

NASA

Earth Resources
A Continuing
Bibliography
with Indexes

NASA SP-7041 (25)
April 1980

National Aeronautics and
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PREVIOUS EARTH RESOURCE BIBLIOGRAPHIES

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| Remote Sensing of Earth Resources | (NASA SP-7036) |
| Earth Resources | (NASA SP-7041(01)) |
| Earth Resources | (NASA SP-7041(02)) |
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| Earth Resources | (NASA SP-7041(10)) |
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| 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)) |
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EARTH RESOURCES

**A Continuing Bibliography
With Indexes
Issue 25**

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 January 1 through March 31, 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 380 reports, articles, and other documents announced between January 1 and March 31, 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:

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TABLE OF CONTENTS

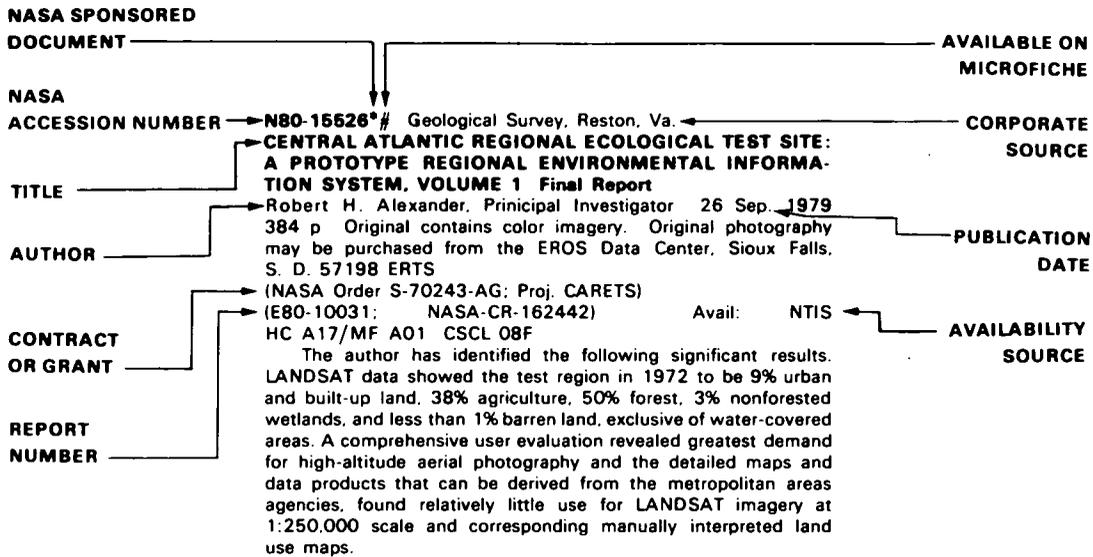
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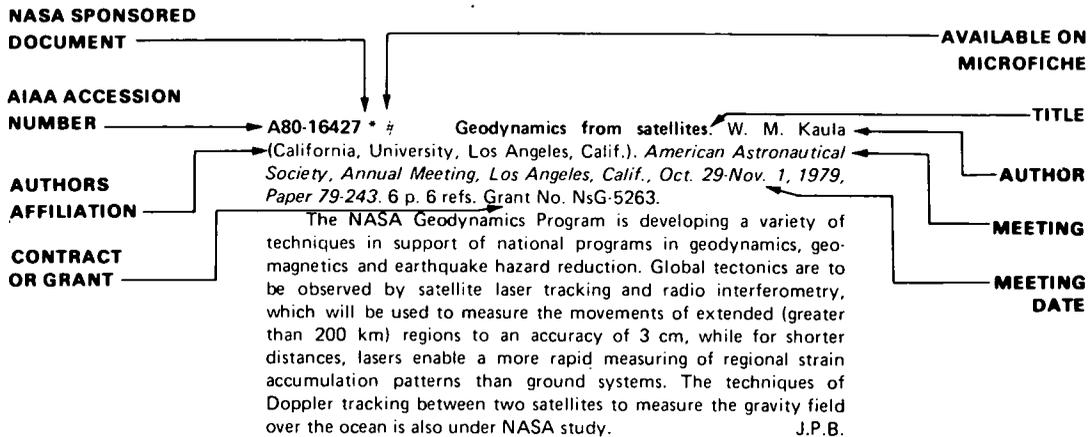
page:

| | |
|---|------------|
| 01 AGRICULTURE AND FORESTRY | 1 |
| Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns. | |
| 02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES | 23 |
| Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis. | |
| 03 GEODESY AND CARTOGRAPHY | 27 |
| Includes mapping and topography. | |
| 04 GEOLOGY AND MINERAL RESOURCES | 31 |
| Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology. | |
| 05 OCEANOGRAPHY AND MARINE RESOURCES | 35 |
| Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location. | |
| 06 HYDROLOGY AND WATER MANAGEMENT | 41 |
| Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies. | |
| 07 DATA PROCESSING AND DISTRIBUTION SYSTEMS | 47 |
| Includes film processing, computer technology, satellite and aircraft hardware, and imagery. | |
| 08 INSTRUMENTATION AND SENSORS | 53 |
| Includes data acquisition and camera systems and remote sensors. | |
| 09 GENERAL | 57 |
| Includes economic analysis. | |
| SUBJECT INDEX | A-1 |
| PERSONAL AUTHOR INDEX | B-1 |
| CORPORATE SOURCE INDEX | C-1 |
| CONTRACT NUMBER INDEX | D-1 |
| REPORT/ACCESSION NUMBER INDEX | E-1 |

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EARTH RESOURCES

A Continuing Bibliography (Issue 25)

APRIL 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.

A80-10171 # Digital processing of multispectral color aerial photographs of forest land (Opyt tsifrovoi obrabotki tsvetnykh spektrozonal'nykh aerosnimkov lesa). R. I. El'man, V. M. Zhirin, and A. N. Potapov (Vsesoiuznoe Ob'edinenie Lesproekt, USSR). *Geodeziia i Aerofotoš'emka*, no. 3, 1979, p. 75-79. In Russian.

The paper gives results of a machine experiment relating to the digital processing of aerial photographs of forest land. A color selection algorithm is presented for determining the parameters that influence the machine interpretation of tree types in a mixed evergreen forest, with an evaluation of the accuracy of such determination. An algorithm is also developed for the identification of damage to recently planted trees; the possibility of determining the portion of pines in pine/birch areas and of evaluating the degree of pollution damage of pines is examined. B.J.

A80-10877 Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters. S. G. Banyard (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal*, no. 2, 1979, p. 267-276.

It is well known that one of the main factors limiting the acquisition of aerial photographs of extensive areas in the tropics is the prevalence of cloud and mist cover. SLAR is especially useful for forest vegetation mapping in tropical regions where the acquisition of aerial photographs is difficult and often impossible due to adverse weather conditions. SLAR imagery can be interpreted for the production of thematic maps, and the paper considers this aspect of radar usefulness, with particular reference to training in forest type mapping. By carrying out a prescribed training exercise, foresters discover for themselves the difficulties and limitations associated with the interpretation of currently available radar images. The importance of reliable ground truth and the use of accurately located 'photo-truth' keys is discussed. S.D.

A80-11708 # Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture. T. W. Gossard (U.S. Department of Agriculture, Forest Service, Washington, D.C.). In: *New technology for mapping;*

Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 726-734. 6 refs.

There are currently three systems in use within the Forest Service that use Digital Terrain Data (DTD) as source material. TOPAS (TOPographic Analysis System) was developed in-house in 1975 and is heavily used by resource managers to evaluate impacts of alternate land uses of National Forest lands. Digital Terrain Information System (DTIS) is a secondary set of programs within TOPAS that has been enhanced to handle more rigorous analyses related to site specific projects, often involving engineering reconnaissance and design. Method of Scenic Alternative Impacts by Computer (MOSAIC) was written under contract, and is a photomontage system that employs computer graphics to depict proposed landscape alterations to overlay on a terrestrial photograph of an existing area. The basic features of each system, and the primary uses of output products are discussed. (Author)

A80-13136 Wheat spectral reflectance - Interactions between crop configuration, sun elevation, and azimuth angle. R. D. Jackson, P. J. Pinter, Jr., S. B. Idso, and R. J. Reginato (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Applied Optics*, vol. 18, Nov. 15, 1979, p. 3730-3732. 9 refs.

Interactions of crop configurations with sun angle and sun azimuth influencing the spectral reflectances of wheat are investigated. Plots of wheat were planted in a dense stand with no rows, and in rows spaced 0.3 m apart running north-south and east-west. Radiance were measured when the plants were 0.35 m in height and covered 70% of the ground in the row plots by means of a radiometer having bandpass intervals similar to those of the Landsat multispectral scanner during the course of one day as the solar elevation angle and azimuth angles changed. Measurements reveal essentially no changes in IR radiances (0.8 to 1.1-micron and 0.7 to 0.8-micron bands) in the no-row plot with solar angle, with slightly greater reflectance in the afternoon than the morning, and similar variations for both row orientations. For the visible (0.6 to 0.7 and 0.5 to 0.6 micron) bands, the reflectance of the no-row plot increased abruptly at noon, the east-west plot exhibited little change with solar elevation, and the reflectance of the north-south plot increased about 2.3 times as the sun neared solar noon. It is concluded that crop configuration is a major determinant of wheat spectral reflectance and should be considered in interpreting imagery spanning a significant time. A.L.W.

A80-13141 Plant canopy information extraction from composite scene reflectance of row crops. R. D. Jackson, R. J. Reginato, P. J. Pinter, Jr., and S. B. Idso (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Applied Optics*, vol. 18, Nov. 15, 1979, p. 3775-3782. 18 refs.

As an aid in the interpretation of remotely sensed data from row crops with incomplete canopies, a model was developed that allowed

01 AGRICULTURE AND FORESTRY

the calculation of the fractions of sunlit soil, shaded soil, sunlit vegetation, and shaded vegetation for each resolution element in a scan of a remote sensor for a given set of conditions (plant cover, plant height/width ratio, row spacing, row orientation, time of day, day of year, latitude, and size of resolution element). Using measured representative reflectances of the four surfaces, composite reflectances were calculated as a function of view angle. Also, representative temperatures for each surface were used to simulate composite temperatures viewed by an IR scanner. With composite reflectances and temperatures known as a function of view angle, ways were explored to extract plant cover and plant temperature data from the composite data. (Author)

A80-13357 Look direction modulation function of the radar backscattering coefficient of agricultural fields. F. T. Ulaby and J. E. Bare (University of Kansas Center for Research, Inc., Lawrence, Kan.). *Photogrammetric Engineering and Remote Sensing*, vol. 45, Nov. 1979, p. 1495-1506. 9 refs.

An experimental evaluation is presented of the look direction modulation function, which describes the dependence of the radar backscattering coefficient on the orientation of the radar look direction relative to the row direction of agricultural fields. The look direction modulation function was investigated for angles of incidence from 0 deg (nadir) to 60 deg, microwave frequencies from 1 GHz to 18 GHz (30 cm to 1.67 cm in wavelength) and for all linear polarization configurations (HH, HV, and VV). Based on experiments conducted for fields of corn, wheat, and soybeans under several different growth conditions, the results indicate a strong dependence of the like-polarized radar backscattering coefficient on look direction at 1 GHz, decreasing exponentially with frequency to an insignificant dependence above 4 GHz. The cross-polarized radar backscattering coefficient shows no significant dependence on look direction at any frequency or angle of incidence. (Author)

A80-14375 The application of Landsat-MSS-imagery for agricultural planning in tropical rain and swamp forest zones (Die Verwendbarkeit von Landsat-MSS-Bildern bei landwirtschaftlichen Planungen in tropischen Sumpf- und Regenwaldzonen). W. Müksch. *Bildmessung und Luftbildwesen*, vol. 47, Nov. 1, 1979, p. 189-193. 5 refs. In German.

Within the frame of a cacao plantation project in the southern rain forest of Cameroon a general use of Landsat-MSS-imagery was tested for agricultural planning. Test basis was a geometrical analysis in three characteristic regions: Mangrove swamps, secondary rain forest, plantations and humid savanna. As geometrical figures points, distances and areas were tested by transformations and comparisons of image and map. The results found were some accuracy relations which admit conclusions for application of the photos in different measures of agricultural planning. (Author)

A80-14580 Microwave radiometric methods and the problem of forest and peat fires. L. F. Borodin, E. N. Valendik, and A. S. Mironov. (*Radiotekhnika i Elektronika*, vol. 23, Oct. 1978, p. 2120-2131.) *Radio Engineering and Electronic Physics*, vol. 23, Oct. 1978, p. 85-93. 29 refs. Translation.

The results of works involving the use of microwave radiometry in solving the problems of forest and peat fire protection are generalized. Information is given concerning the microwave radiation of forest fires. The major tactical parts of a fire can be clearly identified through the use of airborne microwave radiometers under dense smoke conditions. The experimentally obtained spectral dependences of the absorption coefficient and emissivity of peat are presented. An estimate is given of the microwave radiation spectra of peat piles with hidden sources of dangerous heating. It is shown to be possible in principle to estimate the degree of fire danger in territories covered by forests and peat bogs by means of spectral measurements of their emissivity. (Author)

A80-15051 Albedo of vegetated surfaces - Its variability with differing irradiances. K. T. Kriebel (München, Universität, Munich, West Germany). *Remote Sensing of Environment*, vol. 8, Dec. 1979, p. 283-290. 7 refs. Research sponsored by the Deutsche Forschungsgemeinschaft.

The albedo of four vegetated surfaces was investigated to derive its variability with differing distributions of the irradiance. The results are based on measured values of the spectral biconical reflectance factor, which are combined with calculated spectral irradiances for low and high atmospheric turbidity. The solar zenith angle is varied from 0 to 80 deg. The derived spectral albedos are then integrated with respect to wavelength in order to achieve the albedo. It is found that the variability of the albedo with respect to the atmospheric turbidity is less than 0.01 in nearly all cases. The variability of the albedo with respect to the solar elevation angle, however, is larger than 0.02 in many cases. For solar elevation angles from 20 to 60 deg, the variability of the albedo of the four surfaces can be represented by a mean curve which fits the individual variabilities with an accuracy of 0.015. (Author)

A80-15052 Remotely sensed land cover temperature and soil water status - A brief review. G. F. Byrne, J. E. Begg, P. M. Fleming, and F. X. Dunin (Commonwealth Scientific and Industrial Research Organization, Canberra, Australia). *Remote Sensing of Environment*, vol. 8, Dec. 1979, p. 291-305. 42 refs.

The temperature of a plant canopy, as seen by a scanning device, is determined by plant physiological processes and environmental conditions which interact in a complex manner not readily monitored by remote sensing devices. The physiology literature is briefly considered with a view to outlining factors that may be relevant in inferring soil water content from canopy temperature. Examples of energy fluxes and temperatures observed under field conditions are discussed. (Author)

A80-15053 Estimating leaf-area index of wheat with Landsat data. R. B. Pollock and E. T. Kanemasu (Kansas Agricultural Experiment Station, Manhattan, Kan.). *Remote Sensing of Environment*, vol. 8, Dec. 1979, p. 307-312. 9 refs.

Foliage density is a valuable measurement for assessing crop growth, development, and yield. A relationship between foliage density and spectral intensity has been noted in several studies. In this study, an empirical model is developed to estimate foliage density, i.e., leaf area index (LAI), using Landsat multispectral scanner data. LAI measurements of wheat from several fields in three Kansas counties during three growing seasons were correlated with various transformations of Landsat multispectral scanner data. The model performed well at LAIs above 0.5, but significantly poorer below 0.5. (Author)

A80-15057 Measured emissivity of soils in the southeast United States. S. E. Taylor (NOAA, Environmental Studies Service Center, Auburn, Ala.). *Remote Sensing of Environment*, vol. 8, Dec. 1979, p. 359-364. 10 refs.

The thermal emissivities of exposed soil surfaces for the major soil subgroups of Alabama, Georgia, and Florida were determined. It was found that brightness temperature sensed by narrow-band infrared radiometers (10.4-12.6 microns), as used on SMS-GOES spacecraft would not deviate from thermodynamic temperatures by more than -2 C as a result of surface emissivity. Emissivity effects on the brightness temperature determined with broadband radiometers (5-15 microns), however, could be as great as -6 C. (Author)

A80-15559 The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest. P. J. D. Versteegh (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal*, no. 2, 1979, p. 277-291.

An experimental forest inventory was carried out in a tract of tropical rain forest of 2200 hectares on Pulau Laut, South Kalimantan, Indonesia. Shorea (Meranti) and Dipterocarpus (Keruing) are commercially the most important timber species. The spatial distribution of the species is heterogeneous with a pronounced tendency to grouping. The discussion covers sampling design, species group, analysis, and results. The tallying of data in record units afforded analysis per species group. Four species groups are distinguished: Shorea, Dipterocarpus, Euxideroxylon zwageri (ulin or ironwood), and all species. It is shown that the expected discrepancy is not significant for five record unit sizes and four species groups, which were indeed heterogeneous in their spatial distribution. Several tables supplement the text. S.D.

A80-15560 **Examples of aerial photo-interpretation in soil surveys for an agricultural land development project in north-east Brazil.** B. Kemper (IAPAR, Londrina, Brazil). *ITC Journal*, no. 2, 1979, p. 292-301. 6 refs.

A80-15775 # **A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area /Lesotho/.** E. M. Makhanya (London, University, London, England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 27, 29-33.

Erratic sub-tropical rainfall in the study area is very destructive on the erodible soils of this bare and rugged landscape. Soil erosion is further accelerated by poor management of agricultural resources, and is more pronounced where crops are cultivated in areas that are susceptible to erosion. The results of this study, which was carried out by air photo-interpretation and field checking, showed that about 60 per cent of the land area is subjected to severe erosion and about 37 per cent of the cultivated land is situated on it, posing an erosion hazard. (Author)

A80-15776 # **Some applications of remote sensing in agricultural resources with reference to India.** B. Dey (Ottawa, University, Ottawa, Canada). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 35, 37-42. 20 refs.

This paper examines the present experimental and quasi-operational remote sensing activities of the Indian Space Research Organization (ISRO) and the National Remote Sensing Agency (NRSA) for their agricultural resources management programs. Airborne remote sensing with multiband and infrared false color photography has been used from various platforms, including helicopters, aircraft and balloons for crop identification, crop estimation, land use classification and the inventory of water resources. Studies in the United States, Canada and a few other countries have demonstrated the important role Landsat and NOAA provide in agricultural resources inventories and planning. Some of the satellite remote sensing techniques could be applied to India, such as the use of low resolution NOAA imagery to study the behavior of monsoon rainfall, and the use of Landsat imagery for agricultural resources inventories, land use classifications and small-scale thematic mapping for large areas. Moreover, Landsat imagery might be used to obtain the yearly estimate of India's crop acreage. By using Landsat color composites (MSS Bands 4, 5 and 7) of dry and wet seasons, a land use classification map for part of Bihar State has been prepared. (Author)

A80-15777 # **The contribution of Landsat imagery to reconnaissance soil mapping in north-west India.** J. A. Allan (London, University, London, England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 43, 45-47. 12 refs.

Soil maps of northern India are generally inadequate and extremely difficult to locate. In addition, aerial photography is not available to scientists and administrators as a result of which information about the spatial distribution of land units, with their variation in quality, is extremely difficult to obtain. A study in Bulandshahr District in north-west India has shown that in the

circumstances of this study area the spatial, spectral and temporal resolution of the Landsat system are sufficient for the delimitation of land units with soils which can support vigorous agriculture and of those where soils are degraded, or severely degraded, by saline-alkali conditions. (Author)

A80-15778 # **The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin.** A. A. Disperati (Paraná, Universidade Federal, Curitiba, Brazil) and M. A. Keach (National College of Agricultural Engineering, Silsoe, Beds., England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 49, 51-55.

Side-looking airborne radar, satellite imagery and aerial photography were used in a recent forest inventory carried out along part of the Trans-Amazonian Highway. The survey involved the examination of a 20-km wide strip centered on the line of the road starting 120 km east of the Rio Xingu and finishing 200 km west of the river. The area had several terrain forms and most of these could be clearly demarcated on the SLAR though there were areas where the image reproduction seemed blurred. River lines, most important for location purposes, were better revealed on the satellite imagery which also amplified the geomorphological information found on the radar images. Geology was best revealed on the satellite imagery. Vegetation and the precise definition of the form of the geomorphology were observed on the aerial photography. The definition and classification of the forest types was achieved by stereo interpretation. It was found possible to identify different strata in the forests to describe the forms of the crowns, or combination of crowns in each layer, and to locate certain patterns of similarity. These were converted to horizontal diagrams. There appeared to be some correlation with the geological and geomorphological forms. Patterns located on photography could be identified on the satellite imagery in several cases, but the radar images at the scale available were less satisfactory. The use of all three media increased the confidence and accuracy of the survey considerably. (Author)

A80-20267 * **A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring.** C. J. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 579-593. 19 refs.

The first four Landsat-D thematic mapper sensors were evaluated and compared to the RBV and MSS sensors from Landsats-1, 2, and 3. Colvocoresses' proposed 'operational Landsat' three band system, and the French SPOT three band system using simulation/integration techniques and in situ collected spectral reflectance data. Sensors were evaluated by their ability to discriminate vegetation biomass, chlorophyll concentration, and leaf water content. The thematic mapper and SPOT bands were superior in a spectral resolution context to the other three sensor systems for vegetational applications. Significant improvements are expected for vegetational analyses from Landsat-D thematic mapper and SPOT imagery over MSS and RBV imagery. (Author)

A80-20268 * **Dual polarized long wavelength radar for discrimination of agricultural land use.** W. P. Waite, H. C. MacDonald, D. N. Tolman, C. A. Barlow, and M. Borengasser (Arkansas, University, Fayetteville, Ark.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 595-607. 5 refs. Contracts No. JPL-954940; No. JPL-955048.

The scattered return of imaging radars is primarily sensitive to target structure or roughness and to composition of complex permittivity. The relative degree of penetration, or the depth of material to which the return is sensitive, also varies directly with the wavelength. Where vegetation can be eliminated as a factor, the

01 AGRICULTURE AND FORESTRY

surface return may be analyzed for variations in roughness or composition (primarily moisture content). L-band (25-cm) imagery has provided evidence that long-wavelength systems with improved penetration capability have the potential for minimizing the vegetation contribution and enhancing the surface return variations. However, the increased wavelength increases the sensitivity to large-scale structure. In the present paper, it is shown that addition of a cross polarized channel enables the interpreter to distinguish vegetation and orientation perturbations in the surface return. V.P.

A80-20754 # Spectral reflectance of certain weeds (Spektral'naiia otrazhatel'naia sposobnost' nekotorykh sorniakov). K. Ia. Kondrat'ev and P. P. Fedchenko (Glavnaia Geofizicheskaiia Observatoriia, Leningrad, USSR). *Akademiia Nauk SSSR, Doklady*, vol. 248, no. 6, 1979, p. 1318-1320. 6 refs. In Russian.

In order to devise a method to control the weed damage of crops, a study has been undertaken in the USSR to identify and classify weed types in grain fields. This summer-1978 study involved the identification of weed types according to their spectral reflectance characteristics, measured from an airborne photometer system. Data are used in developing an algorithm of weed identification. B.J.

A80-15779 # Problems of remote sensing in the tropics - An appraisal of the Nigerian situation with regard to forest resources. F. B. Larin-Alabi (Edinburgh, University, Edinburgh, Scotland). In: *Remote sensing applications in developing countries*. Birmingham, England, University of Aston, 1978, p. 57, 59-61. 9 refs.

The paper considers problems involved in remote sensing techniques in forest surveys in Nigeria with particular emphasis on the tropical high forest as an example of a complex tropical forest system. The value of remote sensing for forest surveys has not been realized in the tropics due to the persistent cloud cover which impeded photography and made satellite sequential sensing less meaningful, and to environmental conditions limiting the interpretation of remote sensing imagery. Operational remote sensing in tropical countries is often executed by expatriates (because of lack of trained personnel) who leave the country at the conclusion of their assignments, so that the country loses their experience. To benefit from the remote sensing technology, radar should be improved because of its near-all-weather capability, and adequately equipped central and multidisciplinary remote sensing units and personnel training programs should be established. A.T.

A80-15780 # Digital analysis of radar imagery for vegetation detection in Nigeria. D. J. Stanley (Logica, Ltd., London, England). In: *Remote sensing applications in developing countries*. Birmingham, England, University of Aston, 1978, p. 63, 65-74. 6 refs.

Single polarization X-band side-looking airborne radar imagery has recently been acquired for the whole of Nigeria for the primary purpose of generating a reliable forestry inventory to provide a baseline for management of timber resources. A microwave remote sensor was employed because of the persistent cloud cover over the equatorial region and the superior speed of acquisition for large areas. Because of the single channel nature of the imagery, conventional multivariate spectral classification is not possible, and methods have been developed to analyze and quantify the spatial intensity relationships usually described as texture. In addition to the principal aim of providing the human interpreter with a tool to quantify tone and texture relationships, research has also been oriented towards an investigation of the dependence of these quantities on system parameters such as resolution and antenna response as well as processing algorithms. Examples are selected to illustrate the need for a careful evaluation of the effects of such variables. (Author)

A80-15783 * # An assessment of LACIE and related methodologies for conducting crop inventories. R. E. Tokerdud and J. A. Quirein (Lockheed Electronics Co., Inc., Systems and Services Div.,

Houston, Tex.). In: *Remote sensing applications in developing countries*. Birmingham, England, University of Aston, 1978, p. 91, 93-101. 17 refs. Contract No. NAS9-15200.

The Large Area Crop Inventory Experiment (LACIE) is a joint undertaking of the U.S. Department of Agriculture, the National Oceanic and Atmospheric Administration of the U.S. Department of Commerce, and the National Aeronautics and Space Administration. It is designed to verify an economically important application of remote sensing from earth orbital satellites. The first two phases of the experiment have been completed. A description of the experiment and a short discussion on the results and conclusions of the first two phases are presented. The LACIE design is compared with other designs for conducting crop inventories. An integrated design methodology (based upon accumulated LACIE experience) is discussed for conducting crop acreage surveys in developing countries. (Author)

A80-16562 # System of landscape-statistical methods for stocktaking and mapping of forests (Sistema landshaftno-statisticheskikh metodov inventarizatsii i kartografirovaniia lesov). E. N. Kalashnikov. In: *Remote-sensing studies of taiga regions*. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 60-74, 190-192. 13 refs. In Russian.

The basic principles of a methodology based on a system landscape-statistical stocktaking and mapping methods are outlined. The correlation between the methods (and objects) of forest stocktaking and the inventory items and organization of forestry is demonstrated. The complexity of the technological processes is illustrated, and the potentialities of these processes are assessed. V.P.

A80-16563 # Remote identification of the spatial structure of forest phytocoenoses (Distantsionnaia indikatsiia prostranstvennoi struktury lesnykh fitotsenozov). V. V. Kuz'michev, V. P. Cherkashin, V. Ia. Ledovskikh, and K. K. Dzhanseitov. In: *Remote-sensing studies of taiga regions*. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 75-88. 22 refs. In Russian.

Characteristic of phytocoenoses is a well-defined organization level which manifests itself in the spatial structure of tree arrangements and arrangements of groups of trees and also in the arrangement of phytocoenoses within recurrent forms of the relief. This structure is reflected on satellite photographs and can be studied by quantitative methods. In the present paper, the analysis of the frequency-spatial characteristics of wooded areas, obtained from aerial photograph density traces is demonstrated by an example. V.P.

A80-16565 # Mapping the soil cover of taiga landscapes by remote sensing techniques (Kartirovanie pochvennogo pokrova taezhnykh landshaftov s ispol'zovaniem distantsionnykh metodov). V. M. Korsunov, E. E. Boboleva, V. D. Karpenko, and F. I. Pleshikov. In: *Remote-sensing studies of taiga regions*. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 135-151, 185, 188, 189, 195-197. 20 refs. In Russian.

The principles of mapping forest soils from aerial photographs are outlined, along with a structural-ecological approach to the decoding and interpretation of aerial and satellite photographs in the identification of forest soils. An effective procedure for mapping the structure of forest soil covers is proposed. V.P.

A80-16566 # Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography (Analiz landshaftno-ekologicheskoi priurochennosti ochagov Sibirskogo shelkopriada s primeneniem aerokosmicheskoi s'emki). A. S. Isaev and V. Ia. Riapolov. In: *Remote-sensing studies of taiga regions*. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 152-167, 198, 199. 41 refs. In Russian.

A80-16567 # Remote sensing methods applied to the solution of the forest fire problem (Distantsionnye metody v reshenii problemy lesnykh pozharov). E. N. Valendik. In: *Remote-sensing studies of taiga regions*. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 168-182. 32 refs. In Russian.

The current status of remote sensing techniques developed for combating forest fires is reviewed. Some results of the application of IR and microwave radiometry in forestry and in detection, mapping, and estimation of the rate of spread of forest fires are examined. V.P.

A80-19543 Crop identification with L-band radar. F. T. Ulaby, P. P. Batlivala, and J. E. Bare (University of Kansas Center for Research, Inc., Lawrence, Kan.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Jan. 1980, p. 101-105. 9 refs.

In an experiment to classify crops based on L-band radar data a synthetic aperture radar (SAR) was flown over the test site at 2170 meters msl. L-band imagery with HH and HV polarization was obtained. Depression angle ranged from 31 degrees in the near range to 15 degrees in the far range. Radar return values were digitized as grey levels (128 steps) for classification purposes. The data obtained were normalized by range correction curves and a linear discriminant analysis was performed on the normalized data. In the classification analysis, each of the two discriminating variables, like polarization (HH) and cross polarization (HV) returns, were used singly and in combination. The analysis led to the following conclusions: it is possible to separate four categories - corn, soybeans, woods, and continuous cover - with a confidence of 71 percent if both like (HH) and cross (HV) polarization returns are used; if only one polarization is used, HH yields good overall results (65 percent) and is able to separate corn, soybeans and continuous cover crops, but woods, however are confused with crops. V.L.

