071 N80-19587* #	NASA-TM-80550	p0084 N80-20722* #
L-12981	p0078 N80-16575* #	NASA-TM-80555	p0118 N80-16402* #
LARS-TR-011579	p0068 N80-16391* #	NASA-TM-80582	p105 N80-19591* #
LARS-TR-102679	p0068 N80-16393* #	NASA-TM-80602	p0071 N80-19588* #
LARS-093079	p0069 N80-18515* #	NASA-TM-80607	p0071 N80-19590* #
LEC-11497	p0068 N80-16399* #	NASA-TM-80628	p0068 N80-16404* #
LEC-11651	p0070 N80-18519* #	NASA-TM-80632	p0070 N80-18530* #
LEC-11861	p0069 N80-18510* #	NASA-TM-80642	p0084 N80-20723* #
LEC-12826	p0068 N80-16394* #	NASA-TP-1570	p0118 N80-16676* #
LEC-12904-VOL-1	p0111 N80-19586* #	NOAA-TR-NOS-78	p0100 N80-21010 #
LEC-13393-VOL-2	p0070 N80-18525* #	NOAA-79073114	p0118 N80-17535* #
LEC-13498	p0069 N80-18509* #	NOAA-79090406	p0099 N80-18549* #
LEC-14010	p0068 N80-16400* #	NOAA-79100504	p0119 N80-21002 #
LEC-14064	p0069 N80-18511* #	NOAA-79101102	p0100 N80-21010 #
LEMSCO-14077	p0071 N80-19587* #	NORDA-TN-23	p0100 N80-20790 #
METC/CR-79/28	p0089 N80-16410 #	NRL-MR-4086	p0099 N80-19332* #
NASA-CASE-LAR-12344-1	p0104 N80-18498* #	NTIS/PS-77/0088	p0091 N80-21925 #
NASA-CP-2102	p0122 N80-20003* #	NTIS/PS-78/0082	p0091 N80-21925 #
NASA-CR-159165	p0078 N80-16578* #	NTIS/PS-79/0089	p0091 N80-21925 #
NASA-CR-160365	p0068 N80-16394* #	NTIS/PS-79/0732/2	p0079 N80-20952 #
NASA-CR-160379	p0068 N80-16391* #	PB-300409/0	p0122 N80-16424* #
NASA-CR-160381	p0068 N80-16393* #	PB-300413/2	p0118 N80-17535* #
NASA-CR-160405	p0068 N80-16399* #	PB-300460/3	p0068 N80-16600 #
NASA-CR-160406	p0068 N80-16400* #	PB-300463/3	p0069 N80-16429 #
NASA-CR-160421	p0069 N80-18506* #	PB-301333/1	p0089 N80-16430 #
NASA-CR-160422	p0069 N80-18507* #	PB-301334/9	p0089 N80-16430 #
		PB-301417/2	p0099 N80-18549* #
		PB80-111677	p0091 N80-20803 #
		PB80-112782	p0119 N80-21002 #
		PB80-113400	p0105 N80-20797 #
		PB80-118581	p100 N80-21010 #
		PB80-124621	p0073 N80-21613 #
		PB80-804529	p0091 N80-21925 #
		PR-2	p0098 N80-18512* #
		PR-2	p0099 N80-19585* #
		PR-2-14/P6	p0098 N80-18512* #
		PR-3712-7	p0070 N80-18523* #

REPORT/ACCESSION NUMBER INDEX

QPR-9 .....	p0104	N80-16397* #
QR-9 .....	p0104	N80-18520* #
REPT-20 .....	p0070	N80-18528* #
REPT-21 .....	p0070	N80-18529* #
REPT-73 .....	p0082	N80-20638 #
REPT-77 .....	p0113	N80-20705 #
REPT-79/1564-29 .....	p0122	N80-21822* #
REPT-202 .....	p0100	N80-20786 #
REPT-622-101 .....	p0118	N80-17535* #
RSC-3458-4 .....	p0069	N80-18514* #
RSC-3622-2 .....	p0069	N80-18513* #
RSL-TR-331-13 .....	p0098	N80-18542 #
RTI/1833/00-03F .....	p0078	N80-16578* #
SDSU-RSI-80-01 .....	p0105	N80-18524* #
SDSU-RSI-80-02 .....	p0122	N80-19593* #
SR-E9-00404 .....	p0069	N80-18506* #
SR-E9-00404 .....	p0069	N80-18507* #
SR-LO-00408 .....	p0071	N80-19587* #
SR-T9-00402 .....	p0070	N80-18526* #
TVA/ONR-79/01 .....	p0068	N80-16600 #
US-PATENT-APPL-SN-945041 ..	p0104	N80-18498*
US-PATENT-CLASS-343-5CM ..	p0104	N80-18498*
US-PATENT-CLASS-343-5W ..	p0104	N80-18498*
US-PATENT-CLASS-343-18B ..	p0104	N80-18498*
US-PATENT-CLASS-343-18D ..	p0104	N80-18498*
US-PATENT-4.184.155 .....	p0104	N80-18498*

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