A80-19544 * A seasonal verification of the Suits spectral reflectance model for wheat. E. W. LeMaster, J. E. Chance (Pan American University, Edinburg, Tex.), and C. L. Wiegand (Science and Education Administration, Weslaco, Tex.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Jan. 1980, p. 107-114. 15 refs. Grant No. N5G-9033.

Variables that characterize wheat canopies for the Suits Model and spectral bidirectional reflectance measurements in the 450 to 1350 nm interval were determined approximately weekly throughout the growing season for two cultivars of wheat that achieved maximum leaf area index of 5.3 and 10.8. The Suits Model plant variables were tabulated and experimental reflectance measurements were compared with the model predictions in the wavelength interval from 500 to 1150 nm at 50 nm increments for 17 measurement dates. The seasonal average coefficient of determination, r squared, was 0.88 between the Suits spectral bidirectional reflectance model and field-measured reflectance data. Poorest agreement was found very early and very late in the growing season, possibly due to low green plant biomass and incomplete ground cover. (Author)

A80-20024 Fixed-base large-scale photographs for forest sampling. R. D. Spencer (Town and Country Planning Board, Victoria, Australia). *Photogrammetria*, vol. 35, Nov. 1979, p. 117-140. 32 refs. Research supported by the Forests Commission of Victoria, APM Forests Pty., and University of Melbourne.

The use of large-scale aerial photographs for collecting and analyzing forest inventory data (tree heights, stem diameters and crown widths) is considered. Sharp images and improved accuracies of flying heights, essential for the determination of photographic scale, were obtained with fixed-base photography. Stereoscopic pairs of macro-scale photographs were taken simultaneously from heights of 200-500 ft using twin Vinten 70-mm cameras mounted on a 16-ft boom attached to a helicopter. Further development of this technique should be the use of cameras with between-the-lens shutters and could include twin-camera photography from fixed-wing aircraft with cameras mounted in the wings. V.L.

A80-20195 # Calculation of the spectral irradiance in spaceborne photography of the earth (K raschetu spektral'noi osveshchennosti pri fotografirovanii zemli iz kosmosa). Iu. V. Krylov. *Geodeziya i Kartografiya*, Oct. 1979, p. 12-14. 8 refs. In Russian.

A method is proposed for calculating the spectral irradiance of the entrance pupil of an earth surveying camera. For illustration, the

method is applied to calculations for the photography of various types of soil. V.P.

A80-20238 Analysis of plant community structure and successional stage using multispectral and multidade aerial photography. R. R. Anderson, D. McFaden (American University, Washington, D.C.), and R. J. Kramer (Howard, Needles, Tammen, and Bergendoff, Alexandria, Va.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 1-9. 8 refs.

Vegetation community patterns were determined in Rock Creek Park from a combination of several types of aerial photography. No single date of photography provided the total picture because an eastern deciduous forest is a dynamic multilayered mixture of plant species. Natural differences in plant types, such as spring and fall foliage characteristics, and natural relationships, such as the affinity of a plant association for wet soils or exposed slopes were exploited by selecting the appropriate type of photography (color infrared, black-and-white, etc.) and the proper season coverage. A large part of the initial efforts were directed toward determining which combination of film and season was most useful for discriminating the various vegetation communities and their component layers. V.P.

A80-20248 A comparison of Landsat and forest survey estimates of forest cover. R. M. Hoffer, S. C. Noyer, and R. P. Mroczynski (Purdue University, West Lafayette, Ind.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 221-231. 8 refs.

This study was conducted to compare estimates of forest acreages obtained by standard Forest Service procedures to estimates obtained through the application of computer-aided analysis techniques to Landsat data. A total of 158 counties in four states (Mich., Wis., N.Y., and Mo.) involving all or parts of 16 U.S.F.S. Survey Units were involved in the comparison. The results indicate that reasonably comparable acreage estimates can be obtained from the Landsat data, providing that proper analysis procedures are utilized. (Author)

A80-20249 * Spectral vegetation relationships in a tropical rain forest. B. N. Holben and C. T. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 249-263. 7 refs.

Jordan's (1969) spectral method of leaf-area index determination from measurements of the transmitted light at the forest floor is evaluated under a wide variety of illumination conditions in the Luquillo Rain Forest of Puerto Rico, using a hand-held radiometer. Previously suggested 'correction factors' for temporal adjustment were found to degrade the data. Quantitative use of the method was found to be restricted to high sun periods. Data collected under uniformly overcast conditions were of greater stability than under clear skies, however, stability was impaired by changes in cloud thickness. Care must be taken to minimize irradiational variability and to adequately sample the spatial variability. V.P.

A80-20254 Spectral classification of tomato disease severity levels. L. D. Lathrop and S. P. Pennypacker (Pennsylvania State University, University Park, Pa.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 329-342. 10 refs.

Spectral reflectance measurements over the 380-800 nm region in 10 nm bandwidths were made of randomly sampled plants in a

01 AGRICULTURE AND FORESTRY

0.4-ha block of determinant-growth tomatoes having the early blight disease in various severity levels. The relative significance among the forty three 10 nm bands and the severity levels of defoliation was determined by ordinary least-square regression. Two spectral regions of strong statistical significance - 380-510 and 600-690 nm - were identified and subsequently integrated to simulate two broad bandwidths. These bandwidths were used separately and in combination to compare several discriminant functions with respect to the classification of various severity levels of defoliation. V.P.

A80-20257 Mapping vegetation with low cover density from Landsat data. R. M. McCoy and R. G. Witt (Utah, University, Salt Lake City, Utah). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 379-385.

An investigation is made into the problems of mapping vegetation having low cover densities in arid environments. Three study sites in central Utah having different vegetation cover ranging from low to medium densities are described. Results of mapping with a definition of bare ground extending up to 20% cover show improvement of other classes. Band ratios (R 5, 6 and R 5, 7) show capability for good estimates of cover density. (Author)

N80-10588# New Mexico Univ., Albuquerque. Technology Application Center.

REMOTE SENSING APPLIED TO AGRICULTURAL RESOURCES. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1974 - Jun. 1979

Gerald F. Zollars Jul. 1979 48 p (NTIS/PS-79/0733/0) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 02D

This bibliography cites 193 articles from the international literature concerning remote sensing applications in the agricultural sector. The use of remote sensors for soil and vegetation mapping, soil moisture mapping, and the interpretation of agricultural land use is stressed. GRA

N80-10994# Joint Publications Research Service, Arlington, Va.

LOGGING OF GRAIN CROPS AND ITS DETECTION BY AERIAL PHOTOGRAPHY

V. Ye. Budanov (All-Union Scientific Res. Inst. of Cybernetics) In its USSR Report: Biomedical and Behavioral Sci., No. 112 23 Jul. 1979 p 1-6 Transl. into ENGLISH from Zashchita Rasteniy (Moscow), no. 4, 1979 p 32-33

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It was found that in several basic areas of grain production (northern Caucasus, nonchernozem areas, Kazakhstan, Ukraine, Belorussia and others) fermentative mycotic exhaustion especially increases under the influence of rainy weather, incessant dews and fogs. Investigations begun in various areas of the country in 1973 have made it possible to determine the basic features of the complicated biological mechanism causing the appearance, development and occurrence of the described phenomenon. The pathologic process occurs and develops under a certain combination of external and internal factors coming through successively and consists of the two following stages. The first stage is noninfectious and occurs during the phase of milk, wax and, less frequently, full ripeness of grain when the ears are moistened by rain, fog or continuous dews (with irrigated crops, during late watering when the grain is being formed). The second stage is infectious and is caused by saprophyte and semi-parasitic fungi from the genera of *Alternaria*, *Cladosporium*, *Helminthosporium*, *Fusarium*, etc. F.O.S.

N80-12495 Landeskulturamt Hessen, Wiesbaden (West Germany).

CLASSIFICATION OF AGRICULTURAL LAND WITH THE AID OF REMOTE SENSING METHODS [KLASSIFIZIERUNG AGRARISCHER LANDNUTZUNG MIT HILFE VON FERNERKUNDUNGSMETHODEN]

P. Richtscheid In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 281-286 In GERMAN

Avail: Issuing Activity

Visual images of exploited land in the Rhein-Main region and around Wetterou were recorded and compared with scanning data and various photographs. Data obtained from flights in 1976 and May 1977 are interpreted. In spite of the unfavorable vegetation development periods during which data were recorded, it was possible to distinguish between different types of culture with the aid of the DIBIAS system. It is suggested that flights should either be more accurately synchronized with agricultural development phases, or that a program of regular flights should be set up. Author (ESA)

N80-12496 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

AERIAL PHOTOGRAPHY OF AGRICULTURAL FARMING LAND [UNTERSUCHUNG VON LUFTBILDERN LANDWIRTSCHAFTLICHER KULTUREN]

H. Helbig In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 287-294 In GERMAN

Avail: Issuing Activity

Work conducted in the framework of a program for the recognition and determination of plant protection procedures and manure effects is described. Land divided into 2 x 5 sq m plots was studied. Various photographic conditions and vignetting effects made interpretation difficult. A procedure was developed to correct such effects, which relies on information contained in the image itself, and does not require any further measurement data. Author (ESA)

N80-12497 Badische Anilin- und Soda-Fabrik A.G., Landwirtschaftliche, Giessen (West Germany).

FEASIBILITY OF USING REMOTE SENSING FOR DETERMINING NUTRITIONAL REQUIREMENTS, DISEASES AND PEST INFESTATIONS IN AGRICULTURAL CROPS [MOEGELICHKEITEN DER FERNERKUNDUNG ZUR BESTIMMUNG VON NAEHRSTOFFVERSORGUNG, KRANKHEITS- UND SCHADLINGSBEFALL AN LANDWIRTSCHAFTLICHEN KULTUREN]

K. H. Schneider In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 295-305 refs In GERMAN

Avail: Issuing Activity

The radiobiological behavior of crops in the IR and visible spectrum was studied. It is shown that measurements made during the 1976 summer FMP program are satisfactory for classifying different types of culture. Concrete examples with various crops are presented and examined. The biological processes taking place are considered. In one case, it was possible to distinguish between different varieties of oats. It was, however, not possible to determine nutrition requirements for the dry 1976 summer. It was possible, though, in one instance, to detect pest infestation in winter corn. The results obtained indicate that optimum information is acquired from low altitude vertical flights. The data obtained must be processed quickly. Author (ESA)

N80-12498 Freiburg Univ. (West Germany).

TEXTURE ANALYSIS AS A RECOGNITION PARAMETER FOR DIFFERENT TYPES OF FORESTS [ANALYSE DER TEXTUR ALS ERKENNUNGSPARAMETER ZUR IDENTIFIZIERUNG VON WALDTYPEN]

S. A. Masumy and G. Hilderbrandt In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 307-317 refs In GERMAN

Avail: Issuing Activity

It is shown that quantitative and qualitative determinations of forest characteristics from textures are highly dependent on the sensors used and the aircraft altitudes, and at low altitudes, on the position within the image. Examples are given of results obtained using photographic and scanning techniques at varied heights with different forests. Similarities are observed between the values of defined texture parameters determined at given heights with these two techniques. Author (ESA)

N80-12499 Freiburg Univ. (West Germany).
PHENOLOGY AS A FACTOR IN THE DETERMINATION OF DIFFERENT FORMS IN VEGETATION BY REMOTE SENSING [PHÄNOLOGIE ALS EINFLUSSGRÖSSE FÜR DIE FERNERKUNDUNG VERSCHIEDENER VEGETATIONSFORMEN]

H.-J. Doefel /In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 319-330 refs In GERMAN

Avail: Issuing Activity

Temporal and spatial variations in vegetation forms were studied. Microdensitometer profile measurements were performed on images obtained by photographic methods, and different emulsions were tested. Specific phenological characteristics were revealed in forest and agricultural zones. Methods are suggested for recording and processing the corresponding information so as to optimize the differentiation between different forms of vegetation. Author (ESA)

N80-12500 Freiburg Univ. (West Germany).
APPLICABILITY OF MULTISCANNING TECHNIQUES IN ESTABLISHING INVENTORIES FOR AGRICULTURAL FARMING AND FORESTRY [EINSATZMÖGLICHKEITEN DES MULTISPEKTRALSCHANNERS FÜR LAND- UND FORSTWIRTSCHAFTLICHE INVENTUREN]

P. G. Reichert /In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 331-344 refs In GERMAN

Avail: Issuing Activity

Multiscanning results obtained with a preselected test region are presented. Computerized maximum likelihood and minimum distance methods (DIBIAS system) permit the identification and classification of different crops and types of forest together with the regions over which they extend. The problems encountered and the factors to be taken into consideration are discussed. Author (ESA)

N80-12501 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
WHAT ARE THE ADVANTAGES OF MULTISPECTRAL CLASSIFICATION? [WAS BRINGT DIE MULTISPEKTRALE KLASSIFIZIERUNG?]

E. Triendl /In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 345-350 refs In GERMAN

Avail: Issuing Activity

Multispectral methods for classifying different crops are compared with classical procedures. The introduction of an ellipsoidal probability distribution enables a critical parametric function to be obtained from mean values and the covariance matrix (maximum likelihood classification). A practical example (bend in the Main, near Frankfurt) with two scanning channels is studied. It is concluded that reliability and applicability could be enhanced by combining multispectral methods with local parameters. Author (ESA)

N80-12512 Institut fuer Physikalische Weltraumforschung, Freiburg (West Germany).

ON THE SIGNIFICANCE OF SPECTRAL SIGNATURES OF VEGETATION COVERED SURFACES IN THE 400-1100 NANOMETER REGION [ZUR SIGNIFIKANZ VON SPEKTRALEN SIGNATUREN BEWACHSENER OBERFLÄCHEN IM BEREICH 400-110 NANOMETER]

W. Fischer /In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 427-437 refs In GERMAN

Avail: Issuing Activity

The effect of the sun zenith and sun azimuth angles on the spectral reflection factors of fodder beet, corn and other crops is investigated using measurements from a spectroradiometer. Overall radiation effects and variations with time of day and seasonal advances were studied. Results obtained, primarily in the Gottenheim region, are presented as a series of curves. The optical directional, and morphological reasons behind the observed variations are discussed. Author (ESA)

N80-12513 Freiburg Univ. (West Germany).
SPECTRAL REFLECTION FROM AGRICULTURAL AND FOREST REGIONS DURING THE VEGETATION PERIOD [SPEKTRALE REFLEXION LAND- UND FORSTWIRTSCHAFTLICHER KULTUREN WAHREND DER VEGETATIONSPERIODE]

A. Kadro /In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 439-448 refs In GERMAN

Avail: Issuing Activity

Reflection measurements made in the 400 to 1100 nm region with a radiometer are discussed. The highly maneuverable apparatus developed to maintain the radiometer at a height of 17 meters while allowing measurements to be carried out at various angles is described. Investigations, performed on different dates, established typical qualitative and quantitative differences between reflection factor curves corresponding to the different regions studied. Author (ESA)

N80-12523*# Commission of the European Communities, Ispra (Italy).

SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST Progress Report, 1 Apr. - 31 Aug. 1979

31 Aug. 1979 50 p refs Sponsored by NASA ERTS (E80-10007; NASA-CR-162384; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08M

N80-12525*# Commission of the European Communities, Ispra (Italy).

JOINT FLIGHT EXPERIMENT UK/1977. REPORT NO. 1: PLANNING AND EXECUTION

P. Reiniger, Principal Investigator Feb. 1977 22 p Sponsored by NASA ERTS

(Proj. TELLUS) (E80-10022; NASA-CR-162394) Avail: NTIS HC A02/MF A01 CSCL 05B

N80-12526*# Commission of the European Communities, Ispra (Italy).

TELLUS: A COMBINED SURFACE TEMPERATURE, SOIL MOISTURE AND EVAPORATION MAPPING APPROACH

A. Rosema (EARS, Delft, Netherlands), J. H. Bijleveld (EARS, Delft, Netherlands), P. Reiniger, G. Tassone, K. Blyth (Inst. of Hydrology, Wallingford, England), and R. J. Gurney, Principal Investigators (Inst. of Hydrology, Wallingford, England) 1978 11 p refs Presented at 12th Intern. Symp. on Remote Sensing of Environment, 20-26 Apr. 1978; sponsored by ERIM, Natural Resources Management Center, Philippines, Michigan Univ., AID, Geological Survey, Dept. of Agriculture, NASA, DOE, FHA, Dept. of Interior, DOT, NOAA, TVA, GE Co., Daedalus Enterprises, Inc., Bendix Corp., Taiwan Forestry Bureau and NAC, Inc., Tokyo Sponsored by NASA ERTS

(Proj. TELLUS) (E80-10023; NASA-CR-162395) Avail: NTIS HC A02/MF A01 CSCL 05B

N80-12528*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

FOREST RESOURCE INFORMATION SYSTEM, PHASE 3 Quarterly Report, 1 Apr. - 30 Jun. 1979

R. P. Mroczynski, Principal Investigator 30 Jun. 1979 29 p EREP

(Contract NAS9-15325) (E80-10026; NASA-CR-160346; LARS-063079) Avail: NTIS HC A03/MF A01 CSCL 02F

01 AGRICULTURE AND FORESTRY

N80-12529*# Environmental Research Inst. of Michigan, Ann Arbor.

A STUDY OF THE TOLERANCE BLOCK APPROACH TO SPECIAL STRATIFICATION Technical Report, 15 Dec. 1978 - 15 Jun. 1979

W. Richardson, Principal Investigator Aug. 1979 60 p refs EREP

(Contract NAS9-15476)

(E80-10027; NASA-CR-160351; ERIM-132400-25-R) Avail: NTIS HC A04/MF A01 CSCL 13B

The author has identified the following significant results. Twelve winter wheat LACIE segments in Kansas were used to compare the performance of three clustering methods: (1) BCLUST, which uses a spectral distance function to accumulate clusters; (2) blocks-alone, which divides spectral space into equally populated blocks; and (3) block-seeds, which uses spectral means of blocks-alone as seeds for accumulating distance-type clusters. Both BCLUST and block-seeds performed equally well and outperformed blocks-alone significantly. Their average variance ratio of about 0.5 showed imperfect separation of wheat from non-wheat. This result points to the need to explore the achievable crop separability in the spectral/temporal domain, and suggest evaluating derived features rather than data channels as a means to achieve purer spectral strata.

N80-12531*# Commission of the European Communities, Ispra (Italy).

TELLUS NEWSLETTER 1

P. Reiniger, Principal Investigator Oct. 1978 8 p In ENGLISH and FRENCH Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(Proj. TELLUS)

(E80-10029; NASA-CR-162397) Avail: NTIS HC A02/MF A01 CSCL 08F

N80-12532*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

THE RELATIONSHIP OF RED AND PHOTOGRAPHIC INFRARED SPECTRAL DATA TO GRAIN YIELD VARIATION WITHIN A WINTER WHEAT FIELD

C. J. Tucker, Brent N. Holben, James H. Elgin, Jr. (Beltsville Agricultural Res. Center, Md.), and James E. McMurtrey, III (Beltsville Agricultural Res. Center, Md.) Jul. 1979 26 p refs Submitted for publication

(NASA-TM-80328) Avail: NTIS HC A03/MF A01 CSCL 02C

Two band hand-held radiometer data from a winter wheat field, collected on 21 dates during the spring growing season, were correlated within field final grain yield. Significant linear relationships were found between various combinations of the red and photographic infrared radiance data collected and the grain yield. The spectral data explained approximately 64 percent of the within field grain yield variation. This variation in grain yield could not be explained using meteorological data as these were similar for all areas of the wheat field. Most importantly, data collected early in the spring were highly correlated with grain yield, a five week time window existed from stem elongation through antheses in which the spectral data were most highly correlated with grain yield, and manifestations of wheat canopy water stress were readily apparent in the spectral data. Author

N80-13588*# 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 Quarterly Progress Report, 16 Apr. - 15 Jul. 1979

Roger M. Hoffer, Principal Investigator Jul. 1979 8 p EREP (Contract NAS9-15508)

(E80-10009; NASA-CR-160312; LARS-071579) Avail: NTIS HC A02/MF A01 CSCL 08B

N80-13589*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EXPERIMENT PLAN FOR EVALUATION OF LANDSAT AGRONOMIC VARIABLES USING WHEAT INTENSIVE TEST SITES

D. E. Phinney, Principal Investigator Aug. 1979 27 p refs Sponsored by NASA, NOAA, and USDA EREP

(Contract NAS9-15800)

(E80-10010; NASA-CR-160315; JSC-16020; LEC-13632) Avail: NTIS HC A03/MF A01 CSCL 02C

N80-13590*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EVALUATION OF THE LACIE TRANSITION YEAR CROP CALENDAR MODEL

R. E. Cheffin and S. K. Woolley, Principal Investigators Jul. 1979 22 p refs Sponsored by NASA, NOAA, and USDA EREP

(Contract NAS9-15800)

(E80-10011; NASA-CR-160314; JSC-16019; LEC-13482) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The estimates of developmental stage dates from the LACIE adjustable crop calendar (ACC) winter wheat model was somewhat more accurate than the historical crop calendar after jointing. The ACC winter wheat model was not so accurate for the Texas Panhandle as it was for the other areas of the USPG-7 because dry soil conditions delayed fall planting in the Panhandle. Since the LACIE ACC winter wheat model does not contain a moisture term and it was started with historical planting dates, lengthy delays in planting mean that the ACC model will probably be started early and will estimate the developmental growth stages to occur too early in the season. The LACIE ACC spring wheat model was also started early in most areas because of late planting due to fields wet from melting snow and rain. The starter model used to estimate spring planting dates was not accurate under these wet soil conditions and tended to predict the developmental stages to occur earlier than the dates observed in the fields.

N80-13591*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). LIST SPECTRAL KEYS STUDY

T. B. Dennis and M. D. Pore, Principal Investigators Aug. 1979 19 p refs Sponsored by NASA, NOAA, and USDA EREP

(Contract NAS9-15800)

(E80-10012; NASA-CR-160338; JSC-15042; LEC-13456) Avail: NTIS HC A02/MF A01 CSCL 08F

N80-13593*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PHASE 3 DIRECT WHEAT STUDY OF NORTH DAKOTA

M. C. Kinsler, J. D. Nichols, and A. L. Ona, Principal Investigators Apr. 1979 158 p refs Sponsored by NASA, NOAA, and USDA EREP

(Contract NAS9-15800)

(E80-10014; NASA-CR-160340; JSC-14744; LEC-12980) Avail: NTIS HC A08/MF A01 CSCL 02C

The author has identified the following significant results. The green number and brightness scatter plots, channel plots of radiance values, and visual study of the imagery indicate separability between barley and spring wheat/oats during the wheat mid-heading to mid-ripe stages. In the LACIE Phase 3 North Dakota data set, the separation time is more specifically the wheat soft dough stage. At this time, the barley is ripening, and is therefore, less green and brighter than the wheat. Only 4 of the 18 segments studied indicate separation of barley/other spring small grain, even though 11 of the segments have acquisitions covering the wheat soft dough stage. The remaining

seven segments had less than 5 percent barley based on ground truth data.

N80-13594*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PHASE 3 LABELING ERROR CHARACTERIZATION Final Report

N. James Clinton, Principal Investigator Mar. 1979 77 p refs Sponsored by NASA, NOAA, and USDA EREP (Contract NAS9-15800) (E80-10015; NASA-CR-160341; JSC-14745; LEC-13012) Avail: NTIS HC A05/MF A01 CSCL 02C

N80-13595*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). A REVISED SCREENING PROCEDURE FOR LACIE PHASE 3 DATA IN THE US GREAT PLAINS

R. S. Chhikara, Principal Investigator Aug. 1979 9 p refs Sponsored by NASA, NOAA, and USDA EREP (Contract NAS9-15800) (E80-10016; NASA-CR-160313; JSC-14852; LEC-12723) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The screening procedure resulted in a substantial decrease in the official LACIE winter acreage estimate, bringing the two estimates into better agreement with corresponding USDA/ESCS estimates.

N80-13597*# Institut National de la Recherche Agronomique, Paris (France).

ESTIMATES OF REGIONAL ET FROM HCMM DATA: SUMMARY OF 1977 EXPERIMENT AND FINAL ARRANGEMENT FOR 1978 IN SOUTHEASTERN FRANCE TEST SITE

Bernard Seguin, Principal Investigator [1979] 29 p refs Sponsored by NASA ERTS (E80-10018; NASA-CR-162390) Avail: NTIS HC A03/MF A01 CSCL 05B

N80-13598*# Commission of the European Communities, Ispra (Italy).

SOIL MOISTURE AND HEAT BUDGET EVALUATION IN SELECTED EUROPEAN ZONES OF AGRICULTURAL AND ENVIRONMENTAL INTEREST Progress Report, 1 Apr. - 31 Aug. 1979

1978 50 p refs Sponsored by NASA ERTS (Proj. TELLUS) (E80-10019; NASA-CR-162391; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08M

N80-13599*# Institute of Hydrology, Wallingford (England). **THE ESTIMATION OF SOIL MOISTURE CONTENT AND ACTUAL EVAPOTRANSPIRATION USING THERMAL INFRA-RED REMOTE SENSING**

R. J. Gurney, Principal Investigator 1978 20 p refs Sponsored by NASA ERTS (Proj. TELLUS) (E80-10021; NASA-CR-162393) Avail: NTIS HC A02/MF A01 CSCL 08M

N80-13600*# Commission of the European Communities, Ispra (Italy).

BEAUCE TELLUS PROJECT [CAMPAGNE TELLUS BEAUCE]

30 Sep. 1977 21 p In FRENCH Sponsored by NASA ERTS (E80-10024; NASA-CR-162396) Avail: NTIS HC A02/MF A01 CSCL 05B

N80-13616# Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen (Netherlands).

ESTIMATION OF REGIONAL EVAPOTRANSPIRATION AND SOIL MOISTURE CONDITIONS USING REMOTELY SENSED CROP SURFACE TEMPERATURES

G. J. R. Soer Sep. 1977 31 p refs (Rept-1003) Avail: NTIS HC A03/MF A01

The application of thermal infrared scanning to the measurement of aerial heat and water budgets of crop lands is considered. Emphasis is placed on obtaining regional evapotranspiration estimates, making water balance analyses for large areas more feasible. Also, crop production as correlated with the actual crop transpiration rate can be estimated. J.M.S.

N80-14424 State Univ. of New York Coll. of Environmental Science and Forestry, Syracuse.

THE MAPPING OF IMPORTANT FARMLAND USING REMOTE SENSOR AND SOCIO-ECONOMIC VARIABLES Ph.D. Thesis

Jon Laurence Roberts 1979 233 p Avail: Univ. Microfilms Order No. 7920317

A comprehensive digital data base of physical (land use) and socio-economic (zoning, agricultural districts, rental/ownership patterns) factors important to farming was created. LANDSAT land use data was collected over the Ontario County, New York study area and grouped into agriculture and forest classes. The socio-economic data was converted to an image-based format by causing the outlines of zones and districts to be digitized and filled in with pixels of a certain grey level. These images are then stored to create the data base. An accuracy check was made on the LANDSAT data using a color infrared U-2 image of the study area. A spectral land use classification was also performed using digitized U-2 data. LANDSAT classification accuracy is 64% correct for the forest class. U-2 classification accuracy is 82% correct for the forest class. Dissert. Abstr.

N80-14425# Forest Service, Washington, D. C.

FORESTER'S GUIDE TO AERIAL PHOTO INTERPRETATION Agriculture Handbook no. 308

Thomas Eugene Avery Nov. 1978 47 p refs Avail: NTIS HC A03/MF A01

A practical reference on techniques of aerial photo interpretation in forest inventory is provided. While oblique photographs are occasionally useful for interpretation, this manual emphasizes stereoscopic interpretation of vertical aerial photographs available from various agencies of the U.S. Department of Agriculture. A.R.H.

N80-14440# European Space Agency, Paris (France).

SATELLITE REMOTE SENSING: APPLICATIONS IN AGROCLIMATOLOGY AND AGROMETEOROLOGY

Eric C. Barrett, ed. (Bristol Univ.) 1979 177 p refs Proc. of lectures of Joint ESA/Food and Agr. of UN/WMO Intern. Training Course, Rome, 2-13 Oct. 1978 (ESA-SP-1020; ISSN-0379-6566) Avail: NTIS HC A09/MF A01

The principles and potentials of satellite remote sensing as applied to agroclimatological and agrometeorological techniques are considered. Major subjects of discussion include the theory behind remote sensing instrumentation and the interpretation of satellite observations. Various remote sensing programs are covered, such as the Earthnet program and the Agro-Ecological Zones Project. Also presented are numerous mathematical models which can be readily used with inputs of satellite imagery data.

N80-14441# Food and Agriculture Organization of the United Nations, Rome (Italy). Plant Production and Protection Div. **OVERVIEW OF AGROMETEOROLOGY**

01 AGRICULTURE AND FORESTRY

Michel Frere *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 3-7

Avail: NTIS HC A09/MF A01

Agrometeorology, a branch of science which aims at using meteorological information to develop quantitatively and improve qualitatively the products of agriculture by taking maximum advantage of the favorable aspects of climate and minimizing the harmful effects of weather, is reviewed. Strategic aspects of agrometeorology, affecting long term planning of agriculture when envisaging agricultural projects or crop diversification in a given area, are considered. Tactical aspects of agrometeorology, concerning the short term influences of day to day weather on the development of crops and the evolution of their yield, are also discussed. Emphasis is placed on the interdisciplinary aspect of agrometeorology. Author (ESA)

N80-14442# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.

OVERVIEW OF REMOTE SENSING FOR AGRICLIMATOLOGY AND AGROMETEOROLOGY

John A. Howard *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 8-13

Avail: NTIS HC A09/MF A01

The evolution of civilian applications of satellite remote sensing is reviewed. Emphasis is on the greater availability of sensing equipment and the application of more readily obtainable data to agrometeorology as well as to agroclimatology. A forward look into the development of satellite remote sensing is offered, considering Earth resources satellites and environmental satellites. It is shown that good data on land surfaces, ocean surfaces, clouds, and atmospheric composition are now at the disposition of researchers and that emphasis should be placed on improving the quality and uniformity of these data. Author (ESA)

N80-14445# Food and Agriculture Organization of the United Nations, Rome (Italy).

THE AGRO-ECOLOGICAL ZONES PROJECT

A. H. Kassam *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 32-33 refs

Avail: NTIS HC A09/MF A01

An estimate is made of what the production of the world's arable lands must be to support the world population in the year 2000. Different crops with widely varying climatic and soil requirements as well as different levels of agricultural technology are reviewed in order to assess the real world food production potential. The eleven crops considered are pearl millet, sorghum, maize, rice, wheat, phaseolus bean, soybean, cassava, sweet potato, white potato, and cotton. Results include a generalized map of agroclimatic suitability for the various crops and a land suitability assessment. Author (ESA)

N80-14446# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.

REMOTE SENSING APPLIED TO AGRICULTURE

J. A. Howard *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 36-42 ref

Avail: NTIS HC A09/MF A01

The ways in which remote sensing can be used to assist in providing information useful to food production are considered. In this respect remote sensing for agricultural crop estimates is seen as one of the most important inputs. The diagnostic characteristics used in analyzing remote sensing imagery, whether airborne or obtained by an Earth resources satellite, are discussed. They are summarized according to the type of sensing being undertaken. The formulation of agricultural crop estimates is then shown. Author (ESA)

N80-14447# Environmental Analysis and Remote Sensing, Delft (Netherlands).

THE APPLICATION OF THERMAL INFRARED REMOTE SENSING DATA TO SOIL MOISTURE AND EVAPORATION DETERMINATION

I. A. Rosema *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 46-59 refs

Avail: NTIS HC A09/MF A01

The time and weather conditions that favor the extraction of information on soil moisture and evaporation from thermal imagery are discussed. Mathematical models of the relations in question are presented along with an algorithm for the interpretation of remotely sensed surface temperature imagery. Fields of application and the need for ground truth data are discussed. Application of the algorithm to crop irrigation is discussed. J.M.S.

N80-14450# Land Resource Research Inst., Ottawa (Ontario). **CROP WEATHER MODELS: CONCEPTS AND APPLICATIONS**

W. Baier *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 88-93 refs

Avail: NTIS HC A09/MF A01

Various crop-weather analysis models are presented in order to illustrate the role of agrometeorology in scientific crop development. Those models presented include factorial yield models, empirical statistical yield models, and associated sub-models used in crop growth simulation studies. The separation of technological change from meteorological variability is then treated. An example showing time trends and weather variables in a multiple curvilinear regression analysis performed on data taken on the state of Illinois is cited. Finally, possible applications of crop-weather models are briefly assessed. Author (ESA)

N80-14451# Joint Research Centre of the European Communities, Ispra (Italy).

AGROCLIMATOLOGICAL METHODS INVOLVING REMOTE SENSING TECHNIQUES

G. Frayse *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 94-115 refs

Avail: NTIS HC A09/MF A01

The application of remote sensing techniques to agrometeorology and crop monitoring is considered with emphasis on improving the agricultural productivity of developing countries. The data requirements for crop monitoring and yield forecasting models are discussed. The performance of Earth observation satellites and the advantages of the data collecting systems of the satellites are given. J.M.S.

N80-14452# Bristol Univ. (England). Climatology and Remote Sensing.

CROP ENVIRONMENT MONITORING: THE REMOTE SENSING SYSTEMS

E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 116-120 refs

Avail: NTIS HC A09/MF A01

Aircraft and LANDSAT imagery are evaluated for their usefulness in environmental monitoring programs. The favorable and unfavorable characteristics of weather satellite operations in this application are then outlined. A list of weather satellite systems which could contribute to crop environment monitoring is also given. Finally, the participation of weather satellites in international and national monitoring programs is reviewed. Author (ESA)

N80-14454# Bristol Univ. (England). Climatology and Remote Sensing.

CROP ENVIRONMENT MONITORING: THE ASSESSMENT OF ENVIRONMENTAL PHENOMENA USING SATELLITE REMOTE SENSING DATA

E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 127-142 refs

Avail: NTIS HC A09/MF A01

The extension of agrometeorological statistics through the use of satellite data is examined. The environmental parameters or phenomena considered, ranked after the present utility and/or

practicality of satellite remote sensing as an aid in their assessment, are: (1) rainfall, (2) temperature, (3) weather type and variability, and (4) cloud cover (radiation balance). For convenience, a differentiation is made between the atmospheric and pedologic environments of crops. In the first case the emphasis is on the utilization of weather satellite data for the extension of selected conventional meteorological statistics, the available in situ data are used as air or ground truth for the preparation, in effect, of meteorological trend surfaces upon which detail may be embroidered from satellite observations after these have been compared with, and calibrated by, the conventional data. In the second case there is a similar association of conventional and satellite soil intelligence, though in this case techniques to interdigitate the two have been less fully developed.

Author (ESA)

N80-14455# Bristol Univ. (England). Climatology and Remote Sensing.

CROP MONITORING AND PREDICTION USING SATELLITE DATA

E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 149-156 refs

Avail: NTIS HC A09/MF A01

Analysis techniques used in making estimates of biomass (usually of natural or seminatural vegetation, especially in areas exploited for grazing) and in forecasting expected crop production (usually cultivated cereal crops) are studied. The use of LANDSAT spectral reflectance curves as prediction model inputs is emphasized. The use of statistical methods, agroclimatological methods, agrometeorological methods with crop prediction models is then considered. Results show clear advantages in the use of satellite data inputs for the monitoring of crops and in making harvest predictions. It is recommended that global schemes, based on these results, be initiated at least for certain crops in the near future in order to optimize agricultural resources.

Author (ESA)

N80-14456# Bristol Univ. (England). Climatology and Remote Sensing.

SATELLITE REMOTE SENSING IN HAZARD MONITORING AND DISASTER EVALUATION

E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 157-163 refs

Avail: NTIS HC A09/MF A01

The potential applicability of satellite remote sensing to short term disaster monitoring is discussed. Emphasis is on different types of agricultural disasters, such as drought, high-intensity short-period rainfall and subsequent flooding as well as hurricanes or monsoons. It is shown that remote sensing can also be of assistance in the assessment of the areas, and therefore, the volumes and values of the crops involved. Finally, the use of satellite data as a check against qualitative data from other sources, especially for countries with an inadequate conventional network for the observation and reporting of environmental conditions, is suggested.

Author (ESA)

N80-14457# Bristol Univ. (England). Climatology and Remote Sensing.

SATELLITE REMOTE SENSING FOR AGRICULTURAL ADVISORIES AND PLANNING

E. C. Barrett *In* ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 164-165

Avail: NTIS HC A09/MF A01

How an input of remote sensing data might be achieved to improve agroclimatological and related services in the various countries which stand to benefit from this technology is considered. Problems which commonly arise in the face of the implementation of new technologies are discussed. In spite of the individuals and organizations which would be interested in remote sensing data (farmers, farming communities, commercial firms, political organizations, humanitarian agencies), significant problems are

foreseen in the widespread acceptance of remote sensing technology.

Author (ESA)

N80-15448*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

PROCEEDINGS OF TECHNICAL SESSIONS, VOLUMES 1 AND 2: THE LACIE SYMPOSIUM

Jul. 1979 1095 p refs Symp. held at Houston, Tex., 23-26 Oct. 1978 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 (E80-10030; NASA-TM-80811; JSC-16015-Vol-1; JSC-16015-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 02C

The technical design of the Large Area Crop Inventory Experiment is examined and data acquired over 3 global crop years is analyzed with respect to (1) sampling and aggregation; (2) growth size estimation; (3) classification and mensuration; (4) yield estimation; and (5) accuracy assessment. Seventy-nine papers delivered at conference sessions cover system implementation and operation; data processing systems; experiment results and accuracy; supporting research and technology; and the USDA application test system.

N80-15449*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

SAMPLING, AGGREGATION, AND VARIANCE ESTIMATION FOR AREA, YIELD, AND PRODUCTION IN LACIE

C. R. Hallum, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), A. H. Feiveson, and A. G. Houston, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 3-18 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

An approximately 2% sampling error was achieved in LACIE by sampling only approximately 2% of the sampling frame. The sample design in the yardstick region for which historical data were available down to a substratum level to support missing data resulting from cloud cover provided the most accurate estimate possible. The implemented strategy provided data of sufficient quality and quantity to support required performance levels and also to satisfy the existing constraints. The allocation scheme appeared to provide the most efficient usage of the available data and gave segment coverage of major producing areas and thus improved the probability of an accurate estimate.

Author

N80-15450*# Department of Agriculture, Columbia, Md. **ECONOMETRIC MODELS FOR PREDICTING CONFUSION CROP RATIOS**

D. E. Umberger, M. H. Proctor, J. E. Clark (Oregon State Univ., Corvallis), L. M. Eisgruber (Oregon State Univ., Corvallis), and C. B. Braschler, Principal Investigators (Missouri Univ., Columbia) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 19-46 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Results for both the United States and Canada show that econometric models can provide estimates of confusion crop ratios that are more accurate than historical ratios. Whether these models can support the LACIE 90/90 accuracy criterion is uncertain. In the United States, experimenting with additional model formulations could provide improved methods models in some CRD's, particularly in winter wheat. Improved models may also be possible for the Canadian CD's. The more aggressive province/state models outperformed individual CD/CRD models. This result was expected partly because acreage statistics are based on sampling procedures, and the sampling precision declines from the province/state to the CD/CRD level. Declining sampling precision and the need to substitute province/state data for the CD/CRD data introduced measurement error into the CD/CRD models.

A.R.H.

N80-15451*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

LACIE SAMPLING DESIGN

A. H. Feiveson, R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.), and C. R. Hallum, Principal Investigators *In its* Proc. of

01 AGRICULTURE AND FORESTRY

Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 47-52 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The sampling design in LACIE consisted of two major components, one for wheat acreage estimation and one for wheat yield prediction. The acreage design was basically a classical survey for which the sampling unit was a 5- by 6-nautical mile segment; however, there were complications caused by measurement errors and loss of data. Yield was predicted by sampling meteorological data from weather stations within a region and then using those data as input to previously fitted regression equations. Wheat production was not estimated directly, but was computed by multiplying yield and acreage estimates. The allocation of samples to countries is discussed as well as the allocation and selection of segments in strata/substrata. A.R.H.

N80-15452*# Lockheed Electronics Co., Houston, Tex.
LACIE AREA SAMPLING FRAME AND SAMPLE SELECTION

C. J. Liszcz, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 53-56 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Transparent acetate overlays containing agricultural boundaries within each of the LACIE countries were prepared and registered to operational navigation charts (ONC's). Full frame LANDSAT color-infrared images of the same scale as the ONC's (1:1 million) were used to identify agricultural boundaries based on discernible agricultural field patterns. Preliminary steps taken in the preparation of the base map overlay, and the construction of an overlay of the base map physical features are described as well as the construction of the agricultural and nonagricultural delineation overlay. A.R.H.

N80-15453*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

LACIE LARGE AREA ACREAGE ESTIMATION
R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 57-65 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

A sample wheat acreage for a large area is obtained by multiplying its small grains acreage estimate as computed by the classification and mensuration subsystem by the best available ratio of wheat to small grains acreages obtained from historical data. In the United States, as in other countries with detailed historical data, an additional level of aggregation was required because sample allocation was made at the substratum level. The essential features of the estimation procedure for LACIE countries are included along with procedures for estimating wheat acreage in the United States. A.R.H.

N80-15454*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

LARGE AREA AGGREGATION AND MEAN-SQUARED PREDICTION ERROR ESTIMATION FOR LACIE YIELD AND PRODUCTION FORECASTS

R. S. Chhikara (Lockheed Electronics Co., Houston, Tex.) and A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 67-71 ref ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Aggregation formulas are given for production estimation of a crop type for a zone, a region, and a country, and methods for estimating yield prediction errors for the three areas are described. A procedure is included for obtaining a combined yield prediction and its mean-squared error estimate for a mixed wheat pseudozone. A.R.H.

N80-15455*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

CLASSIFICATION AND MENSURATION OF LACIE SEGMENTS

R. P. Heydorn, R. M. Bizzell, J. A. Quirein (Lockheed Electronics Co., Houston, Tex.), K. M. Abotteen (Lockheed Electronics Co.,

Houston, Tex.), and C. A. Sumner, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 73-86 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The theory of classification methods and the functional steps in the manual training process used in the three phases of LACIE are discussed. The major problems that arose in using a procedure for manually training a classifier and a method of machine classification are discussed to reveal the motivation that led to a redesign for the third LACIE phase. A.R.H.

N80-15456*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

LACIE REGISTRATION PROCESSING
Gerald J. Grebowski, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 87-97 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The basic requirements for the LACIE processing system are to extract specified test sites (sample segments) from LANDSAT MSS data, and to apply geometric corrections and perform correlations to ensure registration between successive data acquisitions to within 1 pixel (root mean square). The general flow within the LACIE processing system is described with emphasis on (1) determination of line and pixel location of a search area within an MSS frame; (2) determination of the geometric correction coefficient and the application of geometric corrections; (3) edge detection; and (4) correlation by coincidence of edges. A.R.H.

N80-15457*# Environmental Data and Information Service, Washington, D. C.

DEVELOPMENT OF LACIE CCEA-1 WEATHER/WHEAT YIELD MODELS

N. D. Strommen, C. M. Sakamoto (Environmental Data and Information Service, Columbia, Mo.), S. K. LeDuc (Environmental Data and Information Service, Columbia, Mo.), and D. E. Umberger, Principal Investigators (USDA Economics, Statistics, and Cooperative Service, Columbia, Mo.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 99-108 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The advantages and disadvantages of the casual (phenological, dynamic, physiological), statistical regression, and analog approaches to modeling for grain yield are examined. Given LACIE's primary goal of estimating wheat production for the large areas of eight major wheat-growing regions, the statistical regression approach of correlating historical yield and climate data offered the Center for Climatic and Environmental Assessment the greatest potential return within the constraints of time and data sources. The basic equation for the first generation wheat-yield model is given. Topics discussed include truncation, trend variable, selection of weather variables, episodic events, strata selection, operational data flow, weighting, and model results. A.R.H.

N80-15458*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

GROWTH STAGE ESTIMATION

V. S. Whitehead, D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), and W. E. Crea, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 109-114 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Of the three candidate approaches to adjustment of the crop calendar to account for year-to-year weather differences, the Robertson triquadratic unit, a function of a nonlinear function of maximum and minimum temperature and day length, best described the rate of phenological development of wheat. The adjustable crop calendar (ACC) as implemented for LACIE is used to calculate the daily increment of development through

six physiological stages of growth. Topics covered include dormancy modeling, the spring restart model, spring wheat starter model, winter starter model, winter wheat starter model, inclusion of the moisture variable, and display of crop stage estimation results. Assessment of the ACC accuracy over the period of LACIE operation indicates that the adjustable crop calendars used provided more accurate information than would have been available using historical norms. The models performed best under the conditions from which they were derived (Canadian spring wheat) and most poorly for the dwarf varieties and Southern Hemisphere applications. A.R.H.

N80-15459*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

ACCURACY ASSESSMENT: THE STATISTICAL APPROACH TO PERFORMANCE EVALUATION IN LACIE

A. G. Houston, A. H. Feiveson, R. S. Chikara (Lockheed Electronics Co., Houston, Tex.), and E. N. Hsu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 115-130 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL Q2C

A statistical methodology was developed to check the accuracy of the products of the experimental operations throughout crop growth and to determine whether the procedures are adequate to accomplish the desired accuracy and reliability goals. It has allowed the identification and isolation of key problems in wheat area yield estimation, some of which have been corrected and some of which remain to be resolved. The major unresolved problem in accuracy assessment is that of precisely estimating the bias of the LACIE production estimator. Topics covered include: (1) evaluation techniques; (2) variance and bias estimation for the wheat production estimate; (3) the 90/90 evaluation; (4) comparison of the LACIE estimate with reference standards; and (5) first and second order error source investigations. A.R.H.

N80-15460*# California Univ. at Berkeley.

MANUAL INTERPRETATION OF LANDSAT DATA

C. M. Hay, Principal Investigator *In NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 131-146 refs* Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL Q2C

The task of the analyst throughout LACIE phases 1 and 2 consisted of outlining representative areas (fields) for all spectral classes within a segment on the basis of their appearance on the LANDSAT image products, and then labeling the crop type (wheat/nonwheat) within the selected training areas. For LACIE phase 3, a procedure was developed and implemented which incorporated clustering for spectral class definition and training statistics generation. The only analyst's task was crop type identification. The logical processes involved in interpretation are described, rather than a step-by-step description of analyst procedures. A.R.H.

N80-15461*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

ACQUISITION AND PREPROCESSING OF LANDSAT DATA

T. N. Horn (GE Space Div., Beltsville, Md.), L. E. Brown, and W. H. Anonsen, Principal Investigators *In NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 147-155 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL Q2C

The original configuration of the GSFC data acquisition, preprocessing, and transmission subsystem, designed to provide LANDSAT data inputs to the LACIE system at JSC, is described. Enhancements made to support LANDSAT -2, and modifications for LANDSAT -3 are discussed. Registration performance throughout the 3 year period of LACIE operations satisfied the 1 pixel root-mean-square requirements established in 1974, with more than two of every three attempts at data registration proving successful, notwithstanding cosmetic faults or content inadequacies to which the process is inherently susceptible. The

cloud/snow rejection rate experienced throughout the last 3 years has approached 50%, as expected in most LANDSAT data use situations. A.R.H.

N80-15462*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

ANCILLARY DATA ACQUISITION FOR LACIE

B. E. Spiers (USDA Agricultural Stabilization and Conservation Service, Houston, Tex.) and R. L. Patterson, Principal Investigators *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 157-162 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL Q2C

The design, implementation, and operational functions of the three phases of LACIE supported the data needs of all other elements of the project and required several types of data in addition to LANDSAT multispectral digital data. The nonelectronic data base consisted of statistical data, printed reports, periodicals, ground observed data received from intensive test sites and operational segments, and full-frame multispectral scanner CIR photographs. The following data were collected for the test sites in the United States and Canada: land use inventories, periodic crop observations, solar radiometer measurements, rainfall, and wheat yield for selected fields. A.R.H.

N80-15463*# Lockheed Electronics Co., Houston, Tex.

LACIE DATA-HANDLING TECHNIQUES

G. H. Waits, Principal Investigator *In NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 163-167 ERTS*

Avail: NTIS HC A99/MF A01 CSCL Q2C

Techniques implemented to facilitate processing of LANDSAT multispectral data between 1975 and 1978 are described. The data that were handled during the large area crop inventory experiment and the storage mechanisms used for the various types of data are defined. The overall data flow, from the placing of the LANDSAT orders through the actual analysis of the data set, is discussed. An overview is provided of the status and tracking system that was developed and of the data base maintenance and operational task. The archiving of the LACIE data is explained. Author

N80-15464*# Lockheed Electronics Co., Houston, Tex. **THE ACQUISITION, STORAGE, AND DISSEMINATION OF LANDSAT AND OTHER LACIE SUPPORT DATA**

L. F. Abbotts and R. M. Nelson, Principal Investigators *In NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 169-177 ERTS*

Avail: NTIS HC A99/MF A01 CSCL Q2C

Activities performed at the LACIE physical data library are described. These include the researching, acquisition, indexing, maintenance, distribution, tracking, and control of LACIE operational data and documents. Much of the data available can be incorporated into an Earth resources data base. Elements of the data collection that can support future remote sensing programs include: (1) the LANDSAT full-frame image files; (2) the microfilm file of aerial and space photographic and multispectral maps and charts that encompasses a large portion of the Earth's surface; (3) the map/chart collection that includes various scale maps and charts for a good portion of the U.S. and the LACIE area in foreign countries; (4) computer-compatible tapes of good quality LANDSAT scenes; (5) basic remote sensing data, project data, reference material, and associated publications; (6) visual aids to support presentation on remote sensing projects; and (7) research acquisition and handling procedures for managing data. A.R.H.

N80-15465*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

THE CLASSIFICATION AND MENSURATION SUBSYSTEM

K. M. Abotteen (Lockheed Electronics Co., Houston, Tex.) and R. M. Bizzell, Principal Investigators *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 179-201 refs* Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL Q2C

01 AGRICULTURE AND FORESTRY

From an operational standpoint, the most significant item the classification and mensuration subsystem (CAMS) had to overcome in providing the acreage component of the wheat production estimates for LACIE was the scope (segment volume processing required). Peak processing requirements per day increased from 16 to 20 for phase 1 with 700 total segments, to 35 to 40 per day for phase 2 with 1700 total segments, to 75 to 80 per day for phase 3 with 3000 total segments. Key issues regarding interrelationships between man and machines were identified during phase 1 using first generation technology. Procedure 1, tested and evaluated during phase 2 and continued through the initial phase 3 processing period for winter wheat, showed the need for software modification, procedures development, and analyst training. CAMS operations are described with emphasis on the training backgrounds of the analysts, the available data, and the labeling logic. A.R.H.

N80-15466*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

CONCEPTS LEADING TO THE IMAGE-100 HYBRID INTERACTIVE SYSTEM

T. F. Mackin and J. M. Sulester, Principal Investigators *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 203-209 ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

As LACIE Procedure 1 evolved from the Classification and Mensuration Subsystem smallfields procedures, it became evident that two computational systems would have merit—the LACIE/Earth Resources Interactive Processing System based on a large IBM-360 computer oriented for operational use with high computational throughput, and a smaller, highly interactive system based on a PDP 11-45 minicomputer and its display system, the IMAGE-100. The latter had advantages for certain phases; notably, interactive spectral aids could be implemented quite rapidly. This would allow testing and development of Procedure 1 before its implementation on the LACIE/Earth Resources Interactive Processing System. The resulting minicomputer system, called the Classification and Mensuration Subsystem IMAGE-100 Hybrid System, allowed Procedure-1 operations to be performed interactively, except for clustering, classification, and automatic selection of best acquisitions, which were offloaded to the LACIE/Earth Resources Interactive Processing System.

Author

N80-15467*# Department of Agriculture, Houston, Tex. **USDA ANALYST REVIEW OF THE LACIE IMAGE-100 HYBRID SYSTEM TEST**

P. Ashburn, K. Buelow, H. L. Hansen (USDA Soil Conservation Service, Houston, Tex.), and G. A. May, Principal Investigators (USDA Economics, Statistics, and Cooperatives Service, Houston, Tex.) *In NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 211-215 ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

Fifty operational segments from the U.S.S.R., 40 test segments from Canada, and 24 test segments from the United States were used to provide a wide range of geographic conditions for USDA analysts during a test to determine the effectiveness of labeling single pixel training fields (dots) using Procedure 1 on the 1-100 hybrid system, and clustering and classifying on the Earth Resources Interactive Processing System. The analysts had additional on-line capabilities such as interactive dot labeling, class or cluster map overlay flickers, and flashing of all dots of equal spectral value. Results on the 1-100 hybrid system are described and analyst problems and recommendations are discussed. A.R.H.

N80-15468*# National Oceanic and Atmospheric Administration, Houston, Tex.

OPERATION OF THE YIELD ESTIMATION SUBSYSTEM

D. G. McCrary, J. L. Rogers (USDA Federal Crop Insurance Corp., Houston, Tex.), and J. D. Hill, Principal Investigators *In NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 217-225 ERTS*

N80-15448 06-43)

Avail: NTIS HC A99/MF A01 CSCL 02C

The organization and products of the yield estimation subsystem (YES) are described with particular emphasis on meteorological data acquisition, yield estimation, crop calendars, weekly weather summaries, and project reports. During the three phases of LACIE, YES demonstrated that it is possible to use the flow of global meteorological data and provide valuable information regarding global wheat production. It was able to establish a capability to collect, in a timely manner, detailed weather data from all regions of the world, and to evaluate and convert that data into information appropriate to the project's needs. A.R.H.

N80-15469*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE CROP ASSESSMENT SUBSYSTEM: SYSTEM IMPLEMENTATION AND APPROACHES USED FOR THE GENERATION OF CROP PRODUCTION REPORTS

W. E. McAllum, R. E. Hatch (Department of Agriculture, Houston, Tex.), S. M. Boatwright (Ford Aerospace and Communications Corp., Houston, Tex.), C. J. Liszcz (Lockheed Electronics Co., Houston, Tex.), and S. M. Evans, Principal Investigators (Department of Agriculture, Houston, Tex.) *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 227-241 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

The primary responsibility of the crop assessment subsystem (CAS) during the three phases of LACIE was to produce crop reports that included estimates of wheat area, yield, and production, as well as a specified set of associated statistical descriptors. The operations of CAS are described with emphasis on sampling strategy, input/output data, evolution of aggregation/reporting system capabilities, and CAS aggregation procedures. A.R.H.

N80-15470*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LACIE STATUS AND TRACKING

V. M. Dauphin, C. H. Jeffress (Lockheed Electronics Co., Houston, Tex.), and J. M. Everette, Principal Investigators *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 243-248 ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

The operational requirements and development of a system designed to meet LACIE needs for data to be available at given stations simultaneously, to measure throughput rates, and perform efficiency analyses are described. The final automated status and tracking system (ASATS) is defined and problems encountered during its evolutionary process are discussed. A.R.H.

N80-15471*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LACIE QUALITY ASSURANCE

G. L. Gutschewski, Principal Investigator *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 249-255 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

Topics covered include (1) development of the LACIE quality assurance program; (2) LACIE quality assurance responsibilities of all organizational elements; (3) internal quality assurance support; and (4) accomplishments. A.R.H.

N80-15472*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

ACCURACY ASSESSMENT SYSTEM AND OPERATION

D. E. Pitts, A. G. Houston, G. Badhwar, M. J. Bender, M. L. Rader (Lockheed Electronics Co., Houston, Tex.), W. G. Eppler (Lockheed Missiles and Space Co., Palo Alto, Calif.), C. W. Ahlers (Lockheed Electronics Co., Houston, Tex.), W. P. White (Lockheed Electronics Co., Houston, Tex.), R. R. Vela, and E. M. Hsu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 265-288 refs* Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The accuracy and reliability of LACIE estimates of wheat production, area, and yield is determined at regular intervals

throughout the year by the accuracy assessment subsystem which also investigates the various LACIE error sources, quantifies the errors, and relates them to their causes. Timely feedback of these error evaluations to the LACIE project was the only mechanism by which improvements in the crop estimation system could be made during the short 3 year experiment. A.R.H.

N80-15473*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LACIE APPLICATIONS EVALUATION SYSTEM EFFICIENCY REPORT

Timothy T. White, Principal Investigator *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 281-288 ERTS*

Avail: NTIS HC A99/MF A01 CSCL O2C

The scope of the three LACIE phases is discussed as well as the system efficiencies which had to be implemented to cope with the resulting LANDSAT data load. The methodologies used in system analysis, some of the specific data collected, and the inferences of these data and their implication on future systems are also discussed. A.R.H.

N80-15474*# Lockheed Electronics Co., Houston, Tex.

CARTOGRAPHY: LACIE'S SPATIAL PROCESSOR

M. L. Rader and R. R. Vela, Principal Investigators *In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 291-296 ref Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS*

Avail: NTIS HC A99/MF A01 CSCL O2C

The spatial processing needs of LACIE include the location of agricultural test sites, and the registration of ground truth to LANDSAT imagery. The technological aspects of LACIE cartographic support, the need for cartography in satellite crop surveys, and proposed improvements which would enhance support of future programs are discussed. A.R.H.

N80-15475*# IBM Federal Systems Div., Houston, Texas.

THE LACIE DATA BASES: DESIGN CONSIDERATIONS

L. E. Westberry, Principal Investigator *In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 297-306 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL O2C

The implementation of direct access storage devices for LACIE is discussed with emphasis on the storage and retrieval of image data. Topics covered include the definition of the problem, the solution methodology (design decisions), the initial operational structure, and the modifications which were incorporated. Some conclusions and projections of future problems to be solved are also presented. A.R.H.

N80-15476*# IBM Federal Systems Div., Houston, Texas.

MAN-MACHINE INTERFACES IN LACIE/ERIPS

Barbara B. Duprey, Principal Investigator *In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 307-315 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL O2C

One of the most important aspects of the interactive portion of the LACIE/ERIPS software system is the way in which the analysis and decision-making capabilities of a human being are integrated with the speed and accuracy of a computer to produce a powerful analysis system. The three major man-machine interfaces in the system are (1) the use of menus for communications between the software and the interactive user; (2) the checkpoint/restart facility to recreate in one job the internal environment achieved in an earlier one; and (3) the error recovery capability which would normally cause job termination. This interactive system, which executes on an IBM 360/75 mainframe, was adapted for use in noninteractive (batch) mode. A case study is presented to show how the interfaces work in practice by defining some fields based on an image screen display, noting the field definitions, and obtaining a film product of the classification map. A.R.H.

N80-15477*# IBM Federal Systems Div., Houston, Texas.

LACIE/ERIPS SOFTWARE SYSTEM SUMMARY

C. L. Johnson, Principal Investigator *In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 317-332 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL O2C

The Earth resources interactive processing system (ERIPS) supports LACIE by classifying LANDSAT sensed data on the basis of the statistical similarity to those portions which were identified by analysts. The development and capabilities of the ERIPS software system are described with emphasis on (1) system requirements; (2) LACIE/ERIPS hardware; (3) system functions; (4) pattern recognition concept; and (5) LACIE/ERIPS data bases. Algorithms used in LACIE/ERIPS for statistics, divergence, feature selection, classification, registration, adaptive clustering, iterative clustering, clustering report functions, Sun angle correction, mean level adjustment, and bias correction are appended. A.R.H.

N80-15479*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

VERY HIGH SPEED PROCESSING: APPLICABILITY OF PERIPHERAL DEVICES TO PIXEL-DEPENDENT TASKS

J. C. Lyon, Principal Investigator *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 345-354 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL O2C

Early options studied in the satisfaction of LACIE implementation computational demands are described as well as the ultimate selection and development of an array processing solution to the problem. The economic justification, as a function of required LANDSAT analysis, is provided. The suitability of such processors for LACIE and other applications is discussed. A.R.H.

N80-15480*# IBM Federal Systems Div., Houston, Texas.

A LOOK AT COMPUTER SYSTEM SELECTION CRITERIA

E. W. Poolé, F. L. Flowers, and W. I. Stanley, Principal Investigators *In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 355-396 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL O2C

There is no difficulty in identifying the criteria involved in the computer selection process; complexity arises in objectively evaluating various candidate configurations against the criteria, based on the user's specific needs. A model for formalizing the selection process consists of two major steps: verifying that the candidate configuration is adequate to the user's programming requirements, and determining an overall system evaluation rating based on cost, usability, adaptability, and availability. A 36 step instruction for computer sizing evaluation is included in the appendix along with a sample application of the configuration adequacy model. Selection criteria and the weighting process are also discussed. A.R.H.

N80-15481*# Mitre Corp., Houston, Tex.

COST AND PERFORMANCE CHARACTERISTICS OF DATA SYSTEM CONFIGURATIONS FOR PROCESSING REMOTELY SENSED DATA

P. J. Gregor and J. F. Spitzer, Principal Investigators *In NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 397-408 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL O2C

Some alternative approaches to constructing a large remote-sensing data system are explored. The cost and performance implications of using a collection of 'small' computers versus using one large computer are examined. Several architectures and associated costs for the large data system supporting a single data center are presented. Recurring cost factors (maintenance and operations) currently slightly favor the single large-machine architecture, but other factors may dictate the choice of one of the two multimachine architectures discussed. A.R.H.

01 AGRICULTURE AND FORESTRY

N80-15482*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

THE LACIE CROP YEARS: AN ASSESSMENT OF THE CROP CONDITIONS EXPERIENCED IN THE THREE YEARS OF LACIE

J. D. Hill (NOAA Environmental Data and Information Service, Houston, Tex.) and D. R. Thompson, Principal Investigators *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 411-429* Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Meteorological data and LANDSAT spectral data from growing regions in the U.S. Great Plains, the U.S.S.R., and Canada were used to assess growing conditions and to document where anomalies such as drought, floods, and freezes were impacting the crop yield and appearance of spring and winter wheat. In the United States, the weekly rainfall and temperature data were used to estimate soil moisture, which was then related to crop needs by a crop moisture index. The transformation of LANDSAT digital data into a green index number provided a procedure whereby data from a LACIE segment could be classified as drought affected or not. The growing seasons encountered in each LACIE country during the three phases are described.

A.R.H.

N80-15483*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

APPLICATION OF LANDSAT DIGITAL DATA FOR MONITORING DROUGHT

D. R. Thompson and O. A. Wehmanen, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 431-438 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

A technique utilizing transformed LANDSAT digital data for detection of agricultural vegetative water stress was developed during the 1976 South Dakota drought, and expanded to the U.S. Great Plains the following year to evaluate its effectiveness in detecting and monitoring vegetative stress water stress over large areas. This technique, the green index number (GIN), indicated when the vegetation within a segment was undergoing stress. Segments were classified as either moisture-stressed or normal using remote sensing techniques combined with a knowledge of crop condition. The remote sensing-based information was compared to a weekly ground-based index (the crop moisture index) provided by the U.S. Dept. of Commerce. The approaches used and the results from the GIN monitoring program are presented.

A.R.H.

N80-15484*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S. GREAT PLAINS

Duane L. Marquis, Principal Investigator *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 439-479 ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

The accuracy and reliability of the LACIE design was tested using the nine states of the U.S. Great Plains where comparison data was available. The three phases of LACIE are discussed with respect to the scope; sampling; LANDSAT data; estimates of area, yield, and production; accuracy of the estimates; and technical issues related to each phase.

A.R.H.

N80-15485*# Department of Agriculture, Houston, Tex. **LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: U.S.S.R.**

J. R. Hickman, Principal Investigator *In NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 481-512 ref ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

No estimates were generated for the U.S.S.R. during LACIE phase 1. Phase 2 effort was limited to two indicator regions: winter wheat areas where 385 segments were allocated, and spring wheat areas with 362 allocated segments. The level of

activity for phase 3 was extended to the entire country which automatically increased the segment workload from 747 to 1947 segments. Production, area, and yield estimates, and their accuracy are discussed for phases 2 and 3 with emphasis on scope, sampling strategy, data base, LANDSAT data, yield analysis for winter and spring wheat, area and production analysis for winter and spring wheat, and technical issues and problems.

A.R.H.

N80-15486*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

LACIE AREA, YIELD, AND PRODUCTION ESTIMATE CHARACTERISTICS: CANADA

Delanne Conte (USDA Foreign Agricultural Service, Houston, Tex.), A. G. Houston, and L. O. Lovfald, Principal Investigators (USDA Economics, Statistics, and Cooperatives Service, Houston, Tex.) *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 513-526 ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

Sampling segment allocation for Canada placed 283 segments within three provinces: Saskatchewan (170), Alberta (75), and Manitoba (38). The data base was comprised of five data sets: allocation, historical, ratio, LANDSAT, and yield. In-season area, yield, and production estimates were generated only during phase 2. These data are presented and analyzed.

A.R.H.

N80-15487*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

ACCURACY AND PERFORMANCE OF LACIE AREA ESTIMATES

J. F. Potter (Lockheed Electronics Co., Houston, Tex.), E. M. Hsu (Lockheed Electronics Co., Houston, Tex.), A. G. Houston, and D. E. Pitts, Principal Investigators *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 527-573 refs* Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Results for the three crop years between 1974 and 1977 are presented in 25 tables for four regions of the U.S. Great Plains. Topics covered include error source analyses and special studies during each phase. Abnormal signature and boundary problems still under investigation are examined.

A.R.H.

N80-15488*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

ACCURACY AND PERFORMANCE OF LACIE YIELD ESTIMATES IN MAJOR WHEAT PRODUCING REGIONS OF THE WORLD

D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), R. G. Stuff, A. G. Houston, E. M. Hsu (Lockheed Electronics Co., Houston, Tex.), and M. H. Trenchard, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 575-587 refs ERTS*

Avail: NTIS HC A99/MF A01 CSCL 02C

The LACIE yield models developed, implemented, and tested during the three phases of the experiment represent the first generation of models designed for the large-scale prediction of wheat production. The models are capable of supporting the stated project goal of being within 10 percent of the actual wheat production 90 percent of the time. The limitations of the models are inherent in their nature. The temporal resolution limits their ability to handle the erratic weather occurring in critical situations. The relatively large spatial resolution of the individual models limits the capture of localized but important episodic events.

A.R.H.

N80-15489*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

ACCURACY AND PERFORMANCE OF LACIE CROP DEVELOPMENT MODELS

S. K. Woolley (Lockheed Electronics Co., Houston, Tex.), V. S. Whitehead, R. G. Stuff, and W. E. Crea, Principal Investigators *In its Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 589-604*

refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Of the three principal phenological crop calendar models evaluated for LACIE, Robertson's triquadratic model which predicts the rate of progression of wheat through its biological development, was selected. Daily maximum and minimum temperatures and day length are the input variables, and the principal output is a daily increment of development through six physiological growth stages. Because wheat corresponds differently to the environment during each growth stage, five different equations are required. The estimated and observed crop development data were compared in order to establish a measure of confidence in the model and to identify consistent discrepancies that would adversely affect LACIE operation. Although the model provided reliable estimates for various wheat growing regions of the world, it was found that there are still areas in need of further model improvement or development. A.R.H.

N80-15490*# Department of Agriculture, Washington, D.C.
ECONOMIC EVALUATION: CONCEPTS, SELECTED STUDIES, SYSTEM COSTS, AND A PROPOSED PROGRAM

Frank H. Osterhoudt, Principal Investigator *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 605-616 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The more usual approaches to valuing crop information are reviewed and an integrated approach is recommended. Problems associated with implementation are examined. What has already been accomplished in the economic evaluation of LACIE-type information is reported including various studies of benefits. The costs of the existing and proposed systems are considered. A method and approach is proposed for further studies. A.R.H.

N80-15491*# National Aeronautics and Space Administration,
Lyndon B. Johnson Space Center, Houston, Tex.

METHODS FOR SEGMENT WHEAT AREA ESTIMATION
R. P. Heydorn, M. C. Trichel, and J. D. Erickson, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 621-632 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The major research conducted during the three years of LACIE to solve problems associated with segment wheat area estimation is reviewed. Topics covered include proportion estimation, clustering, feature extraction, and signature extension. It would appear that LANDSAT-1 and LANDSAT-2 data do not contain enough information to discriminate between crop types perfectly all the time and, therefore, a basic problem arises when no ground truth data on crop types in the area are available. New approaches are needed to reduce labeling error. Perhaps better use of multiyear LANDSAT data, a more detailed understanding of the cropping practices in the area, better crop calendar prediction, and a better understanding of the limiting sources of error in LANDSAT data related to crop discrimination may provide the insight required to develop improved designs. A.R.H.

N80-15492*# National Aeronautics and Space Administration,
Lyndon B. Johnson Space Center, Houston, Tex.

ESTIMATING CROP PROPORTIONS FROM REMOTELY SENSED DATA
A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 633-646 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The classification/pixel-count method for estimating the proportion of wheat in each segment is theoretically biased even if all distributional assumptions are met. Alternative ways to estimate crop proportions are examined and their performance testing is considered. Topics covered include general linear functional estimates, the method of moments, and maximum likelihood estimators. A.R.H.

N80-15494*# Lockheed Electronics Co., Houston, Tex.
ON EVALUATING CLUSTERING PROCEDURES FOR USE IN CLASSIFICATION

M. D. Pore, T. E. Moritz, D. T. Register, S. S. Yao, and W. G. Eppler, Principal Investigators *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 661-669 refs ERTS

(Contract NAS9-15200)

Avail: NTIS HC A99/MF A01 CSCL 02C

The problem of evaluating clustering algorithms and their respective computer programs for use in a preprocessing step for classification is addressed. In clustering for classification the probability of correct classification is suggested as the ultimate measure of accuracy on training data. A means of implementing this criterion and a measure of cluster purity are discussed. Examples are given. A procedure for cluster labeling that is based on cluster purity and sample size is presented. A.R.H.

N80-15497*# Environmental Research Inst. of Michigan, Ann Arbor.

FEATURE EXTRACTION APPLIED TO AGRICULTURAL CROPS AS SEEN BY LANDSAT

R. J. Kauth, P. F. Lambeck, W. Richardson, G. S. Thomas, and A. P. Pentland, Principal Investigators *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 705-721 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The physical interpretation of the spectral-temporal structure of LANDSAT data can be conveniently described in terms of a graphic descriptive model called the Tassled Cap. This model has been a source of development not only in crop-related feature extraction, but also for data screening and for haze effects correction. Following its qualitative description and an indication of its applications, the model is used to analyze several feature extraction algorithms. A.R.H.

N80-15499*# California Univ. at Berkeley.
DEVELOPMENT OF PARTITIONING AS AN AID TO SPECTRAL SIGNATURE EXTENSION

R. W. Thomas, C. M. Hay, and J. C. Claydon, Principal Investigators *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 739-755 refs ERTS

(Contract NAS9-14565)

Avail: NTIS HC A99/MF A01 CSCL 02C

Lists of spectrally similar LACIE sample segments may be constructed with the use of three basic information types: static, seasonal, and pass-specific variables. All are related directly or indirectly to spectral signature behavior and can be used to define spatial domains over which crop-specific signatures should be extendable. Topics covered include: (1) static spectral stratification; (2) evaluation of static partitions relative to variance control objectives; (3) evaluation of the relative importance of static versus seasonal and pass-specific partitioning variables in spectral variability; and (4) a current perspective on partitioning. A.R.H.

N80-15500*# Lockheed Electronics Co., Houston, Tex.
METHODS OF EXTENDING CROP SIGNATURES FROM ONE AREA TO ANOTHER

T. C. Minter, Principal Investigator *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 757-800 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Efforts to develop a technology for signature extension during LACIE phases 1 and 2 are described. A number of haze and Sun angle correction procedures were developed and tested. These included the ROOSTER and OSCAR cluster-matching algorithms and their modifications, the MLEST and UHMLE maximum likelihood estimation procedures, and the ATCOR procedure. All these algorithms were tested on simulated data and consecutive-day LANDSAT imagery. The ATCOR, OSCAR,

01 AGRICULTURE AND FORESTRY

and MLEST algorithms were also tested for their capability to geographically extend signatures using LANDSAT imagery.

Author

N80-15501*# Environmental Research Inst. of Michigan, Ann Arbor.

SIGNATURE EXTENSION METHODS IN CROP AREA ESTIMATION

R. J. Kauth and W. Richardson, Principal Investigators *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 801-823 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The Procedure B multispectral processing system is both multisegmentation and multistratum. It uses data from several LACIE-sized segments together and makes a proportion estimate for the entire group of segments as well as for the individual segments. In the clustering of data features, Procedure B produces multiple classes or strata rather than just two strata (as in Procedure 1), and performs stratified sampling on each of these multiple strata in order to make a proportion estimate. Tests results for the components and for the overall performance of Procedure B are presented, and conclusions that can be drawn from these tests are discussed. The rationale for signature extension for crop area estimation is summarized.

A.R.H.

N80-15502*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

AN EVALUATION OF PROCEDURE 1

S. G. Wheeler (IBM, Houston, Tex.), R. P. Heydorn, P. N. Misra (IBM, Houston, Tex.), W. Lee, Jr. (IBM, Houston, Tex.), and R. T. Smart, Principal Investigators (IBM, Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 825-842 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

LACIE Procedure 1 has undergone continuous testing and evaluation, starting with analytical and experimental studies even before it was implemented in ERIPS software and continuing to the present with performance evaluations using blind-site data. The strengths and weaknesses of the procedure are indicated and some areas for possible improvement are identified. Results from three of the experiments performed and an evaluation of LACIE Procedure 1 proportion estimates for some blind-site segments are discussed.

A.R.H.

N80-15503*# Department of Agriculture, Houston, Tex. Foreign Agricultural Service.

THE VEGETATIVE INDEX NUMBER AND CROP IDENTIFICATION

P. Ashburn, Principal Investigator *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 843-855 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

A vegetative index number of numerical value was calculated from the digital values of the LANDSAT system to provide some measure of green growing vegetation. The usefulness of the green numbers for schemes in crop identification and acreage estimation is investigated and the Ashburn vegetation index (AVI) is compared with the Kauth-Thomas vegetation index (KVI) for crop identification schemes. Results of wheat acreage estimation using LACIE Procedure 1 and the AVI for eight sample segments are given. Tables show comparisons between the AVI and the KVI as well as visual results of the AVI.

A.R.H.

N80-15504*# California Univ. at Berkeley.

MANUAL LANDSAT DATA ANALYSIS FOR CROP TYPE IDENTIFICATION

C. M. Hay, Principal Investigator *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 857-866 ref ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The process of manual identification of crop type by human analysts and problems associated in LACIE that were associated with manual crop identification measurement procedures are described. Research undertaken in cooperation with LACIE operations by the supporting research community to effect solutions to, or obtain greater understanding of the problems is discussed.

A.R.H.

N80-15505*# Lockheed Electronics Co., Houston, Tex.

LACIE ANALYST INTERPRETATION KEYS

J. G. Baron, R. W. Payne, and W. F. Palmer, Principal Investigators *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 867-886 ref Original contains imagery. Original photography may be purchased from the EROS data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Two interpretation aids, 'The Image Analysis Guide for Wheat/Small Grains Inventories' and 'The United States and Canadian Great Plains Regional Keys', were developed during LACIE phase 2 and implemented during phase 3 in order to provide analysts with a better understanding of the expected ranges in color variation of signatures for individual biostages and of the temporal sequences of LANDSAT signatures. The keys were tested using operational LACIE data, and the results demonstrate that their use provides improved labeling accuracy in all analyst experience groupings, in all geographic areas within the U.S. Great Plains, and during all periods of crop development.

A.R.H.

N80-15506*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

COLORIMETRIC CONSIDERATION OF TRANSPARENCIES FOR A TYPICAL LACIE SCENE

R. D. Juday, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 887-897 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The production film converter used to produce LACIE imagery is described as well as schemes designed to provide the analyst with operational film products. Two of these products are discussed from the standpoint of color theory. Colorimetric terminology is defined and the mathematical calculations are given. Topics covered include (1) history of product 1 and 3 algorithm development; (2) colorimetric assumptions for product 1 and 3 algorithms; (3) qualitative results from a colorimetric analysis of a typical LACIE scene; and (4) image-to-image color stability.

A.R.H.

N80-15507*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

GENERATION OF UNIFORM CHROMATICITY SCALE IMAGERY FROM LANDSAT DATA

R. D. Juday, F. Johnson, R. A. Abotteen (Lockheed Electronics Co., Houston, Tex.), and M. D. Pore, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 899-910 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

An algorithm is presented for generating uniform chromaticity scale (UCS) imagery from multispectral data. A computer program was written to implement the algorithm, and UCS film products were generated. The colors in the film and their temporal change are consistent with those expected for the particular scaling of Krauth components into the (lab) color space. The film product was not subjected to the practical test of competing with previous transformations. Preliminary examination indicates that the product offers the following possibilities: (1) a single film product that will supplant two film products in current use; (2) improved visibility of data differences in regions in data space that are critical to crop identification; and (3) an analytic route to the determination of data-space transformations that will be optimal for particular discrimination problems.

A.R.H.

N80-15509*# Lockheed Electronics Co., Houston, Tex.
A PROGRAMMED LABELING APPROACH TO IMAGE INTERPRETATION

M. D. Pore and R. A. Abotteen, Principal Investigators *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 923-935 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Manual labeling techniques require the analyst-interpreter to use not only production film converter products but also agricultural and meteorological data and spectral aids in an integrated, judgmental fashion. To control an anticipated high variance in these techniques, a semiautomatic labeling technology was developed. The product of this technology is label identification from statistical tabulation (LIST) which operates from a discriminant basis and has the ability to measure the reliability of the label and to introduce an arbitrary bias. The development of LIST and its properties are described. Numerical results of an application are included and the evaluation of LIST is discussed.

A.R.H.

N80-15510*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

STATUS OF YIELD ESTIMATION TECHNOLOGY: A REVIEW OF SECOND-GENERATION MODEL DEVELOPMENT AND EVALUATION

R. G. Stuff, T. L. Barnett, G. O. Boatwright, D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), and V. S. Whitehead, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 937-950 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Multiple regression models were studied in order to determine their yield estimation capability for any arbitrary unit area and to obtain greater responsiveness and accuracy through the use of additional data sources applied at smaller spatial and temporal scales. It was concluded that data base inadequacy was the factor limiting performance in the models studied and that each of the models has more yield predicting capability than was reached during LACIE.

K.L.

N80-15511*# Kansas State Univ., Manhattan.

A UNIVERSAL MODEL FOR ESTIMATING WHEAT YIELDS
 A. M. Feyerherm and G. M. Paulsen, Principal Investigators *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 951-959 refs ERTS

(Contracts NAS9-14282; NAS9-14533)
 (CONTRIB-78-268-A) Avail: NTIS HC A99/MF A01 CSCL 02C

A universal wheat yield model applicable to both fall- and spring-planted wheat was developed to show separate and joint effects of weather and culture on yields. Data from state experiment stations in a wide range of climates in the U.S. Great Plains were used to build basic relationships among yields, weather, and culture. The application of the model on a macroclimatic scale in the U.S., the U.S.S.R., and India is discussed along with potential improvements.

K.L.

N80-15512*# Lockheed Electronics Co., Houston, Tex.
THE LAW OF THE MINIMUM AND AN APPLICATION TO WHEAT YIELD ESTIMATION

R. B. Cate, D. E. Phinney, and M. H. Trenchard, Principal Investigators *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 961-969 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The adaptation of the law of the minimum (LOM) to wheat yield estimation is discussed. It is demonstrated through a trial application that the LOM concept is a valuable tool for model building when regression tools are inadequate.

K.L.

N80-15513*# National Oceanic and Atmospheric Administration, Columbia, Mo. Center for Climatic and Environmental Assessment.

CCEA SECOND-GENERATION WHEAT YIELD MODEL FOR HARD RED WHEAT IN NORTH DAKOTA

S. K. LeDuc, Principal Investigator *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 971-979 refs Presented at the Crop Modeling Workshop, Columbia, Mo., 3-5 Oct. 1977 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The problem of estimating wheat yields for years with unusual planting dates and/or unusual phenological development is investigated. A yield model developed for hard red spring wheat in North Dakota using historical yields for crop reporting districts in conjunction with meteorological predictor variables based on weekly data is assessed.

K.L.

N80-15514*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

PREDICTION OF WHEAT PHENOLOGICAL DEVELOPMENT: A STATE-OF-THE-ART REVIEW

M. W. Seeley (Lockheed Electronics Co., Houston, Tex.), M. H. Trenchard (Lockheed Electronics Co., Houston, Tex.), D. E. Phinney (Lockheed Electronics Co., Houston, Tex.), J. R. Baker, and R. G. Stuff, Principal Investigators (Fort Lewis Coll., Durango, Colo.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 981-989 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The merits and shortcomings of LACIE wheat development models are described. The effects of planting dates, spatial errors in the variables, and model forms on accuracy are discussed.

K.L.

N80-15515*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

NEW DEVELOPMENTS IN SAMPLING AND AGGREGATION FOR REMOTELY SENSED SURVEYS

A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 991-993 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Sampling techniques used to construct large area crop estimates are briefly reviewed. Problem areas in sampling and aggregation are covered. The natural sampling strategy, two phase sampling, weighted aggregation, and multiyear estimation are among the topics discussed.

J.M.S.

N80-15516*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

NATURAL SAMPLING STRATEGY

C. R. Hallum and J. P. Basu, Principal Investigators (Lockheed Electronics Co., Houston, Tex.) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 995-1013 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

A natural stratum-based sampling scheme and the aggregation procedures for estimating wheat area, yield, and production and their associated prediction error estimates are described. The methodology utilizes LANDSAT imagery and agrophysical data to permit an improved stratification in foreign areas by ignoring political boundaries and re-stratifying along boundaries that are more homogeneous with respect to the distribution of agricultural density, soil characteristics, and average climatic conditions. A summary of test results is given including a discussion of the various problems encountered.

J.M.S.

N80-15517*# Texas A&M Univ., College Station.
MULTIYEAR ESTIMATES FOR THE LACIE SAMPLING PLANS

H. O. Hartley, Principal Investigator *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1015-1028 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

An approach that may be useful in improving the estimates of the wheat acreages for the LACIE countries for each year by using the short-time series of estimates made in the sequence of consecutive years is presented. A simple 'synthesis' based

01 AGRICULTURE AND FORESTRY

method of variance component estimation is described. A general theorem concerning weighted least squares, referred to as the Aiken method, is proved. J.M.S.

N80-15518*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

WEIGHTED AGGREGATION

A. H. Feiveson, Principal Investigator *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1029-1036 ref ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The use of a weighted aggregation technique to improve the precision of the overall LACIE estimate is considered. The manner in which a weighted aggregation technique is implemented given a set of weights is described. The problem of variance estimation is discussed and the question of how to obtain the weights in an operational environment is addressed. J.M.S.

N80-15519*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

DESIGN, IMPLEMENTATION, AND RESULTS OF LACIE FIELD RESEARCH

M. E. Bauer (Purdue Univ., Lafayette, Ind.), M. C. McEwen, W. A. Malila (ERIM, Ann Arbor, Mich.), and J. C. Harlan, Principal Investigators (Texas A and M Univ., College Station) *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1037-1066 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The capability to acquire, process, and interpret remotely sensed multispectral measurements of the energy reflected and emitted from crops, soils, and other Earth surface features is considered. The LACIE Field Measurements Project is described including project objectives, the experimental approach, the data acquisition program, and selected results based on field data. The key accomplishments and results of the experiment and recommendations for future field research are summarized. J.M.S.

N80-15520*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE APPLICATION TEST SYSTEM: AN APPROACH TO TECHNOLOGY TRANSFER

A. C. Aaronson (Dept. of Agriculture, Houston, Tex.), K. Buelow (Dept. of Agriculture, Houston, Tex.), F. C. David (Dept. of Agriculture, Houston, Tex.), R. L. Packard (Dept. of Agriculture, Houston, Tex.), and F. W. Ravet, Principal Investigators *In its* Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1069-1074 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The latest satellite and computer processing and analysis technologies were tested and evaluated in terms of their application feasibility. Technologies evaluated include those developed, tested, and evaluated by the LACIE, as well as candidate technologies developed by the research community and private industry. The implementation of the applications test system and the technology transfer experience between the LACIE and the applications test system is discussed highlighting the approach, the achievements, and the shortcomings. J.M.S.

N80-15521*# Department of Agriculture, Houston, Tex. **FUNCTIONAL DEFINITION AND DESIGN OF A USDA SYSTEM**

S. M. Evans, E. R. Dario, and G. L. Dickinson, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1075-1084 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The fundamental definition and design of a U.S.D.A. system utilizing the LACIE technology available as of June 1976, is discussed. The organization and methods described are focused on LACIE technology in terms of its transfer for use applications. The simulation of a feasible system design provided timely answers to system design questions, such as the ability of a minicomputer to handle the proposed geometrical correction of MSS data. M.M.M.

N80-15522*# Department of Agriculture, Houston, Tex. **DATA BASE DESIGN FOR A WORLDWIDE MULTICROP INFORMATION SYSTEM**

W. G. Driggers, J. M. Downs, J. R. Hickman, and R. L. Packard, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 (Jul. 1979 p 1085-1096 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

A description of the USDA Application Test System data base design approach and resources is presented. The data is described in detail by category, with emphasis on those characteristics which influenced the design most. It was concluded that the use of a generalized data base in support of crop assessment is a sound concept. The IDMS11 minicomputer base system is recommended for this purpose. M.M.M.

N80-15523*# Ford Aerospace and Communications Corp., Houston, Tex.

THE APPLICATION TEST SYSTEM: TECHNICAL APPROACH AND SYSTEM DESIGN

J. L. Benson, D. R. McClelland, J. D. Tarbet, and R. F. Purnell, Principal Investigators (Dept. of Agriculture, Houston, Tex.) *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 1097-1101 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

An insight is provided of the technical approach which was applied to the system design of the USDA Applications Test Program. Included are: identification of requirements, assessment of remote sensing contributions, evaluations of existing techniques, and cost effective development of a system design which utilizes techniques and procedures consistent with requirements. M.M.M.

N80-15524*# Department of Agriculture, Houston, Tex. **RESOURCE MODELING: A REALITY FOR PROGRAM COST ANALYSIS**

L. D. Fouts and R. L. Hurst, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jun. 1979 p 1103-1120 ref ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The approach, implementation, operation, and utilization of a model to establish capital investment and operational costs for the Program is presented. These are based on their interrelationships, dependencies, and alternative actions. M.M.M.

N80-15525*# Department of Agriculture, Houston, Tex. **THE APPLICATION TEST SYSTEM: EXPERIENCES TO DATE AND FUTURE PLANS**

G. A. May, P. Ashburn, and H. L. Hansen, Principal Investigators *In* NASA. Johnson Space Center Proc. of Tech. Session, Vol. 1 and 2 Jul. 1979 p 1121-1125 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

The ATS analysis component is presented focusing on methods by which the varied data sources are used by the ATS analyst. Analyst training and initial processing of data is discussed along with short and long plans for the ATS. M.M.M.

N80-15527*# Instituto Geografico Nacional, Madrid (Spain). **THERMAL MAPPING, GEOTHERMAL SOURCE LOCATION, NATURAL EFFLUENTS AND PLANT STRESS IN THE MEDITERRANEAN COAST OF SPAIN** Progress Report

Rudolfo NunezdelasCuevas, Fernando LopezdeSagredo, D. Joaquin Melia Miralles, D. Pedro Herranz Araujo, D. Jesus Paredes Perlado, D. Antonio Parrilla, D. J. Luis Picon, D. J. Luis Labrandero, and F. Gonzalez Bernaldez, Principal Investigators 30 Sep. 1979 47 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(E80-10032; NASA-CR-162443; PR-1) Avail: NTIS HC A03/MF A01 CSCL 08F

N80-15530*# Canada Centre for Remote Sensing, Ottawa (Ontario).

USE OF THERMAL INFRARED AND COLOUR INFRARED IMAGERY TO DETECT CROP MOISTURE STRESS Interim Report

R. C. McKenzie, N. F. Clark, and J. Cihlar, Principal Investigators
Mar. 1979 36 p refs Sponsored by NASA ERTS
(E80-10036; NASA-CR-162447) Avail: NTIS
HC A03/MF A01 CSCL 02C

The author has identified the following significant results. In the presence of variable plant cover (primarily percent cover) and variable available water content, the remotely sensed apparent temperatures correlate closely with plant cover and poorly with soil water. To the extent that plant cover is not systematically related to available soil water, available water in the root zone values may not be reliably predicted from the thermal infrared data. On the other hand, if plant cover is uniform and the soil surface is shown in a minor way, the thermal data indicate plant stress and consequently available water in the soil profile.

N80-15531*# Canada Centre for Remote Sensing, Ottawa (Ontario). Applications Div.

HCCMM/SOIL MOISTURE EXPERIMENT Progress Report

Josef Cihlar, Principal Investigator 31 Aug. 1979 12 p refs
Sponsored by NASA ERTS
(E80-10037; NASA-CR-162448) Avail: NTIS
HC A02/MF A01 CSCL 08M

N80-15534*# Environmental Research Inst. of Michigan, Ann Arbor.

ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 7 Jun. - 14 Sep. 1979

R. Cicone, E. Crist, Q. Holmes, R. J. Kauth, W. A. Malila, and W. Pont, Principal Investigators Oct. 1979 151 p EREP
(Contract NAS9-15476)
(E80-10040; NASA-CR-160362; ERIM-132400-28-P) Avail:
NTIS HC A08/MF A01 CSCL 02C

N80-15535*# National Aeronautics and Space Administration, Earth Resources Labs., Bay St. Louis, Miss.

DEMONSTRATION OF WETLAND VEGETATION MAPPING IN FLORIDA FROM COMPUTER-PROCESSED SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA

M. Kristine Butera Oct. 1979 27 p refs
(NASA-TP-1553; S-492) Avail: NTIS HC A03/MF A01 CSCL
08B

The success of remotely mapping wetland vegetation of the southwestern coast of Florida is examined. A computerized technique to process aircraft and LANDSAT multispectral scanner data into vegetation classification maps was used. The cost effectiveness of this mapping technique was evaluated in terms of user requirements, accuracy, and cost. Results indicate that mangrove communities are classified most cost effectively by the LANDSAT technique, with an accuracy of approximately 87 percent and with a cost of approximately 3 cent per hectare compared to \$46.50 per hectare for conventional ground survey methods. R.C.T.

N80-15542# National Technical Information Service, Springfield, Va.

REMOTE SENSING OF AGRICULTURAL RESOURCES. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Oct. 1973 - Sep. 1979

Audrey S. Hundemann Oct. 1979 245 p Supersedes
NTIS/PS-78/0969; NTIS/PS-77/0867; NTIS/PS-76/0714;
NTIS/PS-75/668; NTIS/PS-75/068
(NTIS/PS-79/0993/0; NTIS/PS-78/0969; NTIS/PS-77/0867;
NTIS/PS-76/0714; NTIS/PS-75/668; NTIS/PS-75/068) Avail:
NTIS HC \$28.00/MF \$28.00 CSCL 03D

Results of agricultural resources surveys using remote sensing techniques for crop identification, acreage measurement, land mapping, and forest density studies are discussed. A few abstracts pertain to identification of plant diseases and insect pests and fishery resource assessment. This updated bibliography contains 239 abstracts, 28 of which are new entries to the previous edition. GRA

N80-15549# Economics, Statistics and Cooperatives Service, Washington, D. C. Statistical Research Div.

OBTAINING TIMELY CROP AREA ESTIMATES USING GROUND-GATHERED AND LANDSAT DATA

George Hanuschak, Richard Sigman, Michael Craig, Martin Ozga, and Raymond Luebke Aug. 1979 35 p refs
(PB-300825/7; TB-1609) Avail: NTIS HC A03/MF A01 CSCL
02C

The NASA Earth resources monitoring satellites, LANDSAT 2 and 3, were used with conventional ground-gathered data to estimate planted crop areas for the 1978 Iowa corn and soybean crops. Estimates that used LANDSAT data and ground data jointly were substantially more precise than those made from ground data alone. These estimates were one of several data sources used in determining the official year-end Annual Crop Summary for Iowa. Problems associated with total project cost, timely delivery of LANDSAT data to the USDA, and cloud cover must be solved prior to any planning for an operational program. GRA

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.

A80-14705 # Environmental monitoring systems. E. P. Parry (Rockwell International Environmental Monitoring and Services Center, Newbury Park, Calif.). In: Society and Aerospace Technology Workshop, Los Angeles, Calif., November 15, 1979, Proceedings. Los Angeles, American Institute of Aeronautics and Astronautics, Inc.; North Hollywood, Calif., Western Periodicals Co., 1979, p. 85-92.

The measurement of environmental pollutants involves the use of both continuous and integrated analyzers. A combination of sensor instrumentation, sampling system, and data acquisition system comprises an environmental monitoring system for sampling either air or water. The nature of ambient air monitoring systems will be discussed. Techniques used to measure various pollutants and principles of continuous sensor instrumentation will be discussed. Both sophisticated and simple environmental monitoring systems will be shown. Environmental monitoring systems for water will also be described giving the nature of and reason for integrated samplers. Recent advances in electronics and computer technology on environmental systems continue to have an impact. Finally, the application of various systems to monitoring programs and widely varying objectives, the basis for selection of systems, and the trade-offs which can be used will be given with some illustrative examples.

(Author)

A80-15556 * Assessment of the urban heat island effect through the use of satellite data. J. C. Price (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, Md.). *Monthly Weather Review*, vol. 107, Nov. 1979, p. 1554-1557. 12 refs.

A recent NASA satellite is obtaining high spatial resolution thermal infrared data at times of day appropriate for the study of the urban heat island effect. Quantitative estimates of the extent and intensity of urban surface heating are obtained by analysis of digital data acquired over the New York City-New England area. In many large cities satellite sensed temperatures are 10-15 C warmer than in surrounding rural areas. A thorough interpretation of the elevated urban surface temperature will require studies of (1) the relationship between remotely sensed surface temperatures and air temperatures, and (2) compensation for observed very localized heating due to industry and/or power plants.

(Author)

A80-15774 # The use of remote sensing for transport planning and highway engineering in developing countries. T. E. Beaumont (Fairey Surveys, Ltd., Maidenhead, Berks., England). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 17, 19-26. 13 refs.

Rapid methods of terrain appraisal are becoming increasingly important in developing countries in helping transport planners and highway engineers to make early and effective decisions about the location and design of new roads. Recent developments in the collection and analysis of terrain data recorded by remote sensing systems have resulted in a new era in the application of surveillance techniques to the planning, design, construction and maintenance of highways in different overseas environments. This paper discusses the advantages of using these new remote sensing methods for highway engineering surveys and gives examples of recent applications of the techniques to projects in Botswana, Ethiopia and Nepal. (Author)

A80-20259 Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas. V. I.

Myers, D. G. Moore, M. DeVries, and B. Worcester. In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 396-422. 13 refs.

In productive areas where deteriorations of resources is already in an advanced stage, planning and rehabilitation requires an assessment of resources and the determination of their vulnerability to further damage, as well as their potential for rehabilitation and development. In the present paper, it is shown how remote sensing technology can be used to obtain many of the early diagnostic indicators of desertification, as well as an assessment of resources and their potential in cases where the processes are advanced. V.P.

A80-20263 The application of remote sensing techniques for the enforcement of the Michigan Sand Dune Management and Protection Act. G. Schultink (Michigan State University, East Lansing, Mich.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 468-479. 21 refs.

A80-15782 # Land use mapping in the Sahel zone using Landsat. C. Bardinet (Ecole Normale Supérieure, Montrouge, Hauts-de-Seine, France), J.-M. Monget, and M. Poisson (Paris, Ecole Nationale Supérieure des Mines, Paris, France). In: Remote sensing applications in developing countries. Birmingham, England, University of Aston, 1978, p. 85, 87-90.

The LANCHAD mapping project was initiated under a joint research effort of both the Chad University and Paris 1 University. The aim of this project was to develop research and teaching in land use and cartography using remote sensing from satellites. The LANCHAD acronym (land use in Chad) clearly indicates that the subject of this study was to produce maps of use to local land managers. The kind of information obtained from Landsat is particularly useful in the planning of urban development, in this case in the Sahel type environment of Chad. The concentration of population with traditional ways of life is inducing rapid changes in the natural environment surrounding the large towns. Desertification and increased erosion in deforested areas, as well as the need for new agricultural areas, are typical problems which can be approached by multitemporal classification of satellite data. The first results have been obtained for the N'Djamena area which is the capital city of Chad, but the study will be extended to the entire country during a five year survey. (Author)

A80-20025 Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos. H. Turner (Toronto, University, Mississauga, Ontario, Canada) and D. Steiner (Zürich, Eidgenössische Technische Hochschule, Zürich, Switzerland). *Photogrammetria*, vol. 35, Nov. 1979, p. 141-160. 17 refs. National Research Council of Canada Grant No. A-7501.

This paper investigates the use of shadows on aerial photographs to obtain ground parameters (length, width, height, area and volume) of buildings by image processing technique. The assumptions of flat ground and true vertical photography are made in the study, and the investigation is performed on a scale model of an urban environment. Only the case of separate shadows is examined, and no attempt is made to deal with the cases of overlapping shadows and shadows falling on other buildings. The numerical values of the building parameters obtained by image processing are compared with the corresponding 'true' values measured directly on the scale model and a statistical error analysis is performed. The presence of a systematic error is detected in the height and volume residuals. A working model, based upon regression analysis, is suggested for use with actual aerial photographs. (Author)

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

A80-20241 The use of Landsat imagery to monitor desert encroachment in arid areas. A. M. Brera and F. Shahrokhi (Tennessee, University, Tullahoma, Tenn.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 58-68. 20 refs.

Major programs of sand fixation and afforestation have been undertaken by the Libyan Government. The purpose of these programs is to prevent sand dune encroachment over newly developed agricultural projects in the southern part of the country. Analysis of the imagery available from Landsat 1 and 2 for the period between 1972 to 1977 using digital and analogue techniques over selected test areas in the Libyan Desert has been undertaken. The results of this analysis has demonstrated that desert spreading can be estimated effectively and most economically through the use of Landsat imagery if proper image analysis techniques are used.

(Author)

A80-20246 A suggested method for delimiting urbanized areas using digital Landsat data. R. Ellefsen and D. Peruzzi (San Jose State University, San Jose, Calif.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 176-183. 6 refs.

Manipulation of a land-use map product generated by computer-aided analysis of Landsat digital data has been used, in a test case, to delimit the boundary of an urbanized area. Delimitation was determined by invoking rules adapted from the U.S. Census to encompass exclaves and to close embayments. The units of generalization were single urban pixels, groups of four, and groups of nine. The urbanized boundary was smoothed to varying degrees depending on whether the 'rule of one,' the 'rule of two' or the 'rule of three' was employed. This detailed set of systematic rules was developed with the hope of having universal applicability.

(Author)

A80-20251 A light aircraft camera Pod - The Enviro-Pod. G. E. Howard, Jr. (U.S. Environmental Protection Agency, Environmental Photographic Interpretation Center, Warrenton, Va.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 283-295.

The paper deals with an airborne self-contained low-cost remote sensing system, called the Enviro-Pod (Pod), developed for monitoring the environment of the United-States territory to ensure the validity of environmental standards and assure legal compliance. The results of feasibility tests and demonstrations indicate that the camera-configured Pod will acquire cost effectively high-quality high-resolution imagery in routine monitoring of point targets, stream segments, and small areas of generally less than 25 square miles. In its current configuration, the Pod provides high-resolution panoramic imagery in both the oblique and vertical camera positions. At a typical flight altitude of 3000 ft. the resolution of panchromatic film at nadir is 18 cm.

V.P.

A80-20255 Compositing natural resource and land use information in Spearfish, South Dakota - A land capability study. T. Loveland, J. Schlesinger, and B. Ripple (South Dakota State Planning Bureau, Pierre, S. Dak.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 343-359.

The South Dakota State Planning Bureau recently completed a land capability study for Spearfish, South Dakota. This effort concentrated on the utilization of remote sensing data and computer composite mapping techniques. NASA high altitude aerial photography was interpreted to obtain land use information within the Spearfish area for 1969 and 1976. Detailed soils and surficial geology

data were digitized, interpreted, and composited to determine the physical limitations in the area. The land capability data and the land use data were then composited to produce maps and statistics that related the area's physical limitations to actual, historical, and changing land use patterns.

(Author)

N80-10553*# Smithsonian Institution, Washington, D. C. **COLOR ZONING IN THE WESTERN DESERT OF EGYPT** Farouk El-Baz and Hassan A. El-Etr (Ain Shams Univ., Cairo, Egypt) /n NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 203-217 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

The Western Desert of Egypt was selected for detailed study as a type locality of the north African desert environment. In addition to astronaut observations, 55 color photographs of Egypt were obtained during the Apollo-Soyuz mission using 70 and 35 mm cameras. These photographs showed regional and local color zones that were mapped and checked in the field. The Apollo-Soyuz color data were used in the selection of areas for field investigations and in the extrapolation of knowledge to unphotographed areas of the Western Desert. One of the results, the mapping of an arable zone west of the Nile Delta, attests to the potential value of color photographs in desert study.

Author

N80-10554*# Smithsonian Institution, Washington, D. C. **ORBITAL OBSERVATIONS OF SAND DISTRIBUTION IN THE WESTERN DESERT OF EGYPT** Ann W. Gifford, Delia M. Warner, and Farouk El-Baz /n NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 219-236 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz Test Project photographs of the Western Desert of Egypt were studied to discover the usefulness of orbital imagery in delineating sand deposits. A strip of Apollo-Soyuz mapping-camera photographs was used to map sand distribution patterns. Information from this strip was extrapolated to the rest of Egypt using a falsecolor mosaic of LANDSAT images.

Author

N80-11535# Army Engineer Topographic Labs., Fort Belvoir, Va.

LAND COVER CLASSIFICATION FROM LANDSAT DATA: PHASE 3 OF A JOINT DOE/NASA DEMONSTRATION Final Report

Richard N. Foreman Mar. 1979 84 p (AD-A071723: ETL-0175) Avail: NTIS HC A05/MF A01 CSCL 14/5

The Corps of Engineers and NASA's Earth Resources Laboratory conducted a joint demonstration of the production of land cover classification data from LANDSAT data. This report describes Phase III of the demonstration, in which classification maps and data were produced for two Corps of Engineers Districts Wilmington District, an area in the upper Roanoke River basin of Virginia; and Jacksonville District, an area along the route of the Cross Florida Barge Canal. The report includes the Districts: evaluations of the accuracy and applicability of the classifications and cost information for Phase III of the demonstration. The report also includes cost information for the application of interdisciplinary analysis of aerial photography as a means of obtaining land cover and environmental data. LANDSAT data may be cost-effective for identifying and showing the distribution of general types of land cover for large areas, although some land cover types may not be identifiable on a particular LANDSAT scene. Interdisciplinary analysis of aerial photography identifies and explains in a technical report the distribution of land cover. The extra detail of the report and the ability to ensure that specific land cover types are studied may make interdisciplinary analysis of aerial photography cost-effective for limited study areas.

GRA

N80-11537# Washington Univ., Seattle. Remote Sensing Applications Lab **STUDY IN REMOTE SENSING FOR LAND USE Final Report,**

Apr. 1977 - Jun. 1978

Richard D. Shinn and Frank V. Westerlund Air Force Engineering and Services Lab., Tyndall AFB, Fla. Jun. 1979 74 p refs (Contract F08635-77-C-0278; AF Proj. 2103) (AD-A071802; AFESC/ESL-TR-79-15) Avail: NTIS HC A04/MF A01 CSCL 14/2

This research tested three methods of obtaining land use information by remote sensing for United States Air Force (USAF) land use planning. The three methods tested were: (1) photo interpretation of aircraft photography; (2) equidensitometric processing of aircraft or LANDSAT imagery; and (3) statistical analysis of LANDSAT digital data. The two sites tested were McChord AFB and Fairchild AFB in Washington State. Using test scenarios of mission realignments it was found that photo interpretation was an accurate and ready means to obtain land use information. GRA

N80-12484 Regionale Planungsgemeinschaft Utermain, Frankfurt (West Germany).

FUTURE REMOTE SENSING TASKS IN REGIONAL PLANNING [ZUKUNFTIGE AUFGABEN DER FERNERKUNDUNG IN DER REGIONALPLANUNG]

A. vonHesler *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 183-186 In GERMAN

Avail: Issuing Activity

Remote sensing techniques when used at the beginning of a whole variety of projects can provide notable advantages. Country, regional and town planning activities have, up until now, because of increasing population characteristics, employed quantitative planning procedures. The need for qualitative planning is becoming increasingly apparent. Financial and administrative problems are ever present. The maximum efficiency in the use of the information so acquired is essential. Suggestions put forward include promoting the availability of DIBIAS systems among experimental workers, making aircraft flights more easily available and encouraging exchanges of information. Author (ESA)

N80-12485 Ruhr Planning Authority, Essen (West Germany). **INTERPRETATION OF IR AND MSS DATA FOR TOWN AREAS [INTERPRETATION VON IR- UND MSS-DATEN IM STADGEBEIT]**

F. H. Hirt and P. Stock *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 187-190 refs In GERMAN

Avail: Issuing Activity

While the classification of open spaces and areas of vegetation is relatively easy, it is difficult to identify building and other built-up area elements (such as houses, roads and automobile parks) as they are not associated with any precise spectral characteristics. A maximum likelihood method is used to separate vegetation, asphalt, rooftop and shade. Preliminary experiments using digital data processing suggest important new applications for town and regional planning in builtup areas. Author (ESA)

N80-12517 Institut fuer Angewandte Geodaesie, Singlingen (West Germany).

THE DETERMINATION OF LAND USAGES FOR PLANNING AND CARTOGRAPHY [DIE GEWINNUNG VON NUTZUNGSKATEGORIEN AUS MULTISPEKTRALEN ABTASTERAUFGZEICHNUNGEN FUER PLANUNG UND KARTOGRAPHIE]

K. Niemz *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 493-500 In GERMAN

Avail: Issuing Activity

Analog and digital processing of data for regional planning and small scale map production purposes is described. The analog procedure is used for applications with diazo layers in which color compositions are generated. The digital processing employs the DIBIAS system and the maximum likelihood method for classification. Ground maps are produced by both methods. Multispectral scanning and the classification of LANDSAT 2 data are treated. Examples are given covering the classification of a variety of crops. Author (ESA)

N80-12524*# Texas A&M Univ., College Station. Remote Sensing Center.

APPLIED REGIONAL MONITORING OF THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION IN THE GREAT PLAINS CORRIDOR Final Report

J. C. Harlan and D. W. Deering, Principal Investigators Sep. 1979 30 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (Contract NAS5-20796)

(E80-10008; NASA-CR-162385; RSC-3018-7) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. Rangelands in southwest Texas were used to establish threshold values and limitations on measuring herbaceous biomass under typical arid and semi-arid range conditions. Previous regression relationships established between ND6 and green biomass for two different ecosystems were similar. The west Texas data set for brush-free sites was too small to be statistically conclusive. It appears that a line with a third (and steeper) slope would be best for the west Texas data, and that line would intersect the other two. Results show that similar relationships exist between ND6 and green biomass under low brush canopy cover conditions, but local variations require a calibration to determine the best fit for an ecosystem. The brush canopy has a detrimental effect on the ND6 vs. herbaceous green biomass relationship.

N80-12622*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A MULTISPECTRAL LOOK AT OIL POLLUTION DETECTION MONITORING AND LAW ENFORCEMENT

Clarence E. Catoe and James T. McLean Oct. 1979 25 p refs (NASA-TM-80573) Avail: NTIS HC A02/MF A01 CSCL 13B

The problems of detecting oil films on water, mapping the areal extent of slicks, measuring the slick thickness, and identifying oil types are discussed. The signature properties of oil in the ultraviolet, visible, infrared, microwave, and radar regions are analyzed. K.L.

N80-13614# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO ENVIRONMENTAL POLLUTION DETECTION AND MANAGEMENT. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979

Audrey S. Hundemann Aug. 1979 176 p Supersedes NTIS/PS-78/0789; NTIS/PS-77/0674 (NTIS/PS-79/0842/9; NTIS/PS-78/0789; NTIS/PS-77/0674) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 13B

The application of remote sensing methods to air, water, and noise pollution problems is discussed. Topic areas cover characteristics of dispersion and diffusion by which pollutants are transported, eutrophication of lakes, thermal discharges from electric power plants, outfalls from industrial plants, atmospheric aerosols under various meteorological conditions, monitoring of oil spills, and application of remote sensing to estuarine problems. This updated bibliography contains 167 abstracts, 11 of which are new entries to the previous edition. GRA

N80-13615# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO URBAN AND REGIONAL PLANNING. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979

Audrey S. Hundemann Aug. 1979 74 p Supersedes NTIS/PS-78/0790 and NTIS/PS-77/0675 (NTIS/PS-79/0843/7; NTIS/PS-78/0790; NTIS/PS-77/0675) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 13B

Urban and regional planning using aerial photography and satellite remote sensing methods is discussed. Abstracts cover the use of remote sensing in land use mapping, traffic surveys

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

and urban transportation planning, and taking inventories of natural resources for urban planning. Abstracts dealing with land use and residential quality associated with and acting as an influence on health and physical well-being are included. This updated bibliography contains 65 abstracts, 2 of which are new entries to the previous edition. GRA

N80-15526*# Geological Survey, Reston, Va.
**CENTRAL ATLANTIC REGIONAL ECOLOGICAL TEST SITE:
A PROTOTYPE REGIONAL ENVIRONMENTAL INFORMATION SYSTEM, VOLUME 1 Final Report**
Robert H. Alexander, Principal Investigator 26 Sep. 1979.
384 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG; Proj. CARETS)
(E80-10031: NASA-CR-162442) Avail: NTIS
HC A17/MF A01 CSCL 08F

The author has identified the following significant results. LANDSAT data showed the test region in 1972 to be 9% urban and built-up land, 38% agriculture, 50% forest, 3% nonforested wetlands, and less than 1% barren land, exclusive of water-covered areas. A comprehensive user evaluation revealed greatest demand for high-altitude aerial photography and the detailed maps and data products that can be derived from the metropolitan areas agencies, found relatively little use for LANDSAT imagery at 1:250,000 scale and corresponding manually interpreted land use maps.

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A80-10172 # Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements (K voprosu o sovremstnom primenenii kartograficheskogo i aerokosmicheskogo metodov pri izuchenii noveishikh i sovremennykh tektonicheskikh dvizhenii). V. I. Mikhailov (Belorusskii Politekhnikeskii Institut, Minsk, Belorussian SSR). *Geodeziia i Aerofotos'emka*, no. 3, 1979, p. 82-87. In Russian.

A80-11695 New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Symposium sponsored by the International Society of Photogrammetry, Canadian Institute of Surveying, and Department of Energy, Mines and Resources. Ottawa, Canada, Canadian Institute of Surveying, 1979. 789 p. In English and French. \$20.

A80-11698 # Proposed parameters for an automated mapping satellite /MAPSAT/ system. A. P. Colvocoresses (U.S. Geological Survey, National Center, Reston, Va.). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 374-382.

Landsats-1, 2, and 3, although not defined as mapping satellites, are in fact effectively recording the earth in a form suitable for presentation as small-scale image maps. These spacecraft have demonstrated the effectiveness of earth sensing, which must now move from the research to the operational phase. Landsat-D is designed to continue the research effort, but NASA, whose charter precludes operations, has not defined an operational system. An operational Landsat has previously been proposed in technical terms, but this concept was limited to the orthographic (two-dimensional) mode demonstrated by Landsat-1, 2, and 3. Mapping involves topography as well as planimetry, and a satellite compatible with the Landsat that also resolves the three-dimensional mode of topography is proposed. Such a satellite requires very high stability and pointing accuracy. The current state of the art permits such a satellite to be built and flown in a mode suitable for automated modeling of the earth's surface in three-dimensional as well as two-dimensional modes. The satellite would be complementary to or could be combined with the operational Landsat previously proposed, and it is suggested that it be designated the Automated Mapping Satellite or Mapsat. (Author)

A80-11699 # The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications. D. A. Cottrell and J. C. Maia (Conselho Nacional de Desenvolvimento Científico e Tecnológico, Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 383-401. 19 refs.

The Brazilian Landsat program is reviewed with respect to geodetic support, future plans in cartographic applications, and ongoing mapping projects using Landsat data. Attention is given to a discussion of the software/hardware phases of the program. Illustrative examples are provided. Continued research along certain lines will provide a system to update existing survey and cartographic maps and refine thematic mapping productions over a wide range of land and water resources applications. S.D.

A80-11701 # Concept for the automatic registration of satellite images with a digital map data base. W. Kropatsch and F. Leberl (Graz, Technische Universität, Graz, Austria). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 411-424. 11 refs. Grant No. DA-ERO-78-G044.

The concept of a computer program system for automatic recording of digital satellite images using a digital cartographic data bank is described. This concept is developed on the basis of a survey of literature on image recording, on digital line detection, and on structural pattern recognition. The computer program system is basically modular so that additional features can be added, and it has a learning capability so that accumulated experience can improve its performance. The proposed system is described along with its various elements. The entire system is based on a digital image processing system called DIDAK which was developed for a general-purpose computer environment (Wiesel, 1977). Programming for this system is under way. S.D.

A80-11702 # The practical contribution of space imagery to topographical mapping. J. D. Leatherdale (Hunting Surveys, Ltd., Boreham Wood, Herts., England). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 425-444.

Space imagery is already making a practical contribution to topographical mapping at very small scales. Several examples of the use of Landsat, space photography and radar for mapping at scales between 1:1 million and 1:100,000 are described and illustrated. (Author)

A80-11703 # Integration of LANDSAT CCT data and digital terrain data in cartographic application. S. Murai and R. Tateishi (Tokyo, University, Tokyo, Japan). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 445-454.

The paper deals with integration of LANDSAT CCT data and digital terrain data in cartographic application. Geographic correction (scene correction) of LANDSAT MSS data with high accuracy which enables the overlay of LANDSAT data upon the national digital terrain model, automated relief shading using both LANDSAT data and digital terrain data, pseudo stereoscopic LANDSAT images and their three dimensional representation are major themes in the study. (Author)

A80-11705 # Latin American experiences in utilizing satellite imagery for cartographic purposes. J. E. Staples (Pan-American Institute of Geography and History, Mexico City, Mexico). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 474-483. 7 refs.

One of the new technologies being investigated and used to study and resolve earth resources and environmental problems is remote sensing. The Latin American cartographic institutions became aware of the potential of remote sensing technology and space-derived imagery together with the need for a multidisciplinary mapping approach, and since 1972 have experimented with satellite imagery to prepare cartographic products. In this paper attention is given to a review of the historical evolution of satellite imaging systems. During the 1981-1985 period, it is planned to place Landsat D in orbit with an advanced multispectral scanner. A 1:250,000 scale unified hemispheric map with unified data, grid systems, and similar symbology will provide earth resource and environmental scientists a cartographic and geographic base which can be used to yield the information necessary to their disciplines. S.D.

03 GEODESY AND CARTOGRAPHY

A80-11706 # Landsat imagery. A cartographic reference base. W. M. Strome, E. A. Fleming, W. D. Bruce, and V. R. Slaney (Department of Energy, Mines and Resources, Ottawa, Canada). In: *New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978.* Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 484-502. 14 refs.

In recent years, the U.S. Landsat program has provided a small but continuing source of information for the production of new maps and the revision of existing maps for Canada. More recently, experiments have been conducted to examine the usefulness of new map products based on Landsat data. These are based on digitally enhanced and/or geometrically corrected MSS scenes. The discussion focuses on operational use of Landsat in mapping and on refining Landsat data for mapping. It is hoped that the derived maps will prove to be useful references for investigators in many disciplines. An assessment will be made by the Canadian Advisory Committee on Remote Sensing. If warranted by this evaluation and other comments received, additional maps may be produced in the future, with possible changes in format whenever necessary. S.D.

A80-11709 # Interactive analysis methods for resource mapping. A. K. Turner (Environment Consultants, Inc., Lakewood, Colo.). In: *New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978.* Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 735-754. 6 refs.

An interactive composite mapping system called GMAPS (General Map Analysis and Planning System), has been used to evaluate energy development plans, and make resource and environmental assessments. GMAPS is superior to the traditional transparent overlay methods because it is much cheaper, faster and more quantitative. Using GMAPS, variables and interactions can be easily modified to rapidly investigate an unlimited range of development alternatives. An associated mapping system GCARS, (Generalized Computer Aided Route Selection), can generate a set of alternative corridors between specified termini by applying linear programming methods to GMAPS models. The corridors are ranked for suitability according to environmental and socio-economic criteria. (Author)

A80-15176 # Method for increasing the accuracy of an airborne geodetic radio rangefinder (Metod povysheniia tochnosti samoletnogo geodezicheskogo radiodal'nomena). A. I. Belov, A. M. Rasin, and L. S. Goldobina. *Geodeziia i Aerofotos'emka*, no. 4, 1979, p. 42-49. 5 refs. In Russian.

The paper analyzes the accuracy of an airborne two-antenna rangefinder, with a view to reducing errors associated with reflections from the underlying surface. Two components of range error are investigated: fluctuating and determinate. The analysis makes it possible to determine basic design and operational parameters for the rangefinder system. B.J.

A80-15182 # Standardization of cartographic field and aerial and space photography data for automatic map generation (Normalizatsiia kartograficheskikh polevykh i aerokosmicheskikh materialov dlia avtomaticheskogo postroeniia kart). E. E. Shiriaev (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *Geodeziia i Aerofotos'emka*, no. 4, 1979, p. 81-85. In Russian.

The paper describes a method for preparing cartographic data for automatic processing with a view to automated map generation. A data standardization procedure, based on optimal division of functions between man and machine, is proposed for various scanning systems. B.J.

A80-16560 # Structure of taiga landscapes and its study by remote sensing techniques (Struktura taezhnykh landshaftov i metody ee distantsionnogo izucheniia). D. M. Kireev. In: *Remote-sensing studies of taiga regions.* Novosibirsk, Izdatel'stvo Nauka, 1979, p. 11-44, 185. 9 refs. In Russian.

The applications of remote sensing to the study of taiga landscapes is demonstrated by the example of a region in western Siberia. Landscapes and land forms are identified by the method of ecological indicators using land forms of various scales. Landscape and morphological studies, in conjunction with analyses of thematic maps, confirmed the correctness of natural territorial identifications on a structural-morphological basis. V.P.

A80-16561 # Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography (Printsiipy izucheniia gornykh lesnykh landshaftov basseina oz Baikal s ispol'zovaniem aerokosmicheskikh snimkov). N. I. Rubstov. In: *Remote-sensing studies of taiga regions.* Novosibirsk, Izdatel'stvo Nauka, 1979, p. 45-59, 186-189. 10 refs. In Russian.

A80-17403 * Earth feature identification and tracking technology development. R. G. Wilson and W. E. Sivertson, Jr. (NASA, Langley Research Center, Hampton, Va.). In: *Smart sensors; Proceedings of the Seminar, Washington, D.C., April 17, 18, 1979.* Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 185-194. 37 refs.

The paper discusses needs for smart sensing in terrestrial and atmospheric remote sensing as related to current technology and a scheduled Shuttle experiment. An approach is outlined involving Shuttle-borne experiments to develop earth feature identification and tracking technology including a Feature Identification and Location Experiment (FILE) scheduled for flight on the NASA Shuttle with an objective of classifying earth features into categories of bare land, water, vegetation, and clouds, snow, and ice. The plan for evolution of the FILE-related technology leads to capabilities for pointing instruments to predetermined sites, reacquiring earth features or landmarks, and tracking features such as coastlines and rivers. Technology concepts relative to an overall system transfer function is discussed, and the development status outlined. A.T.

A80-20200 # Recording the contour of a region with an airborne laser profilograph (Registratsiia rel'efa mestnosti s pomoshch'iu lazernogo aviaprofilografa). A. G. Kuliasov, L. E. Marasin, Iu. V. Popov, S. A. Sokolov, V. I. Solodukhin, I. N. Mazhugin, A. Ia. Zhukov, and V. I. Narkevich. *Geodeziia i Kartografiia*, Oct. 1979, p. 40-42. In Russian.

In the study described, a phase-type profilograph employing an He-Ne laser and an interference filter with a passband of 15 Å was used onboard an aircraft to record the contours of a factory and a wooded slope. The profilograph was found to provide contour recordings, not only of a wooded area but also of the underlying earth surface, with a high resolution with respect to height. V.P.

A80-20253 * An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy. C. O. Justice (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). In: *American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings.* Falls Church, Va., American Society of Photogrammetry, 1978, p. 303-328. 29 refs.

The paper deals with the method and results of a study which involved an examination of the statistical relationships between selected ground properties and Landsat MSS data, and whose aim was to assess the applicability of Landsat data to surface cover mapping in areas characterized by high-frequency spatial variations of surface cover type over small areas. The results indicate that by systematic ground data collection it is possible to understand the basic relationships between ground properties and Landsat sensor data in areas of complex surface cover and terrain, and to classify the cover types. V.P.

N80-10556*# Smithsonian Institution, Washington, D. C.
TEMPORAL CHANGES AS DEPICTED ON ORBITAL PHOTOGRAPHS OF ARID REGIONS IN NORTH AFRICA
 Marie H. Slezak and Farouk El-Baz /n NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 263-272 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Processes typical of arid environments can be monitored from space by comparing orbital photographs taken over a period of years. Oblique photographs can be used, but best results are obtained with vertical or near-vertical photographs. Changes observed by comparing the 1975 Apollo-Soyuz photographs with data from previous missions include (1) an increase in vegetation west of the Nile Delta of approximately 1108 sq km in 10 years; (2) an average shift of 2.5 km over a 6 year period in the sand patterns of the Oweinat Mountain region at the borders between Egypt, Libya, and Sudan; and (3) a reduction in the water level of Lake Chad and dune encroachment upon the lake over a period of 9 years. R.E.S.

N80-14443# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.

PHYSICAL BACKGROUND OF REMOTE SENSING

W. D. Langeraar /n ESA Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol. 1979 p 14-19

Avail: NTIS HC A09/MF A01

The physical principles of remote sensing are reviewed. After a brief discussion of the evolution of sensory data acquisition and interpretation, instruments, such as infrared detectors, seismometers, geiger-counters, and magnetometers, are considered. Emphasis is on the role of electromagnetic radiation in the detection of signals which would otherwise not be perceivable by human senses. Multispectral scanning data, like that available from LANDSAT, is taken as an example and spectral signatures are discussed. Finally, the spectral bands utilized by METEOSAT are also briefly treated. Author (ESA)

N80-14482# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).

ON THE USE OF DIGITAL PHOTOGRAMMETRIC MEASUREMENTS IN THE COMPILATION OF TOPOGRAPHIC MAPS [BEITRAEGE ZUR DIGITALEN PHOTOGRAMMETRISCHEN MESSUNG FUER DIE HERSTELLUNG TOPOGRAPHISCHER KARTEN]

Hermann G. Neubauer 1978 125 p refs In GERMAN; ENGLISH summary Original contains color illustrations (Ser-1-Original-Rept-76) Avail: NTIS HC A06/MF A01

The preparation of topographic maps is discussed. The technique where topographic maps are first prepared in the form of graphic manuscripts by applying photogrammetric methods is briefly reviewed. It is shown that attempts at a rationalization of map production leads, with the aid of digital data, to automated procedures. The measurements, the computations by means of electronic data processing equipment, and the output of field comparison documents are discussed. Author (ESA)

N80-14603* National Aeronautics and Space Administration, Pasadena Office, Calif.

SYSTEM FOR REAL-TIME CRUSTAL DEFORMATION

MONITORING Patent

Peter F. MacDoran, inventor (to NASA) (JPL) Issued 9 Oct. 1979 7 p Filed 21 Dec. 1977 Supersedes N78-17529 (16 - 08, p 1043) Sponsored by NASA (NASA-Case-NPO-14124-1; US-Patent-4,170,776; US-Patent-Appl-SN-863024; US-Patent-Class-343-112D; US-Patent-Class-343-100ME) CSCL 08G

A system is described for use in detecting earth crustal deformation using an RF interferometer technique for such purposes as earthquake predictive research and eventual operational predictions. A lunar based RF transmission or transmissions from earth orbiting satellites are received at two locations on Earth, and a precise time dependent phase measurement is made of the RF signal as received at the two locations to determine two or three spatial parameters of the antenna relative positions. The received data are precisely time tagged and land-line routed to a central station for real-time phase comparison and analysis. By monitoring the antenna relative positions over an extended period of months or years, crustal deformation of the Earth can be detected.

Official Gazette of the U.S. Patent and Trademark Office

N80-14605 Washington Univ., Seattle.
CRUSTAL DEFORMATION IN CENTRAL CALIFORNIA: MULTI-WAVELENGTH GEODETIC OBSERVATIONS AND INTERPRETATIONS Ph.D. Thesis

John Oliver Langbein 1979 213 p

Avail: Univ. Microfilms Order No. 7927822

A precision geodetic experiment was conducted on a segment of the Calaveras fault near Hollister, Calif., which had been previously instrumented for surface creep. The experiment utilized a multi-wavelength distance measuring (MWDM) device which produced daily distance determinations of nine baselines ranging from 3 to 9 km in length with a measurement precision approaching 0.1 micron strain. Analysis of the MWDM data reveals the following: (1) Long-term trends over the 2-1/2 years sampled are consistent with rigid block displacement across the Calaveras fault zone. (2) The present strain release mechanism appears to be episodic aseismic slip on the Calaveras fault with a characteristic time of about one month. (3) Maximal inversion of the baseline displacement shows that Calaveras slip episodes could result from either a small amount of slip distributed over a large fault area or a large amount distributed over a small fault area. Dissert. Abstr.

N80-15446*# Lamont-Doherty Geological Inst., Palisades, N. Y.
SHAPE OF THE OCEAN SURFACE AND IMPLICATIONS FOR THE EARTH'S INTERIOR: GEOS-3 RESULTS

M. E. Chapman, M. Talwani, H. Kahle, and J. H. Bodine Wallops Flight Center, Wallops Island, Va. NASA Nov. 1979 189 p refs

(Contract NAS6-2519)

(NASA-CR-156859) Avail: NTIS HC A09/MF A01 CSCL 08G

A new set of 1 deg x 1 deg mean free air anomalies was used to construct a gravimetric geoid by Stokes' formula for the Indian Ocean. Utilizing such 1 deg x 1 deg geoid comparisons were made with GEOS-3 radar altimeter estimates of geoid height. Most commonly there were constant offsets and long wavelength discrepancies between the two data sets; there were many probable causes including radial orbit error, scale errors in the geoid, or bias errors in altitude determination. Across the Aleutian Trench the 1 deg x 1 deg gravimetric geoids did not measure the entire depth of the geoid anomaly due to averaging over 1 deg squares and subsequent aliasing of the data. After adjustment of GEOS-3 data to eliminate long wavelength discrepancies, agreement between the altimeter geoid and gravimetric geoid was between 1.7 and 2.7 meters in rms errors. For purposes of geological interpretation, techniques were developed to directly compute the geoid anomaly over models of density within the Earth. In observing the results from satellite altimetry it was possible to identify geoid anomalies over different geologic features in the ocean. Examples and significant results are reported. R.C.T.

GEOLOGY AND MINERAL RESOURCES

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

A80-16427 * # Geodynamics from satellites. W. M. Kaula (California; University, Los Angeles, Calif.). *American Astronautical Society, Annual Meeting, Los Angeles, Calif., Oct. 29-Nov. 1, 1979, Paper 79-243*. 6 p. 6 refs. Grant No. NSG-5263.

The NASA Geodynamics Program is developing a variety of techniques in support of national programs in geodynamics, geomagnetics and earthquake hazard reduction. Global tectonics are to be observed by satellite laser tracking and radio interferometry, which will be used to measure the movements of extended (greater than 200 km) regions to an accuracy of 3 cm, while for shorter distances, lasers enable a more rapid measuring of regional strain accumulation patterns than ground systems. The techniques of Doppler tracking between two satellites to measure the gravity field over the ocean is also under NASA study. J.P.B.

A80-14373 Terrestrial aerial photogrammetric surveying of large open pit mines in the Rhein lignite district (Terrestrische und aerophotogrammetrische Vermessung grosser Tagebaue im Rheinischen Braunkohlenrevier). K. Reichenbach (Rheinische Braunkohlenwerke AG, Cologne, West Germany). *Bildmessung und Luftbildwesen*, vol. 47, Nov. 1, 1979, p. 173-178. 11 refs. In German.

A80-20258 * Long wavelength radar for geological analysis in vegetated terrain. H. C. MacDonald, W. P. Waite, D. N. Tolman, and M. Borengasser (Arkansas, University, Fayetteville, Ark.). In: *American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings*.

Falls Church, Va., American Society of Photogrammetry, 1978, p. 386-394. Contracts No. JPL-954940; No. JPL-955048.

In contrast to shorter wavelength radars, the range of returns from vegetated surfaces is appreciably less at L-band frequencies. However, the evaluation of differences in image quality due to changes in operational frequency is hindered by several system dissimilarities. In particular, a comparison of the Ka, X- and L-band radar imagery is difficult because of differences in 'effective' resolution. Though the physical resolution of these systems may be somewhat comparable, the inherent averaging of the real aperture systems (X- and Ka-) provides an apparent wider range of gray tones. This effect is related to the fact that at a scale where the resolution cell is discernable, the coherent scintillation of 'speckle' of the synthetic aperture L-band system masks tonal variations. This mismatch of effective resolution impedes detection of small changes in gray tone and makes subtle boundary changes less distinct. V.P.

N80-10540*# California Inst. of Tech., Pasadena.
GEOLOGIC ANALYSIS OF ASTP PHOTOGRAPHS OF PARTS OF SOUTHERN CALIFORNIA

R. E. Powell and L. T. Silver *In* NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 9-27 refs

Avail: NTIS HC A99/MF A01 CSCL 08G

Tectonic interpretations of the geologic features of the San Andreas, San Gabriel, and San Jacinto faults are discussed.

F.O.S.

N80-10542*# Amherst Coll., Mass.

EVALUATION OF SATELLITE IMAGES OF THE LEVANTINE RIFT ZONE

Richard M. Foose *In* NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 37-43 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Structural and lithologic features along the Levantine Rift zone were mapped using satellite images from three sources: LANDSAT, Skylab, and Apollo-Soyuz. The accuracy and completeness of these maps were checked during January 1977 on a field trip from the southern end of the Gulf of Elat to the Israeli-Syrian border. Specific structural features and regional tectonic relationships along the zone were clearly displayed on all images. In certain instances, the oblique photographs from Apollo-Soyuz were superior; but, in most cases, the vertical images from LANDSAT provided more complete and accurate relationships. The analysis of tectonic features mapped on space images concurrent with geologic mapping in the field provides an improved basis for understanding the tectonic evolution of large regions. Author

N80-10543*# Texas Univ. at Austin.

ANALYSIS OF SKYLAB AND ASTP PHOTOGRAPHS OF THE LEVANTINE (DEAD SEA) FAULT ZONE

W. R. Muehlberger, L. K. Goetz, and R. C. Belcher *In* NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 45-62 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Manned-spacecraft photographs of the Dead Sea Rift Zone (DSRZ) were studied to evaluate the fault zone. The interpretation shows a splintering of the DSRZ toward the East Anatolian Fault Zone. This splintering deranged modern drainage systems, which indicates that this region is tectonically active, and these faults constitute a major earthquake hazard. F.O.S.

N80-10544*# Missouri Univ. at Rolla.

ANALYSIS AND SYNTHESIS OF SPACE IMAGERY OF THE SOUTHEASTERN-TURKEY/NORTHWESTERN-IRAN MOBILE BELT

Paul Dean Proctor, Douglas C. Melton, Jr., Ali Beken (Middle Eastern Technical Univ., Ankara, Turkey), and L. K. Abrams *In* NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 63-85 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz photographs and LANDSAT images of eastern Turkey and northwestern Iran were analyzed for major geological features to develop a regional tectonic map. The analysis revealed three major geological terrains: an autochthonous block of folded layered rocks; and allochthonous block of older, more uniform rocks with folds and faults; and a volcanic terrain. F.O.S.

N80-10545*# Ain Shams Univ., Cairo (Egypt).

STRUCTURAL PATTERN OF THE NORTHERN PART OF THE EASTERN DESERT OF EGYPT

Mohamed A. Abdel-Rahman and Hassan A. El-Etr *In* NASA. Johnson Space Center Apollo-Soyuz Test Project. Vol. 2 1979 p 87-96 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz color photographs of the northern part of the eastern desert of Egypt were excellent for regional structural mapping because of their color fidelity and large areal coverage. The oblique, Apollo-Soyuz photographs were used for the identification of faults, whereas enlarged LANDSAT images were used for planimetric mapping. Aerial photographs were also examined to verify the mapped fault lines, and it was revealed that several of the lines detected on Apollo-Soyuz photographs were, in fact, zones of narrowly spaced, parallel faults. The results support the contention that vertical tectonics were responsible for the development of the fault pattern of the area. J.M.S.

04 GEOLOGY AND MINERAL RESOURCES

N80-10546*# Ain Shams Univ., Cairo (Egypt).
PHOTOLINEAMENTS IN THE ASTP STEREOSTRIP OF THE WESTERN DESERT OF EGYPT

Hassan A. El-Etr, Adel R. Moustafa, and Farouk El-Baz /*In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 97-105 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Photolineaments displayed on the Apollo-Soyuz stereostrip covering part of the western desert of Egypt were studied. Virtually all of the photolineaments detected on LANDSAT images (black-and-white as well as false-color composites) were also detected on Apollo-Soyuz photographs of the same scale and approximately the same resolution. The drawbacks of Apollo-Soyuz photographs include (1) the low base/height ratio, which limited the effective stereovision; (2) the high sun-elevation angle, which limited the shadows required to easily identify linear features; and (3) the overexposure of the central parts of the frames, particularly over the Great Sand Sea. Recommendations are made to remedy this on future earth-orbital photographic missions.

J.M.S.

N80-10547*# Ain Shams Univ., Cairo (Egypt).
UTILIZATION OF ASTP PHOTOGRAPHS IN THE STUDY OF SMALL STRUCTURES IN ABU RAWASH AND WADI EL NATRUN, EGYPT

Hassan A. El-Etr and Farouk El-Baz (Smithsonian Institution) /*In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 107-118 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Geologic structures of the northern part of the western desert of Egypt were studied utilizing enlargement of Apollo-Soyuz Test Project color photographs. The Apollo Soyuz photographs of Abu Rawash clearly show structural uplifts that brought white chalk deposits to the surface, depict the distribution of dark volcanic rocks in the region, and clearly delineate complex structures including several domes and plunging anticlines. The Apollo Soyuz photographs of Wadi el Natrun display its structures as well as the string of salt lakes within it and the barren nature of the northern and southern extremities of the depression. The photographs reveal that there is a potential for increasing the area of cultivated land on the eastern slope of the depression.

J.M.S.

N80-10548*# Missouri Univ. at Rolla.
PHOTOTECTONIC ANALYSIS OF SOUTHEASTERN SPAIN FROM ASTP PHOTOGRAPHS AND LANDSAT IMAGES

Paul Dean Proctor, Kenneth B. Horrall, Douglas C. Melton, Jr., and David F. Thompson /*In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 119-148 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

The tectonic characteristics of southeastern Spain were analyzed using the Apollo Soyuz Test Project oblique color photographs and LANDSAT vertical images. Four distinct tectonic provinces were identified along with three orders of fold dimensions and two orders of lineaments. Both thrust faults and normal were shown to occur in the region. A discussion of the geologic setting of southeastern Spain is given along with the results of the phototectonic analysis.

J.M.S.

N80-10549*# Ain Shams Univ., Cairo (Egypt).
EAST-WEST PERVASIVE LINEAMENTS IN CENTRAL AND SOUTHEASTERN SPAIN

Mohamed A. Abdel-Rahman /*In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 149-156 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

The lineament pattern of central and southeastern Spain was detected on photographs taken during the Apollo-Soyuz mission. The obliquity of these photographs made possible the recognition of previously unnoticed structures. The true color of the photographs also aided in identifying the lineaments. Statistical analysis indicated that the lineament pattern was not random and must be caused by geological factors. Three lineament trends

were identified. In decreasing order of significance, these were east-west, northeast, and northwest. Faults in this region were traced from a geological map, and their strikes were analyzed and found to include two preferred orientations, a northeasterly trend and a west-northwesterly trend; the first trend was more prominent. Author

N80-10550*# Missouri Univ. at Rolla.
PHOTOLOGIC ANALYSIS OF ASTP PHOTOGRAPHS OF THE LAKE TORRENS-FLINDERS RANGES-LAKE BLANCHE AREA, SOUTH AUSTRALIA

Paul Dean Proctor and Robert Sickler /*In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 157-181 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Excellent ASTP color prints and transparencies of the North Flinders Ranges and the adjacent Lake Torrens-Lake Blanche basin areas of South Australia were analyzed to determine the characteristics of the regional fold structures. Major folds, faults, and other lineaments were identified. Tectonic patterns and their relationships to mobile belt-plate tectonics were examined. In addition, basin forms and features were analyzed and related to the desert environment of the area. Possible rock types and the character of the widespread alluvial materials surrounding the bedrock areas were predicted. An interpretive photogeologic map covering the area of the ASTP photographs was produced.

J.M.S.

N80-10551*# Arizona State Univ., Tempe.
VOLCANIC LANDFORMS AND ASTROBLEMES

R. S. Dietz and J. F. McHone (Illinois Univ. at Urbana-Champaign) /*In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 183-202 refs

Avail: NTIS HC A99/MF A01 CSCL 08G

Apollo crewmembers, while searching for circular ground features, observed and photographed astroblemes (ancient impact scars) in Brazil and Libya, and volcanoes in Italy, the Galapagos Islands, and Mexico. The Brazilian site was previously unknown to impact scientists, and photographic measurements of the Libyan structure proved larger than measurements made by earth-based investigators. Plumes of active volcanoes in Italy were traced great distances, and the inaccessible Galapagos Islands were viewed synoptically. In Mexico, a feature that had been previously identified as a possible meteorite impact site was found to be formed by a volcanic steam explosion. Author

N80-10552*# Illinois Univ. at Urbana-Champaign.
RIACHAO RING, BRAZIL: A POSSIBLE METEORITE CRATER DISCOVERED BY THE APOLLO ASTRONAUTS
J. F. McHone /*In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 193-202 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

In north-central Brazil, the Apollo crewmembers photographed a 4 km wide circular ground pattern. Although the feature was not visible on airborne radar and in near-infrared satellite images, it was clearly seen from space in the visible part of the spectrum. A ground reconnaissance of this location and of a second circular structure nearby strongly supports a meteoritic origin for both sites. Author

N80-10555*# Smithsonian Institution, Washington, D. C.
PRELIMINARY ANALYSIS OF COLOR VARIATIONS OF SAND DEPOSITS IN THE WESTERN DESERT OF EGYPT
Farouk El-Baz, Marie H. Slezak, and Ted A. Maxwell /*In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 237-262 refs

Avail: NTIS HC A99/MF A01 CSCL 08G

Astronaut observations and photographs of color variations in the Western Desert of Egypt are related to both iron oxide coating on individual grains and the presence of locally derived material in the sand deposits. The northern region of the Western

Desert has the highest percentage of calcareous grains originating from local limestone outcrops. Samples from the central part of the Western Desert contain numerous iron-rich grains originating from the iron deposits of Bahariya and are locally enriched in shale fragments from the Dakhla Shale. Sands of the Great Sand Sea are relatively homogeneous, quartz-rich deposits that vary little in percentage of minor components.

R.E.S.

N80-10557*# Smithsonian Institution, Washington, D. C.
ASTP PHOTOGRAPHS OF SOUTHEASTERN ANGOLA
 Delia M. Warner *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 273-283 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Apollo-Soyuz photographs of southeastern Angola were studied to provide a preliminary description of landforms in this remote and sparsely populated region. These photographs were useful in distinguishing drainage patterns, lineament trends, rock types, and the distribution of unusual play-like features. Author

N80-10558*# Smithsonian Institution, Washington, D. C.
COLOR OF DESERT SURFACES IN THE ARABIAN PENINSULA
 Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 285-299 refs

Avail: NTIS HC A99/MF A01 CSCL 08G

A detailed analysis of the Apollo-Soyuz photographs is presented. The following facts were established: (1) available charts and maps can be updated using the orbital photographs, particularly of coastal zones; (2) geologic maps can be improved by use of the natural color photographs, which clearly delineate major geologic features and their characteristics; (3) the photographs can be used in characterizing sand fields and classifying dune forms; and (4) enlargements of the photographs can be useful in detailed studies of small areas, such as the city of Ad Dawhah (Doha), Qatar, and its environs.

M.M.M.

N80-10559*# Smithsonian Institution, Washington, D. C.
MONTE DESERT OF SAN JUAN, ARGENTINA, AS PHOTOGRAPHED BY ASTP
 Delia M. Warner and Farouk El-Baz *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 301-318 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

The photographs by the ASTP reveal that the physiographic setting of the study area is characterized by mountain-and-bolson topography controlled mainly by faulting. Most of the lineaments detected on the photographs appear to correspond to faults, and some of them may provide evidence of recent fault movement in the area. Typical topographic features include barren, deeply dissected block mountains bordered by slopes of alluvial materials that descent to a flat-floored desert basin. M.M.M.

N80-10560*# Geological Survey, Flagstaff, Ariz.
DUNES AND OTHER WINDFORMS OF CENTRAL AUSTRALIA, AND A COMPARISON WITH LINEAR DUNES ON THE MOENKOPI PLATEAU, ARIZONA
 C. S. Breed and W. J. Breed (Museum of Northern Arizona, Flagstaff) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 319-358 refs

Avail: NTIS HC A99/MF A01 CSCL 08G

Internal structures of linear dunes that were examined in central Australia and in northern Arizona are mainly medium-scale, thin cross-beds or cross-laminae with dips commonly less than 20 deg. Astronauts aboard the Apollo spacecraft identified the same hue, chroma, and value of red sand in dunes of central Australia that ground survey teams found in the main body of the Simpson Desert. Ground examination confirms that within each field of dunes, relative degrees of redness can help discern sequences of depositional events in that area (given a uniform

sand supply and climatic zone). It was concluded that reconnaissance from space is ideal for identifying key sites for field studies of specific geomorphic problems in remote desert regions.

M.M.M.

N80-10571*# Ain Shams Univ., Cairo (Egypt).
DETECTION OF A PROBABLE ANCESTRAL DELTA OF THE NILE RIVER

Mohamed A. Abdel-Rahman and Farouk El-Baz (Smithsonian Institution) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 511-520 refs

Avail: NTIS HC A99/MF A01

Interpretation of a near vertical Apollo Soyuz photograph of the present Nile Delta in northern Egypt is presented. The interpretation determines an ancestral delta of the Nile River. The limits, shape, position, and age of the ancestral Nile Delta are identified. The mineralogy of the delta is reported and the geochemistry data is analyzed.

A.W.H.

N80-11527# Joint Publications Research Service, Arlington, Va.

GEOPHYSICS, ASTRONOMY AND SPACE, NO. 450
 2 Aug. 1979 47 p refs Transl. into ENGLISH from selected Russian articles
 (JPRS-73946) Copyright. Avail: NTIS HC A03/MF A01

Articles concerning the earth's crust under the ocean, and the upper atmosphere are reported.

N80-12482 Technische Universitaet, Munich (West Germany).
QUANTITATIVE DETERMINATION OF MORPHOLOGICAL STRUCTURES IN SAND BANK REGIONS FROM IMAGE STRUCTURE ANALYSIS [QUANTITATIVE ERFASSUNG MORPHOLOGISCHER STRUKTUREN IN WATTGEBIETEN DURCH ANWENDUNG VON VERFAHREN DER BILD-STRUKTURANALYSE]

U. Wieczorek *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 153-164 refs *In* GERMAN

Avail: Issuing Activity

Several factors must be taken into consideration: variations in the altitude of the sun, the position of the object in the image field, the release of residual water from the sand bank's surface, drying out of the sand bank, and relief characteristics (micro, intermediate and macro features). Surface and texture variations are discussed. The way in which the problems encountered are overcome is described together with the computerized treatment of the data obtained. Examples are given.

Author (ESA)

N80-12483 Technische Universitaet, Munich (West Germany).
MAKING MORPHOLOGICAL MAPS OF SAND BANKS FROM AERIAL PHOTOGRAPHS [MORPHOLOGISCHE WATTKARTIERUNG NACH LUFTBILDERN]

C. Franke *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 165-182 refs *In* GERMAN

Avail: Issuing Activity

Different current distribution and direction regions can be distinguished in aerial photographs of water sand banks. These regions correspond to different sedimentary dispositions of the sand bank surfaces. The materials and methods used are described together with the interpretation of color and texture characteristics. Studies of the Crildumensiel sand banks are treated in detail; the corresponding are given and interpreted.

Author (ESA)

N80-12521*# Geological Survey, Denver, Colo. Petrophysics and Remote Sensing Branch.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Jun. - 31 Aug. 1979

04 GEOLOGY AND MINERAL RESOURCES

Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Aug. 1979 14 p Sponsored by NASA ERTS
(E80-10005; NASA-CR-162382) Avail: NTIS
HC A02/MF A01 CSCL 08B

N80-13612# National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO GEOLOGY AND MINERALOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Jul. 1979

Audrey S. Hundemann Aug. 1979 189 p Updates NTIS/PS-76/0500 Supersedes NTIS/PS-78/0791; NTIS/PS-77/0676 (NTIS/PS-79/0844/5; NTIS/PS-78/0791; NTIS/PS-77/0676)
Avail: NTIS HC \$28.00/MF \$28.00 CSCL 08G

The use of LANDSAT satellites and other remote sensing methods in geological and mineralogical applications is discussed. Abstracts cover rock and soil mapping, terrain analysis, direct and indirect mineral exploration, fault tectonics, and general geologic studies of various countries. A few abstracts pertain to equipment and techniques used in the studies. This updated bibliography contains 180 abstracts, 33 of which are new entries to the previous edition. GRA

N80-13613# New Mexico Univ., Albuquerque. Technology Application Center.

REMOTE SENSING APPLIED TO GEOLOGY. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1977 - Jun. 1979

Gerald F. Zollars Aug. 1979 53 p Sponsored by NTIS (NTIS/PS-79/0822/1) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 08G

This bibliography cites 215 articles concerning LANDSAT images, satellite-borne photography, aerial photography, and radar techniques being used to conduct geological surveys. Articles concerning photomapping and photo interpretation techniques relating to resource exploration are stressed. GRA

N80-15528*# Stanford Univ., Calif. School of Applied Earth Sciences.

GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION Progress Report, 1 Jul. - 30 Sep. 1979

R. J. P. Lyon and A. E. Prelat, Principal Investigators 30 Sep. 1979 2 p ERTS
(Contract NAS5-24232)
(E80-10033; NASA-CR-162444) Avail: NTIS
HC A02/MF A01 CSCL 08G

N80-15529*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.

GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Jul. - Sep. 1979

Helen N. Paley, Anne B. Kahle, and Stuart E. Marsh, Principal Investigators Nov. 1979 5 p ERTS
(Contract NAS7-100)
(E80-10035; NASA-CR-162446) Avail: NTIS
HC A02/MF A01 CSCL 08G

OCEANOGRAPHY AND MARINE RESOURCES

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

A80-10116 **Optical methods for investigating oceans and inland basins** (Opticheskie metody izucheniia okeanov i vnutrennikh vodoemov). Edited by G. I. Galazii (Akademiia Nauk SSSR, Limnologicheskii Institut, Listvenichnoe, USSR) and K. S. Shifrin (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR). Novosibirsk, Izdatel'stvo Nauka, 1979. 373 p. In Russian.

The book deals with the application of visible and infrared optical methods to the study of oceans and inland waters. Some aspects of oceanographic optics and remote sensing are examined, along with the color and spectrum of the outgoing light as a means of evaluating the oceanic chlorophyll and suspensions. Optical methods of studying swell, pollution, and radiation temperature are outlined. V.P.

A80-10731 * # **New developments in satellite oceanography and current measurements.** N. E. Huang (NASA, Wallops Flight Center, Wallops Island, Va.). (*International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.*) *Reviews of Geophysics and Space Physics*, vol. 17, Oct. 1979, p. 1558-1568. 175 refs.

Principal satellite remote sensing techniques and instruments are described and attention is given to the application of such techniques to ocean current measurement. The use of radiometers, satellite tracking drifters, and altimeters for current measurement is examined. Consideration is also given to other applications of satellite remote sensing in physical oceanography, including measurement of surface wind stress, sea state, tides, ice, sea surface temperature, salinity, ocean color, and oceanic leveling. B.J.

A80-11750 # **Use of satellites in polar meteorology (Utilisation de satellites en météorologie polaire).** A. Poggi (CNRS, Laboratoire de Glaciologie, Grenoble, France). In: Data collection and location by satellite; Workshop on ARGOS Utilization, Toulouse, France, March 28, 29, 1979, Proceedings. Toulouse, Centre National d'Etudes Spatiales, 1979. 5 p. 16 refs. In French.

The study of atmosphere-ice-ocean interaction in East Antarctica which will use newly developed satellite systems is presented. In particular, the ARGOS system will provide quick access to data transmitted by platforms deployed on the Antarctic continent over an area bordered by the Terre Adélie coast and extending 1000 km inland. The Landsat imagery will be used to study pack ice, and the Nimbus meteorological satellite data will be utilized to characterize the lower troposphere over the area under study. It will also determine ice surface temperatures and the radiation balance, but the platform data (surface pressure and temperature) may also be used as a reference for the correction of satellite information. A.T.

A80-13129 * **Chlorophyll gradient map from high-altitude ocean-color-scanner data.** H. H. Kim, C. R. McClain (NASA, Goddard Space Flight Center, Greenbelt, Md.), and W. D. Hart (Science Systems and Applications, Inc., Lanham, Md.). *Applied Optics*, vol. 18, Nov. 15, 1979, p. 3715, 3716.

A chlorophyll density map of an ocean area 25 x 30 km is presented, and the procedure used in generating the map from high-altitude ocean-color-scanner data is discussed. Data were ob-

tained from a ten-channel radiometer on board a U-2 aircraft flying at 19.8 km above the coastal waters of Monterey Bay, California under conditions of clear skies and clear and deep water; the processing algorithms should be useful for satellite data as well. The total radiance measured at high altitude was separated into an atmospheric and sea-surface component and a water component, which is associated with chlorophyll content, for each pixel using the upwelling radiance of a near IR channel to estimate the atmospheric effect. Chlorophyll data were extracted by taking the ratio of the difference of intensities in the 472 and 506 nm channels to the sum of the channels, and are found to agree with shipboard chlorophyll determinations at a depth of 5 m. A.L.W.

A80-14467 * # **Synthetic aperture radar imaging of moving ocean waves.** C. T. Swift (NASA, Langley Research Center, Hampton, Va.) and L. R. Wilson. *IEEE Transactions on Antennas and Propagation*, vol. AP-27, Nov. 1979, p. 725-729. 8 refs.

A theory for the radar imaging of ocean waves is presented under the assumptions that a swell propagates through an ensemble of Bragg scatterers and that the integration time of the synthetic aperture radar (SAR) is small compared to the angular velocity of the swell. Results are presented which show image development and distortions caused by the radial velocities and accelerations of the swell. Neglecting small wave bunching and tilts due to the longer underlying waves, and considering only one-dimensional geometries, the mechanism of wave motions are considered and their efforts on the production of the usual intensity pattern representing the wave image are studied. The analysis shows that in certain situations a processed image can appear which has twice the spatial period of the actual long wave on the ocean, which can confuse the interpretation of ocean wave analysis. (Author)

A80-20260 **Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey.** C. E. Ogrosky (Rutgers University, New Brunswick, N.J.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 423-430. 14 refs. NOAA-supported research.

Cost-effective methods for an aerial inventory of submerged beds of vegetation 2 hectares or more in area using 35 mm film/filter/exposure combinations and the effects of environmental conditions on image interpretability were developed. Ektachrome 200 Professional (daylight) and Ektachrome IR film were tested, where the natural color Ektachrome 200 film with Wratten No. 4 or 8 filtration, exposed at +1 or +2 f-stop(s) at an altitude of 1500 m, gave reasonable image densities and target definition of 1:27000 scale transparencies, making possible the detection of submerged vegetation at depths of up to 2 m in the highly turbid waters. The mapped distribution of submerged beds in a test area correlated well with ground truth data, demonstrating the potential usefulness of aerial photographic methods for the delineation of marine plant resources in a comprehensive statewide estuarine survey. (Author)

A80-20938 **The structure and variability of shelf sea fronts as observed by an undulating CTD system.** C. M. Allen (Liverpool, University, Liverpool, England), J. H. Simpson (Marine Science Laboratories, Anglesey, Wales), and R. M. Carson (Nairobi, University, Nairobi, Kenya). *Oceanologica Acta*, vol. 3, Jan. 1980, p. 59-68. 18 refs.

Detailed observations of the structure of shelf sea fronts have been made by means of an undulating towed CTD. The high resolution data reveal a complex pattern of variability in both space and time; seasonal development and the effects of wind stirring on the frontal structure are also illustrated. An estimate of the variation in the efficiency of tidal mixing, e , on the basis of the observed

05 OCEANOGRAPHY AND MARINE RESOURCES

potential energy, (V), distribution is suggestive of a positive feedback process in the establishment of stratification. Such a process would be consistent with recent observations which show that the fronts do not adjust significantly during the spring-neaps cycle as predicted by the vertical mixing model of James (1977). (Author)

A80-15893 Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar. W. A. Sandham, E. D. R. Shearman, and D. J. Bagwell (Birmingham, University, Birmingham, England). In: International Conference on Antennas and Propagation, London, England, November 28-30, 1978, Proceedings. Part 2. London, Institution of Electrical Engineers, 1978, p. 1-5. 7 refs. Research supported by the Science Research Council.

The potential of ground-wave radar with high-resolution spectral analysis for sea-state sensing and surface current measurements is outlined and some experiments with a MF radar on a peninsular site in the UK are presented. Analysis of the observations made with an omnidirectional antenna shows that at such a site, ground attenuation limits the sector of ocean surveyed. Directional observations were made by two synthetic aperture techniques. A new technique using synthetic aperture measurements and bistatic geometry is also briefly discussed. V.T.

A80-16247 Gulf stream boundary eddies off the east coast of Florida. F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King (Research Triangle Institute, Research Triangle Park, N.C.). *Journal of Physical Oceanography*, vol. 9, Nov. 1979, p. 1214-1222. 11 refs. Contract No. EF-77-C-05-05444.

Satellite infrared data and in situ data were used to study eddies off the east coast of Florida. The surface thermal manifestation of the eddies identified in the infrared data were alternating cold and warm tongues, conforming to the cyclonic spin-off eddies observed by Lee (1975); however, the eddies identified in the satellite data were larger than those observed by Lee. Statistics derived from the satellite data indicated that the eddies had average major and minor axes of 136 and 36 km, respectively, assuming an elliptic shape. They moved northward at an average speed of 30 km/day, and the average period was 9 days. (Author)

A80-19541 * Remote sensing for water quality and biological measurements in coastal waters. R. W. Johnson and R. C. Harris (NASA, Langley Research Center, Hampton, Va.). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Jan. 1980, p. 77-85. 36 refs.

Recent remote sensing experiments in the United States' coastal waters indicate that certain biological and water quality parameters have distinctive spectral characteristics. Data outputs from remote sensors, to date, include: (1) high resolution measurements to determine concentrations and distributions of total suspended particulates, temperature, salinity, chlorophyll a, and phytoplankton color group associations from airborne and/or satellite platforms, and (2) low resolution measurements of total suspended solids, temperature, ocean color, and possibly chlorophyll from satellite platforms. A summary of platforms, sensors and parameters measured is given. Remote sensing, especially when combined with conventional oceanographic research methods, can be useful in such high priority research areas as estuarine and continental shelf sediment transport dynamics, transport and fate of marine pollutants, marine phytoplankton dynamics, and ocean fronts. V.L.

A80-20095 # The study of the ocean from space (Issledovanie okeana iz kosmosa). B. V. Novogrudskii, V. E. Skliarov, K. N. Fedorov, and K. S. Shifrin. Leningrad, Gidrometeoizdat, 1978. 55 p. 104 refs. In Russian.

The application of earth satellites and manned spacecraft to the study of the world's oceans is reviewed. Attention is given to the atmospheric transfer function in the visible, near-IR, middle-IR and microwave regions and the use of satellites in ocean data acquisition and transmission systems. The measurement of sea level and the topography of the ocean surface by means of orbital radar altimeters is discussed, together with IR and microwave measurements of ocean surface temperature and the study of surface roughness, surface evidence of internal waves, oil pollution and ice fields. Consideration is also given to the determination of ocean chlorophyll content and color distribution, coastal region characteristics, ocean salinity and other biological parameters from space. A.L.W.

N80-10562*# National Oceanic and Atmospheric Administration, Washington, D. C.

INTERPRETING ASTP PHOTOGRAPHS OF THE OCEAN AND LOCATING THE AREA PHOTOGRAPHED, CASE STUDY OF THE GULF OF MEXICO

G. A. Maul /In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 371-383 refs

Avail: NTIS HC A99/MF A01 CSCL 08J

Some of the Skylab recommendations relative to the problem of locating the ocean area obtained in the handheld-camera photographs and the problem of interpreting data in the space photographs by comparison with shipboard observations that were acquired at approximately the same time are discussed. Based on Skylab experience, the frequently observed circular cloud features were thought of as indicators of mesoscale turbulence in ocean currents. It was found that the features could be consistently explained as being attributable entirely to atmospheric changes and that the features were not associated with cold-core ocean eddies. M.M.M.

N80-10563*# National Aeronautics and Space Administration, Lyndon B. Johnson Space Center, Houston, Tex.

VISUAL OBSERVATIONS OVER OCEANS

R. D. Terry (Richard Terry and Assoc.) /In its Apollo-Soyuz Test Project, Vol. 2 1979 p 385-407 refs

Avail: NTIS HC A99/MF A01 CSCL 08C

Important factors in locating, identifying, describing, and photographing ocean features from space are presented. On the basis of crew comments and other findings, the following recommendations can be made for Earth observations on Space Shuttle missions: (1) flyover exercises must include observations and photography of both temperate and tropical/subtropical waters; (2) sunglint must be included during some observations of ocean features; (3) imaging remote sensors should be used together with conventional photographic systems to document visual observations; (4) greater consideration must be given to scheduling earth observation targets likely to be obscured by clouds; and (5) an annotated photographic compilation of ocean features can be used as a training aid before the mission and as a reference book during space flight. M.M.M.

N80-10564*# Scripps Institution of Oceanography, La Jolla, Calif.

ANTIPODAL SEAS

Robert E. Stevenson /In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 409-429 refs

Avail: NTIS HC A99/MF A01 CSCL 08J

An oceanographic experiment was conducted to learn: (1) whether or not astronauts could be trained to observe specific ocean features from space; (2) the variability of certain sea surface conditions in time and space; and (3) the role that these ocean features play in our understanding of synoptic oceanography. Sea surface and subsurface data to be compared to astronaut observations were collected by ships and aircraft from waters east of Australia, north of New Zealand, east of Ireland, and

east of Spain. The analysis show that observations by man from orbiting space platforms have an important role in the development of synoptic oceanography. K.L.

N80-10565*# Smithsonian Institution, Washington, D. C.
MALTESE FRONT AND STRAIT OF SICILY OCEAN PATTERN ANALYSIS

Daniel Jean Stanley /n NASA, Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 431-440 refs

Avail: NTIS HC A99/MF A01 CSCL 08B

Ocean surface phenomena related to turbulence, including possible internal waves, are observed in Apollo-Soyuz Test Project color photographs of the eastern part of the Strait of Sicily between Djerba and the southeastern corner of Sicily. The convergence of the eastward flowing, less saline upper water of Atlantic origin and the dense intermediate water flowing underneath it in the opposite direction gives rise to the Maltese Front clearly visible off Cape Passero, Sicily. The investigation shows that the geographic position of these ocean surface features is in part related to sea floor topography. The vertical coverage made from an altitude of 226 km allows good definition of turbulence phenomena and serves to supplement earlier physical oceanographic observations made of the central region of the Mediterranean Sea. K.L.

N80-10566*# Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.

OCEAN COLOR OBSERVATIONS

C. S. Yentsch, W. Skea, J. C. Laird, and T. S. Hopkins /n NASA, Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 441-454 refs

(Contracts NAS5-22948; E(11-1)-2538)

Avail: NTIS HC A99/MF A01 CSCL 08J

Apollo astronauts were briefed on four features that could alter ocean color: (1) phytoplankton chlorophyll; (2) dissolved yellow substance; (3) suspended sediments; and (4) bottom reflection. Before and during the Apollo-Soyuz mission, the crew was alerted to the possibility of a red tide occurrence along the coast of new England. They were unable to obtain useful photographs because of heavy fog and cloud cover. The astronauts were successful in observing ocean discolorations, and their verbal comments indicate that they were aware of the causes and sources of these color changes. Experience on this mission suggests that ground crews can work with astronauts in attempts to locate discolorations and to determine their extent and their sources. K.L.

N80-10568*# McGill Univ., Montreal (Quebec).

ASTP AT BARBADOS: MESOSCALE POOLS OF AMAZON RIVER WATER IN THE WESTERN TROPICAL ATLANTIC

G. Borstad /n NASA, Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 481-497 refs

Avail: NTIS HC A99/MF A01 CSCL 08H

Sea surface data was obtained at Barbados for temperature, salinity, chlorophyll concentration, clarity, color, and plankton concentration. The data suggest a successive passage of pools of brackish Amazon River water until late August. Hence, it is unlikely that the discolored water observed by the Apollo crew during the Apollo Soyuz Test Project was due to the Orinoco River. The expansive freshening of the Western Tropical Atlantic by brown colored Amazon water in July would mask any effect by the smaller Orinoco. K.L.

N80-10569*# Bigelow Lab. for Ocean Sciences, West Boothbay Harbor, Maine.

ESTIMATE OF TOTAL REFLECTANCE FROM THE ORINOCO RIVER OUTFLOW

C. S. Yentsch and Farouk El-Baz (Smithsonian Institution) /n

NASA, Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 499-503 refs

(Contracts NAS5-22948; E(11-1)-2538)

Avail: NTIS HC A99/MF A01 CSCL 08H

The Orinoco River Delta was photographed by Apollo astronauts. The photographs show discrete water color zones that reflect the mixing of the sediment laden Orinoco outflow with the water of the tropical Atlantic. A datacolor/edge enhancer analysis, assuming a 5-percent reflectance value for the open ocean water, showed the reflectance of the area varied between 4 percent for the jungle and approximately 13 percent for sediment laden river outflow. These values approximate those obtained by direct measurements of the Mississippi River Delta water. The results confirm that the reflectance from coastal waters is not high enough to saturate instruments onboard unmanned satellites such as the Coastal Zone Scanner. K.L.

N80-10570*# National Oceanic and Atmospheric Administration, Seattle, Wash.

OBSERVATIONS OF INTERNAL-WAVE SURFACE SIGNATURES IN ASTP PHOTOGRAPHS

John R. Apel /n NASA, Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 505-509 refs

Avail: NTIS HC A99/MF A01 CSCL 08C

Three Apollo Soyuz Test Project photographs are presented which show indications of oceanic internal gravity waves. The features are indicated by periodic changes in the optical reflectivity of the ocean surface overlying the waves. Position and conditions of the internal wave photographs are presented and theories of the structure and existence of the surface signatures are reviewed. A.W.H.

N80-10573*# Environmental Defense Fund, Inc., Denver, Colo.
USE OF APOLLO-SOYUZ PHOTOGRAPHS IN COASTAL STUDIES

M. T. El-Ashry /n NASA, Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 531-543 refs

Avail: NTIS HC A99/MF A01 CSCL 08J

The use of spaceborne photography in coastal studies is examined. Apollo Soyuz photographs of coastal zones are provided to demonstrate various areas of application in coastal studies. These include shoreline features such as barrier islands, beach ridges, salt marshes, tidal inlets, and tidal deltas; shoreline changes including identification of major areas of erosion or accretion and prediction of future changes along rapidly/changing shorelines; and information regarding littoral drift. A.W.H.

N80-10583# Coast Guard Research and Development Center, Groton, Conn.

LONG-TERM TRACKING OF ARCTIC ICEBERGS Final Report

R. Q. Robe and D. C. Maier Apr. 1979 41 p refs
 (AD-A072473; CGR/DC-8/79; USCG-D-36-79) Avail: NTIS HC A03/MF A01 CSCL 08/12

Seven Greenland icebergs were tracked, two in 1977 and five in 1978, using ADRAMS (Air-Deployable Random Access Measurement System) ice buoys. The ice buoys transmit a signal to the NIMBUS-6 satellite which is used in computing the buoy's position. Observation periods ranged from 138 days to 202 days. The tracking of two icebergs began near Disko Island, Greenland, and the tracking of the other five began on the Baffin Island side of Baffin Bay near Davis Straits. The icebergs initially located near Disko Island did not appear to be influenced by any well-defined current system, the drift track of each was erratic and the drift speeds generally less than 0.20 m/s. The icebergs initially located along the coast of Baffin Island followed the prevailing currents southward. These icebergs drifted at speeds as high as 0.8 m/s with model speeds generally falling between 0.10 m/s and 0.20 m/s. Groundings occurred frequently occupying 40 percent of the observed time. Data processing

05 OCEANOGRAPHY AND MARINE RESOURCES

methods, accuracy of the ice buoy system, and a detailed analysis of each iceberg's drift is presented. It was estimated using the drift data obtained, that approximately 190 days are needed for an average size iceberg to travel the 1100 nautical miles from Cape Dyer, Baffin Island, to the outer limits of the Grand Banks of Newfoundland. GRA

N80-11532*# Battelle Columbus Labs., Ohio.
SEASAT DEMONSTRATION EXPERIMENTS WITH THE OFFSHORE OIL, GAS AND MINING INDUSTRIES Final Report

A. G. Mourad, A. C. Robinson, and J. E. Balon Nov. 1979
145 p refs
(Contract NASw-2800)
(NASA-CR-162423; BCL-OA-TFR-79-6) Avail: NTIS
HC A07/MF A01 CSCL 05B

Despite its failure, SEASAT-1 acquired a reasonable volume of data that can be used by industrial participants on a non-real-time basis to prove the concept of microwave sensing of the world's oceans from a satellite platform. The amended version of 8 experimental plans are presented, along with a description of the satellite, its instruments, and the data available. Case studies are summarized for the following experiments: (1) Beaufort Sea oil, gas, and Arctic operations; (2) Labrador Sea oil, gas, and sea ice; (3) Gulf of Mexico pipelines; (4) U.S. East Coast offshore oil and gas; (5) worldwide offshore drilling and production operations; (6) Equatorial East Pacific Ocean mining; (7) Bering Sea ice project; and (8) North Sea oil and gas.A.R.H.

N80-12479 Deutsches Hydrographisches Institut, Hamburg (West Germany).

RESEARCH INTO DETERMINING CHEMICAL PARAMETERS AT THE SURFACE OF THE SEA BY REMOTE SENSING [UNTERSUCHUNG ZUR BESTIMMUNG CHEMISCHER PARAMETER VON DER MEERES OBERFLAECHE DURCH FERNERKUNDUNG]

D. Schmidt and K. Struebing *In* Tech. Hochschule On Meas. from Aircraft Jun, 1978 p 131-138 refs *In* GERMAN

Avail: Issuing Activity

In the example selected, regularly introduced quantities of waste solution released by a titanium dioxide fabricant situated in northwest Helgoland since 1969 are studied. Remarkable coloration phenomena are observed; these phenomena have been investigated over a period of several years. Measurements made in the sea and results from aerial and satellite photography are discussed together with image analysis techniques. Images of ships' wakes and their digital treatment are presented.

Author (ESA)

N80-12516 Deutsches Hydrographisches Institut, Hamburg (West Germany).

DETERMINATION OF THE OPTICAL PROPERTIES OF THE SEA IN THE GERMAN BIGHT [MEERESOPTISCHE UNTERSUCHUNGEN IN DER DEUTSCHEN BUCHT]

H. Gienapp *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 471-492 refs *In* GERMAN

Avail: Issuing Activity

The spectral distribution, transmission scattering, and CIE coordinate characteristics of the sea were investigated in the framework of the 1976 FMP program. The region between Helgoland and Sylt, and the Elb estuary were studied. The sea on the southern boundary of the Verklappung's region was shown to be very dirty. Relations between color metric magnitudes Gelbstoff, Chlorophyll, and suspended matter contents were shown to exist. Comparisons were made with ERTS satellite photographs. A high degree of correlation in some of these relations was seen for the Elb estuary. The DIBIAS system is used in the calculations performed. Author (ESA)

N80-12535*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

OCEAN CHLOROPHYLL STUDIES FROM A U-2 AIRCRAFT PLATFORM

Hongsuk H. Kim, Charles R. McClain, Lamdin R. Blaine, William D. Hart (Sci. Systems and Applications, Inc., Lanham, Md.), Larry P. Atkinson (Skidaway Inst. of Oceanography, Savannah, Ga.), and James A. Yoder (Skidaway Inst. of Oceanography, Savannah, Ga.) Aug. 1979 37 p refs

(NASA-TM-80574) Avail: NTIS HC A03/MF A01 CSCL 08J

Chlorophyll gradient maps of large ocean areas were generated from U-2 ocean color scanner data obtained over test sites in the Pacific and Atlantic Oceans. The delineation of oceanic features using the upward radiant intensity relies on an analysis method which presupposes that radiation backscattered from the atmosphere and ocean surface can be properly modeled using a measurement made at 778 nm. An estimation of the chlorophyll concentration was performed by properly ratioing radiances measured at 472 nm and 548 nm after removing the atmospheric effects. The correlation between the remotely sensed data and in-situ surface chlorophyll measurements was validated in two sets of data. The results show that the correlation between the in-situ measured chlorophyll and the derived quantity is a negative exponential function and the correlation coefficient was calculated to be -0.965. R.E.S.

N80-12546# National Oceanic and Atmospheric Administration, Washington, D. C.

SEASAT: GULF OF ALASKA EXPERIMENT. SURFACE TRUTH DATA INVENTORY

John C. Wilkerson and S. Lynn McNutt 15 Feb. 1979 100 p (PB-294616; NOAA-79031609) Avail: NTIS
HC A05/MF A01 CSCL 05B

An experiment designed to collect in situ physical oceanographic and meteorological data for verification and evaluation of SEASAT sensor performance is described. The experiment was carried out from ships, aircraft, and buoys. An inventory of all physical oceanographic and meteorological surface truth data collected during the experiment from each of the participating platforms is presented. J.M.S.

N80-13753*# EG and G Washington Analytical Services Center, Riverdale, Md.

A STUDY OF POSSIBLE SEA STATE INFORMATION IN THE SAMPLE AND HOLD GATE STATISTICS FOR THE GEOS-3 SATELLITE ALTIMETER Final Report

W. T. Wells, K. L. Borman, R. D. Mitchell (RCA/Missile and Surface Radar Div., Moorestown, N.J.), and D. J. Dempsey (RCA/Missile and Surface Radar Div., Moorestown, N.J.) Sep. 1979 36 p refs
(Contract NAS6-2497)

(NASA-CR-156858) Avail: NTIS HC A03/MF A01 CSCL 08C

The statistical variations in the sample gate outputs of the GEOS-3 satellite altimeter were studied for possible sea state information. After examination of a large number of statistical characteristics of the altimeter waveforms, it was found that the best sea predictor for H-1/3 in the range of 0 to 3 meters was the 75th percentile of sample and hold gate number 11. R.E.S.

N80-14390# Naval Ocean Research and Development Activity, Bay St. Louis, Mo. Mapping, Charting and Geodesy Development Group.

OPERATING SCENARIO FOR A HYDROGRAPHIC AIRBORNE LASER SOUNDER (HALS) Interim Report

H. J. Byrnes May 1979 36 p refs
(AD-A073872; NORDA-TN-34) Avail: NTIS
HC A03/MF A01 CSCL 08/10

This note is intended to acquaint interested parties with the anticipated deployment of Hydrographic Airborne Laser Sounder (HALS). Data acquisition, data processing, data reduction rationale.

data density, test results, and environmental considerations are covered. The document is intended primarily as presolicitation information for the HALS procurement. GRA

N80-14663# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE RELATIONSHIP BETWEEN OCEANIC CHEMICAL MESOSCALE AND SEA SURFACE THERMAL STRUCTURE AS DETECTED BY SATELLITE INFRARED IMAGERY M.S. Thesis

Don Alan Nestor Jun. 1979 93 p refs
 (AD-A074186) Avail: NTIS HC A05/MF A01 CSCL 08/10

In recent years the study of ocean fronts and eddies has become increasingly important to the U.S. Navy for they are of vital importance in understanding underwater sound transmission. From the history of satellite pictures for the area of the ocean off the central California coast, it appears that cold water which has come to the surface as a result of upwelling has become intertwined within the California current. The persistent thermal features in the sea surface which are formed were the subject area of this study. Direct telephone contact was established with the satellite receiving station which afforded real time satellite information as to the thermal structure of the sea surface on a mesoscale. This satellite sensed thermal structure was then compared with in situ nutrient and temperature data collected on three cruises on board the research vessel ACANIA. The agreement between the in situ data and the satellite imagery was very strong and the utilization of satellite imagery was shown to be a very effective method to localize an ocean front. GRA

N80-14664# Polar Research Lab., Inc., Santa Barbara, Calif.
ARCTIC RESEARCH IN ENVIRONMENTAL ACOUSTICS (AREA). TECHNICAL REPORT NO. 8: ARCTIC LEAD-AIRDROP DATA BUOY

Beaumont M. Buck, Samuel P. Burke, and John O. Anderson
 25 Jul. 1979 22 p refs
 (Contract N00014-79-C-0042)
 (AD-A074731; PRL-TR-8) Avail: NTIS HC A02/MF A01 CSCL 20/1

Arctic data buoys are capable of data collection that is impractical of accomplishment by manned-station techniques primarily because of high logistics costs. These cost differentials can be even further reduced by buoy paradrop. Size, weight, and power limit the usefulness of such devices, but their most serious drawback has been automatic deployment of sensors under the ice. A new concept which employs a data buoy that is designed for airdrop into open water leads of opportunity, is powered for up to a year's life, and uses the new TIROS-N ARGOS system for position and data recovery which offers promise in solving these problems. The configuration of the buoy, called 'LAD' (Lead Air Droppable), is described along with the results of preliminary Arctic field tests of the concept. Because of the limited nature of those tests, viability of the approach is not yet established, and additional trials are planned for spring 1980. GRA

N80-14665# Naval Research Lab., Washington, D. C. Space Science Div.

OCEAN WAVE SPECTROMETER MEASUREMENTS IN THE GULF STREAM EXPERIMENT Final Report

Davidson T. Chen, Donald L. Hammond, and Paul Bey 20 Aug. 1979 54 p refs
 (WF52553000; RR0310343)

(AD-A074369; AD-E000321; NRL-MR-4070) Avail: NTIS HC A04/MF A01 CSCL 08/3

By assuming finite conducting, Gaussian-distributed, statistically stationary and homogeneous ocean surface, the ocean wave spectrometer measurements made in the Gulf Stream Experiment have demonstrated the capability of inferring the directional wave number slope spectra by using the specular point model for look-angles of less than 20 degrees. These measurements have also demonstrated the necessity of independent measurements of wind direction, mean square surface slope, and foam and spray. The results also indicate that at least four independent directional measurements with spatial resolution of 0.1 meters

or smaller and spatial coverage of 750 to 1000 meters are necessary. GRA

N80-15543# National Oceanic and Atmospheric Administration, Miami, Fla. Atlantic Oceanographic and Meteorological Labs.
SURVEY OF SATELLITE SENSORS AND DATA WITH APPLICATION TO OTEC RESOURCE AND OPERATIONS REQUIREMENTS

George A. Maul, Fred M. Vukovich, Mark Bushnell, and Bobby W. Crissman Mar. 1979 80 p refs
 (PB-300297/9; NOAA-TM-ERL-AOML-37; NOAA-79081002)
 Avail: NTIS HC A05/MF A01 CSCL 22A

The existing instruments and the capability of those instruments for observing geophysical variables that contribute to surface thermal resource fluctuations, the operating environment, and the impact of an ocean thermal energy conversion plant on the ocean are summarized. It is emphasized that remote sensing is not capable at this stage in its development to independently provide all the observations necessary for measurement of a given variable. Only an integrated in situ and remotely sensed measurement system can offer high quality data needed for environmental research. GRA

N80-15603# Research Triangle Inst., Research Triangle Park, N. C.

SEA-SURFACE TEMPERATURE VARIABILITY ANALYSIS OF POTENTIAL OTEC SITES UTILIZING SATELLITE DATA Final Report

F. M. Vukovich, B. W. Crissman, M. Bushnell, and W. J. King
 Aug. 1978 159 p refs
 (Contract EG-77-C-05-5444)

(ORO-5444-1) Avail: NTIS HC A08/MF A01

An analysis of the constancy of the sea-surface temperature in candidate locations for ocean thermal energy conversion (OTEC) siting was performed. Satellite infrared data were used to identify and locate major thermal fronts at the sea surface. These data were then used to glean certain statistics on these fronts. In situ data were used, when available, to determine temperature difference across specified thermal fronts. The study was performed in three regional locations of interest to OTEC. The specific regions are: Region I, Eastern Gulf of Mexico (bounded by 22 N to 30 N and 91 W to the west coast of Florida including the Straits of Florida); Region II, the east coast of Florida (bounded by 23 N to 32 N and the east coast of Florida to 79 W); and Region III, Puerto Rico and vicinity, (bounded by 17 to 19 N, 64 to 68 W). Results are presented and discussed. DOE

N80-15772# Environmental Data and Information Service, Washington, D. C.

INTERNATIONAL DECADE OF OCEAN EXPLORATION, VOLUME 7 Progress Report, Apr. 1977 - Apr. 1978

Oct. 1978 108 p refs
 (NOAA-S/T-78-211-Vol-7) Avail: NTIS MF A01; SOD HC

A number of programs concerned with the use of the ocean and its resources are presented. Specific programs dealing with environmental quality, improving environmental forecasting, expanding sea bed assessment activities, and developing an ocean monitoring system are described. Information, data inventories, and lists of scientific reports derived from U.S. IDOE projects are presented. A.W.H.

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.

A80-10125 # Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation (Osnovy distantsionnykh metodov izmereniia vlagozapasov v snege i vlazhnosti pochv po gamma-izlucheniiu zemli). A. V. Dmitriev and Sh. D. Fridman. Leningrad, Gidrometeoizdat, 1979. 304 p. 99 refs. In Russian.

The book deals with experience and practical use of aerial measurements of snow water equivalent from passive terrestrial gamma radiation. The potentialities of such methods in the solution of various hydrological and agricultural-meteorological problems is discussed and the principles of snow gauging by airborne radiological surveys are examined. A gamma radiation system for aerial snow surveying is examined and the error of the system is assessed. V.P.

A80-10370 Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson (Etude par télédétection de la dispersion en mer des eaux estuariennes issues de la Gironde et du Pertuis de Maumusson). P. Castaing (Bordeaux I, Université, Talence, Gironde, France), G. P. Allen, Y. Moign (Bretagne, Center Océanologique, Brest, France), and M. Houdart (Centre National pour l'Exploitation des Océans, Paris, France). *Oceanologica Acta*, vol. 2, Oct. 1979, p. 459-468. 18 refs. In French.

The present study was carried out in order to determine the nature of seaward dispersion of estuary waters and suspended sediments during spring tide and high river flow in the Gironde inlet area. On June 3, 1977, three flights were made over the inlet at mid-ebb, low tide, and mid-flood. Thermal IR coverage was obtained along with black and white photographs. These data were correlated with accompanying measurements of current velocity, salinity, temperature, and suspended sediment concentration. B.J.

A80-15054 Use of satellite infrared data for geomorphology studies. S. R. Schneider, D. F. McGinnis, Jr., and J. A. Pritchard (NOAA, National Environmental Satellite Service, Washington, D.C.). *Remote Sensing of Environment*, vol. 8, Dec. 1979, p. 313-330. 28 refs.

Enhanced nighttime thermal infrared imagery and digital data from a NOAA polar orbiting satellite were used to map drainage patterns and landforms in North and South Dakota. Features delineated include the Missouri Escarpment from Saskatchewan to the Nebraska border, the Manitoba Escarpment, Coteau des Prairies, recessional moraines on the Coteau du Missouri and partial drainage boundaries for the following rivers: James, Big Sioux, Minnesota, Red of the North, Souris, and the main stem of the Missouri plus its western tributaries in the Dakotas. In several instances drainage from gentle slopes in the Midwest was discerned and correlated with local relief. Analyses of satellite digital thermal data for western tributaries of the Missouri River revealed north-facing slopes to be warmer than south-facing slopes by an average of 1.5 C. Comparisons of ground and satellite temperatures for 11 stations in South Dakota showed good agreement. (Author)

A80-15055 A study of moisture conditions in the Pantanal of Brazil using satellite imagery. J. P. Darch (Bedford College,

London, England). *Remote Sensing of Environment*, vol. 8, Dec. 1979, p. 331-348. 9 refs.

The combined use of additive viewing and digital processing of Landsat-2 imagery of part of the Pantanal of Brazil has allowed detailed maps of the drainage network to be constructed. The distributions have been made of wet and dry areas, including differentiations of clear water, water containing suspended sediments, and categories of land with differing moisture conditions. Some unconventional use of color filters and MSS band combinations are suggested in order to extract maximum information from the imagery. Density slicing has allowed gray-scale values to be placed on the three categories of land identified. The distributions of the identified categories are verified by comparing the information from the visual classification with the classes isolated by density slicing. (Author)

A80-15056 Monitoring of euphotic depth from aircraft. B. M. Sorensen and G. Maracci (Comitato Nazionale per l'Energia Nucleare, Centro Comune di Ricerche, Ispra, Italy). *Remote Sensing of Environment*, vol. 8, Dec. 1979, p. 349-351.

The determination by aircraft of the euphotic depths of three lakes in distinct trophic states is presented. Numbers of white panels, analogous to Secchi disks, submerged in Lakes Monate, Comabbio and Varese in northern Italy to various depths that were visible from an altitude of 1000 feet were counted, and the depths at which the panels were visible were compared with on-site conventional Secchi disk depth determinations in order to obtain a relation between panel visibility and euphotic depth. The reliability and reproducibility of the method are discussed, and it is noted that the depths obtained are considered to be predominantly functions of plankton content in the oligotrophic, eutrophic and polluted lakes. A.L.W.

A80-15265 # Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management. E. L. Morgan (Tennessee Technological University, Cookeville, Tenn.), K. W. Eagleson (North Carolina, Dept. of Natural Resources, Raleigh, N.C.), R. Herrmann (U. S. Department of the Interior, National Park Service, Atlanta, Ga.), and N. D. McCollough, Jr. (Tennessee, University, Knoxville, Tenn.). *American Society of Mechanical Engineers, Intersociety Conference on Environmental Systems, 9th, San Francisco, Calif., July 16-19, 1979, Paper 79-ENAs-41*. 6 p. 6 refs. Members, \$1.50; nonmembers, \$3.00. Research supported by the Tennessee Technological University and U.S. Department of the Interior.

A80-20261 The integration of Landsat with other natural resource data for 208 water quality planning in South Dakota. J. Schlesinger, B. Ripple, and T. Loveland (South Dakota State Planning Bureau, Pierre, S. Dak.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 440-456. 7 refs.

A80-20264 Satellite snow-cover observations in Arizona. H. H. Schumann (U.S. Geological Survey, Phoenix, Ariz.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1978, p. 480-489. 7 refs.

Techniques for snow-cover mapping from imagery acquired by satellites are discussed. Multispectral scanners aboard the satellites of the Landsat series provide high-resolution imagery (80 m ground resolution) which can be interpreted visually, directly or using

06 HYDROLOGY AND WATER MANAGEMENT

different image-enhancement techniques, and which is also available in digital form for computerized mapping systems. The imagery covers 185- by 186 km areas and is almost orthographic when used for direct mapping at the common scale of 1:1,000,000. The main limitation is that only one observation is available every 9 days. Meteorological satellites provide small-scale imagery in the visible and infrared parts of the spectrum on a daily basis and have horizon-to-horizon coverage. This imagery is used for operational snow-cover mapping in large watersheds. The main disadvantages are low resolution and geometric distortion, though recent research indicates that geometric correction, image enhancement and snow-cover measurements could be accomplished by computer processing of the satellites' digital data. V.L.

A80-16564 # Principals of mapping hydrological parameters from natural systems, using satellite photography (Printsiy kartirovaniia gidrologicheskikh parametrov po prirodnykh kompleksam s ispol'zovaniem kosmicheskikh snimkov). A. V. Lebedev. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 89-108. 31 refs. In Russian.

A80-20194 * A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data. L. J. Allison, T. J. Schmutge (NASA, Goddard Space Flight Center, Greenbelt, Md.), and G. Byrne (Commonwealth Scientific and Industrial Research Organization, Canberra, Australia). *American Meteorological Society, Bulletin*, vol. 60, Dec. 1979, p. 1414-1427. 40 refs.

The chronological development and diminution of six floods in eastern Australia during January, February, and March 1974 were mapped for the first time by the Nimbus Electrically Scanning Microwave Radiometer (ESMR). Day and nighttime ESMR (19.35 GHz) coverage was analyzed for the low gradient, flooded Darling River system in New South Wales. Apparent movement of surface water as indicated by low brightness temperatures (less than 250 K, day and less than 240 K, night) was easily followed around the curved runoff basin along the northern shoreline of the flooded Darling River during this 3-month period. This pattern was in good agreement with flood crest data at selected river height gage stations, even under cloudy conditions. (Author)

A80-20240 * Monitoring of deltaic wetland processes with seasonal aerial photography. A. R. Benton, Jr. and W. W. Snell (Texas A&M University, College Station, Tex.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 37-57. 10 refs. Research supported by the Texas Water Development Board and Texas A&M University; Grant No. NGL-44-001-001.

A year-long study of four river deltas, using color infrared photography at three-month intervals, showed clearly the impact of damming the lower river or channelizing its outlet on the wetland environment. An important result of the season's photography was the dramatic appearance of the detrital material being flushed out of the deltaic wetlands by flood waters, and moved down into the lower estuaries for use by the marine organisms in the lower tropical levels. The species makeup and relative vigor of the deltaic plant communities were well recognizable on the imagery, as was the flushing mechanism in one stillviable delta marsh. V.P.

A80-20243 Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data. A. Cibuzar (A.W. Research Laboratories, Brainerd, Minn.), R. Kluegel, and L. Hansmeyer (Regional Development Commission, Staples, Minn.). In: American Society of Photogrammetry, Fall

Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 105-115. 11 refs.

Landsat digital data from the July 24, 1976 overflight was used in conjunction with existing water quality information to produce color coded maps of Secchi Disc depths and chlorophyll a concentrations within the lakes of north central Minnesota. Regression analysis of the radiance values and the water quality data indicated a relationship between Secchi depth and the ratio of Landsat band 4 to 5, and a relationship between chlorophyll a to band 6. The Landsat water quality data has provided local land use/water managers with a useful data base so they may better implement the policies fashioned by the decision makers. (Author)

A80-20245 Remote sensing of Playa lakes as a source of climatic data. J. I. Ebert (National Park Service and University of New Mexico, Remote Sensing Div., Albuquerque, N. Mex.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1978, p. 159-175. 31 refs. NSF Grant No. SOC-75-02253.

A possible solution to the present fragmentary climatic record is the measurement of closed-basin or Playa lakes - water bodies with no physical outward flow nor evaporative outflow. Remote sensing offers methods by which such measurements can be made over large parts of the earth, possibly using automated techniques. In the present paper, the theoretical and practical bases of Playa lake measures are discussed. It is suggested that the nature of these measures, resulting from a combination of meteorological variables and such things as soil properties and landform, may constitute an ideal source of information on actual available water - providing data far more useful than those resulting from meteorological instruments. V.P.

A80-20247 * Passive microwave studies of frozen lakes. D. K. Hall, J. L. Foster, A. Rango, and A. T. C. Chang (NASA, Goddard Space Flight Center, Hydrospheric Sciences Branch, Greenbelt, Md.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1978, p. 195-208. 8 refs.

Lakes of various sizes, depths and ice thicknesses in Alaska, Utah and Colorado were overflowed with passive microwave sensors providing observations at several wavelengths. A layer model is used to calculate the microwave brightness temperature, $T_{sub B}$ (a function of the emissivity and physical temperatures of the object), of snowcovered ice underlain with water. Calculated $T_{sub B}$'s are comparable to measured $T_{sub B}$'s. At short wavelengths, e.g., 0.8 cm, $T_{sub B}$ data provide information on the near surface properties of ice covered lakes where the long wavelength, 21.0 cm, observations sense the entire thickness of ice including underlying water. Additionally, $T_{sub B}$ is found to increase with ice thickness. 1.55 cm observations on Chandalar Lake in Alaska show a $T_{sub B}$ increase of 38 K with an approximate 124 cm increase in ice thickness. (Author)

N80-10567*# Smithsonian Institution, Washington, D. C. ANALYSIS OF WATER COLOR AS SEEN IN ORBITAL AND AERIAL PHOTOGRAPHS OF CAPE COD, NANTUCKET, AND MARTHA'S VINEYARD, MASSACHUSETTS

Tracey Tisdall and Farouk El-Baz In NASA Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 455-480 refs

Avail: NTIS HC A99/MF A01 CSCL 08J

Coastal water color was analyzed in two Apollo-Soyuz photographs. The natural color of the photographs enabled recognition of shoals and suspended sediments, sediment transport

by longshore drift, wind streaks, and crests and troughs of internal ocean waves. Comparison with high altitude aircraft photographs revealed that the aerial photographs are necessary for detailed analyses and the spaceborne photographs are useful for studying large areas. A comparison of the aerial photographs with bathymetric charts showed that numerous changes occurred in the coastlines after the charts were made. Absolute reflectance values of shoals, chlorophyll concentrations, sediments, etc. were roughly estimated, but could not be accurately determined. K.L.

N80-10572* # Smithsonian Institution, Washington, D. C.
SUSPENDED-SEDIMENT DISPERSAL PATTERNS OF RIVER DELTAS PHOTOGRAPHED BY ASTP
 Ted A. Maxwell / In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 521-530 refs

Avail: NTIS HC A99/MF A01 CSCL 08H

Orbital photographs of five river deltas are presented. Suspended sediment plume patterns are identified and are related to models of sedimentation in a deltaic environment. The relative effects of river inertia, buoyancy of suspended matter, and turbulent bed friction are evaluated using delta geometry and plume pattern. A.W.H.

N80-10574* # Texas Univ. at Austin.
SOUTH AMERICAN RIVER MORPHOLOGY AND HYDROLOGY
 R. K. Holz, V. R. Baker, S. M. Sutton, Jr., and M. M. Pentead-Orellana (Fundacao Univ. de Brasilia) / In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 545-594 refs

Avail: NTIS HC A99/MF A01

A guide to the hydrologic properties of streams in the Amazon and Paraguay Basins is presented. Photographs are presented from the Apollo Soyuz Test Project of the Amazon Basin. Stream regimes, including analyses of meander wavelengths, flood plain development, and basin morphology are discussed. Basin size, drainage network density, flood plain width, vegetation types and density, climatic factors, and terrain variability are assessed. Adjustments of changes in river morphology caused by altered water and sediment discharges and by quaternary climatic changes are discussed. A.W.H.

N80-10575* # Environmental Research and Technology, Inc., Concord, Mass.

SNOW HYDROLOGY STUDIES

M. D. Smallwood, C. J. Bowley, and J. C. Barnes / In NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 595-615 refs

Avail: NTIS HC A99/MF A01 CSCL 08L

Photographs from the Apollo Soyuz Test Project of snow covered areas in the northwestern United States and Canada, the Chilean Andes, and the southern Alps of New Zealand are discussed. The photographs are analyzed and a tendency for the snowline elevations to be lower in the areas surrounding the permanent snowfields and glaciers rather than in areas of seasonal snowpack is examined. A.W.H.

N80-10590 # University of Eastern Michigan, Ypsilanti. Dept. of Geography and Geology.
IMPACT OF GREAT LAKES WATER LEVEL FLUCTUATIONS ON COASTAL WETLANDS Final Report, 1 Oct. 1976 - 30 Nov. 1978

Eugene Jaworski, C. Nicholas Rapnael, P. J. Mansfield, and Brooks B. Williamson Apr. 1979 364 p refs
 (Contract DI-14-0001-7163)

(PB-296403/9; W79-07001; OWRT-B-045-MICH(1)) Avail: NTIS HC A16/MF A01 CSCL 08H

Field measurements were collected at seven study areas along Lakes Michigan, Huron, St. Clair, and Erie. Surface landforms

were mapped and models of the four coastal wetland types were developed. With the aid of aerial photography and field bisects, the zonal plant communities were identified and three historical distribution maps were constructed which represented various lake level conditions. Field data indicate that water level, wave energy, and substrate type are important factors in determining the shifting of plant communities in response to lake level fluctuations. GRA

N80-11538 # Army Cold Regions Research and Engineering Lab., Hanover, N. H.
DETECTION OF ARCTIC WATER SUPPLIES WITH GEOPHYSICAL TECHNIQUES

S. A. Arcone, A. J. Delaney, and P. V. Sellmann Jun. 1979 37 p refs

(DA Proj. 4A7-62730-AT-42)

(AD-A072157; CRREL-79-15) Avail: NTIS HC A03/MF A01 CSCL 13/2

This report discusses the application of several modern geophysical techniques to groundwater exploration in areas in permafrost. These methods utilize the principles of magnetic induction and radiowave surface impedance in the 10- to 400-kHz band, the techniques of impulse and side-looking radar in the 50- to 10,000-MHz band, and also some optical techniques using imagery obtained from a satellite. Low frequency case studies demonstrate the use of the techniques for detecting free water under an ice cover in shallow, almost completely frozen lake basins, and thaw zones within lake beds, stream channels, and in permafrost in general. The radar studies demonstrate the use of these techniques for determining depth of free water and ice cover thickness on lakes and rivers. GRA

N80-11553 # National Technical Information Service, Springfield, Va.

REMOTE SENSING APPLIED TO HYDROLOGY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1979

Audrey S. Hunderman Aug. 1979 219 p Supersedes NTIS/PS-78/0792 and NTIS/PS-77/0677

(NTIS/PS-79/0845/2; NTIS/PS-78/0792; NTIS/PS-77/0677) Avail: NTIS HC \$28.00/MF \$28.00 CSCL 08H

The use of aerial and satellite imagery in hydrologic studies, including water resources planning and management, is discussed. The abstracts cover remote sensing studies of water quality, soil moisture, floodplain delineation, ice cover, and determination of snow depth and water equivalent. This updated bibliography contains 210 abstracts, 22 of which are new entries to the previous edition. GRA

N80-12478 Hamburg Univ. (West Germany).

ON THE PROBLEM OF THE REMOTE SENSING OF SUBSTANCES IN WATER BY MULTISPECTRAL SCANNING [ZUM PROBLEM DER FERNERKUNDUNG VON SUBSTANZEN IM WASSER MIT DEM MULTISPEKTRALSCHANNER]

R. Doerffer / In Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 123-130 refs In GERMAN

Avail: Issuing Activity

Measurements devised to determine the characteristics and concentrations of three groups of substances (those producing a yellow/brown coloration, suspended matter and phytoplankton) are described. If qualitative and quantitative information is to be deduced, account must be taken of contributions to the measured signal arising from ground surfaces, interfaces and the atmosphere. Backscattered radiation fields are related to concentration levels. Author (ESA)

06 HYDROLOGY AND WATER MANAGEMENT

N80-12493 Freiburg Univ. (West Germany).
INTERPRETATION OF WATER QUALITY USING REMOTE SENSING TECHNIQUES [ZUR INTERPRETATION DER QUALITAET VON WASSERKOERPERN AUS FERNERKUNDUNGS-AUFZEICHNUNGEN]
H. Dietze, G. Hildebrandt, and D. Mahr *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 257-270 *In* GERMAN

Avail: Issuing Activity

Characteristics of large water surfaces and waterways were investigated using an eleven channel multiscanner and from aerial photographs taken at different heights and times of the year. The results obtained show how information in the near infrared is influenced by high absorption. A more realistic interpretation of the results obtained can be achieved by employing a VP 8 analog evaluation system. A table of measured characteristics for eutrophic and non-eutrophic water masses is presented.

Author (ESA)

N80-12518*# 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, Jul. - Sep. 1979

Donald G. Moore, Principal Investigator and J. L. Heilman Sep. 1979 3 p ERTS

(Contract NAS5-24206)

(E80-10002; NASA-CR-162379; SD SU-RSI-79-15) Avail: NTIS HC A02/MF A01 CSCL 08H

N80-12520*# National Oceanic and Atmospheric Administration, Washington, D. C.

APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report

Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 2 Oct. 1979 9 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (E80-10004; NASA-CR-162381) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. Additional analyses of Luverne, Minnesota ground data revealed that soil moisture variations are independent of elevation effects. Tidal fluctuations in the Potomac River and Delaware Bay were examined as a function of surface temperature. Preliminary findings suggest that temperature boundaries are sufficient to detect various stages of the tidal cycle in Delaware Bay, but are as yet uncertain for prediction in the Potomac River. At least three additional cases are needed to completely evaluate the tidal cycle. An alphanumeric printout at a scale of 1:1,000,000 compares closely with a 1:1,000,000 scale DMD image of the Chesapeake Bay region.

N80-12522*# Commission of the European Communities, Ispra (Italy).

MAPPING THERMAL INERTIA, SOIL MOISTURE AND EVAPORATION FROM AIRCRAFT DAY AND NIGHT THERMAL DATA

J. Dejae, Principal Investigator, J. Meger, M. Kohl, G. Maracci, P. Reiniger, G. Tassone, and J. Huygen 1978 10 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(Proj. TELLUS)

(E80-10006; NASA-CR-162383)

Avail: NTIS HC A02/MF A01 CSCL 08G

N80-12527*# Pennsylvania State Univ., University Park. Dept. of Meteorology.

REMOTE ESTIMATION OF SURFACE MOISTURE OVER A WATERSHED M.S. Thesis

Paul Jeffrey Kocin, Principal Investigator Nov. 1979 70 p refs Sponsored by NASA ERTS

(E80-10025; NASA-CR-162368)

Avail: NTIS

HC A04/MF A01 CSCL 08H

The author has identified the following significant results. Contoured analyses of moisture availability, moisture flux, sensible heat flux, thermal inertia, and day and nighttime temperatures over a Missouri watershed for a date in June and in September show that forests and creeks exhibit the highest values of moisture availability, whereas farmlands and villages are relatively dry. The distribution of moisture availability over agricultural districts differs significantly between the two cases. This difference is attributed to a change in the surface's vegetative canopy between June and September, with higher moisture availabilities found in the latter case. Horizontal variations of moisture, however, do

indicate some relationship between moisture availability and both local rainfall accumulations and the nature of the terrain.

N80-12547# Geological Survey, Reston, Va.

U. S. GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: BEAVER CREEK WATERSHED

Janet Bonner, comp. 1979 89 p refs

(PB-297442/6) Avail: NTIS HC A05/MF A01 CSCL 08B

Remotely sensed data gathered from spacecraft and aircraft is presented. GRA

N80-13606# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.

DEVELOPMENT OF AN AIRBORNE GAMMA RADIATION SYSTEM FOR SNOW SURVEYS

Allen E. Fritzsche 1979 10 p refs Presented at Workshop on Remote Sensing of Snow and Soil Moisture by Nucl. Techniques, Voss, Norway, 23 Apr. 1979

(Contract EY-76-C-08-1183)

(EGG-1183-1679; CONF-790495-1)

Avail: NTIS

HC A02/MF A01

The use of NaI(Tl) gamma detectors with a full gamma energy spectrum pulse height analyzer together with a small computer provides a self contained and flexible system for snow surveys. The dual detector method determines atmospheric radon perturbations in the detection system. Detailed calibration experiments must be performed to determine twenty parameters that describe the physical nature of the system. Multiple high altitude and lake flights are used to obtain background components. Simulation pads, loaded with varying concentrations of K-40, Th-232, and U-238, yield photopeak stripping coefficients and basic system sensitivity. Multiple altitude flights over land lines provide air attenuation coefficients which may be converted to water attenuation coefficients. DOE

N80-13609# World Meteorological Organization, Geneva (Switzerland). Hydrology and Water Resources Dept.

SPACE OBSERVATIONS FOR WATER RESOURCES: A POTENTIAL TO BE DEVELOPED

A. J. Askew and J. Nemeč 1978 14 p refs Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May-Jun. 1979

Avail: NTIS HC A02/MF A01

Information is presented concerning the data requirements that were established for work in hydrology and water resources and mention is made of the use of spacecraft for the transmission of hydrological data. It was concluded that a dialogue should be established between those supplying the data and investigating their potential uses and those actually engaged in the assessment and management of water resources. Author (ESA)

N80-13611# Zurich Univ. (Switzerland). Dept. of Geography.
SNOW MAPPING FROM SPACE PLATFORMS
 K. I. Itten 1979 23 p refs Presented at 22d COSPAR
 Plenary Meeting, Bangalore, India, May-Jun. 1979 Submitted
 for publication

Avail: NTIS HC A02/MF A01

Present knowledge of snow mapping from space is reviewed, discussing the problems of optimum resolution, periodicity, features to be measured, and wavelength bands to be used. The requirements for analog and digital data analysis are described, recommendations given, and questions on the economic implementation of such methods raised. It is concluded that the various newly developed satellites for meteorology, Earth and marine resources do not yet constitute a major breakthrough in solving the task of snow mapping. Author (ESA)

N80-13726# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Abt. Meerestechnik.
STRATEGIES FOR THE SURVEILLANCE OF COASTAL WATERS OF THE FEDERAL REPUBLIC OF GERMANY Final Report

Helmut Kosche Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1977 181 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol. (BMFT-FB-M-77-11) Avail: NTIS HC A09/MF A01; ZLDI, Munich DM 37,80

Strategies for surveillance of anorganic and organic pollutants in coastal waters are necessary to fulfill international conventions. The development of a realistic strategy for the surveillance of low and slowly changing concentration levels is intended. The analysis of collected data show that the knowledge of anorganic pollutants surpasses the knowledge of organic pollutants. The necessary detection limits are in the range of ppb for anorganic and ppt for organic pollutants. Existing measuring devices are presented and discussed with regard to their useful ranges and merits. In addition, the possible potential and use of biological indicators as well as of remote sensing is discussed. The resulting, proposed strategy consists of a three element approach (coordination of existing activities, installment of a central institution, special activities regarding accidents with pollutants) based on sampling, preparation, the use of laboratories, and scientific interpretation. Author (ESA)

N80-15447*# Ministero dell'Agricoltura e delle Foreste, Rome (Italy).

TOPOGRAPHICAL CHARACTERISTICS THROUGH THE STUDY OF THE THERMAL AND HYDROLOGICAL DISUNIFORMITY OF THE SOIL FROM THE MESOSCALE. AN APPLICATION TO LOCAL FORECASTING OF AMBIENT TEMPERATURE FROM THE TELLUS PROJECT [IL TELERILEVAMENTO PER LO STUDIO A MESOSCA LA DELLE DISUNIFORMITA TERMICHE ED IDRICHE DEL SUOLO. APPLICAZIONE ALLA PREVISIONE LOCALE DEI TEMPORALI NELL'AMBITO DEL PROGETTO TELLUS]

E. Rosini and P. Caponigro, Principal Investigators 1977 6 p In ITALIAN ERTS

(E80-10020; NASA-CR-162392) Avail: NTIS HC A02/MF A01 CSCL 05B

(NASA Order S-40255-B)

(E80-10039; NASA-CR-162450)

Avail: NTIS

HC A02/MF A01 CSCL 05B

N80-15546# National Ocean Survey, Rockville, Md. Office of Marine Technology.

TECHNICAL PAPERS ON AIRBORNE LASER HYDROGRAPHY Technical Memorandum, Mar. - Dec. 1978

Gary C. Guenther, Robert W. L. Thomas (EG and G Washington Anal. Serv. Center, Inc., Rockville, Md.), Lowell R. Goodman, David B. Enabnit, and Robert N. Swift (EG and G Washington Anal. Serv. Center, Inc., Rockville, Md.) Feb. 1979 74 p refs (PB-299321/0; NOAA-TM-NOS-25; NOAA-79072309) Avail: NTIS HC A04/MF A01 CSCL 08J

Early results of an experimental and theoretical investigation into the technical aspects of airborne laser bathymetry are presented in the following papers: (1) Laser Bathymetry for Near-Shore Charting Application (A Status Report); (2) Laser Hydrography; (3) Bathymetry Intercomparison: Laser vs. Acoustic; (4) Laser Application for Near-Shore Nautical Charting; (5) Laser Bathymetry for Near-Shore Charting Application (Preliminary Field Test Results); and (6) Theoretical Characterization of Bottom Returns for Bathymetric Lidar. GRA

N80-15533*# Department of Agriculture, Phoenix, Ariz. Water Conservation Lab.

HEAT CAPACITY MAPPING MISSION (HCMM) Quarterly Progress Report, 1 Aug. - 31 Oct. 1979

Ray D. Jackson, Principal Investigator 31 Oct. 1979 1 p ERTS

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A80-10173 # Some aspects of determining object coordinates from scanner photographs (Nekotorye aspekty opredeleniia koordinat ob'ektov po skanernym snimkam). O. I. Egorovia. *Geodeziia i Aerofotos'emka*, no. 3, 1979, p. 88-92. In Russian.

The paper presents an analytical method for determining object coordinates from photographs obtained from an infrared line-scanning system with mechanical scanning, under the condition that the image geometry is known. The method is useful in remote sensing studies of earth resources. B.J.

A80-10876 Selection of Landsat MSS data for inventories of earth resources. F. W. Hilwig (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal*, no. 2, 1979, p. 249-266. 14 refs.

At present, an important problem preceding the application of satellite multispectral scanning (MSS) data for inventory of earth resources surveys is the selection of the most relevant scenes for interpretation purposes. The most promising satellite MSS data for multitemporal studies of earth resources can only be obtained if careful consideration is given to the following factors: cloud cover, image quality, snow cover, bioclimate (soil moisture), vegetation/crops, and sidelap. These factors are necessary for both visual interpretation and digital analysis of Landsat MSS data. As outlined in the paper, a terminal connected to data bases of space imagery, e.g., EROS (USA) or ESRIN (Italy), may speed up the time-consuming iterative process of selection of satellite imagery. A data base, obtained by the coordination, standardization and exchange of data of the various receiving stations, distribution centers and documentation institutes, would be an essential step in optimizing the selection, interpretation and application of satellite MSS data. S.D.

A80-11190 Inexpensive radar mapping by Ericsson Star. B. Ekengren (LM Ericsson Telefon AB, Molndal, Sweden). In: Military Electronics Defence Expo '78; Proceedings of the Conference, Wiesbaden, West Germany, October 3-5, 1978. Geneva, Interavia, S.A., 1979, p. 769-777.

The paper examines an inexpensive radar mapping technique employing a real aperture sidelooking airborne radar. The fundamental principles of real aperture SLAR are reviewed, noting that experience has shown that good radar maps can be achieved with radar installed in a light business aircraft without sophisticated antenna stabilization. Attention is given to the following major applications: oil spill mapping, sea ice mapping, ship detection, including supervision of fishing, monitoring of borders, and supervision of sea traffic. In addition, use for land mapping is also covered. It is concluded that such a system is flexible and has high availability. M.E.P.

A80-11696 # Advances in digital image display and simulation from digital terrain data bases. M. B. Faintich, G. B. Sigler, and D. P. Fahy (U.S. Defense Mapping Agency, Aerospace Center, St.

Louis Air Force Station, Mo.). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 111-135.

The digital terrain data produced at the Defense Mapping Agency Aerospace Center (DMAAC) supports a wide variety of products, including input to radar simulators, guidance systems and automated cartographic systems. To facilitate the display of the data bases for analysis, DMAAC has developed the capability for computer generation of digital image displays of the terrain data in the form of gray level elevation coding, contouring, variable sun angle shaded relief and computer generated sensor scenes, including perspective views, stereo-pairs, and synthetic radar displays. All of the examples shown in this paper were generated at DMAAC on a UNIVAC 1000 series computer and reimaged onto film format using an OPTRONICS scanning, digitizing and reimaging (SDR) system. It is shown that digital terrain data bases may be effectively displayed in various image formats. This capability has proven to be a valuable editing and analysis tool for the production and specification refinement of digital terrain data. S.D.

A80-11697 # Combined Skylab and high altitude aircraft photography space triangulation. M. E. O. Ali and A. J. Brandenberger (Université Laval, Quebec, Canada). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 354-373. 6 refs. Research supported by the National Research Council of Canada and Department of Energy, Mines and Resources.

The paper is concerned with an investigation designed to study a combination of high-altitude aircraft photography and Skylab photography aerial triangulation. The discussion covers a brief description of the materials used in the investigation, selection of an appropriate number of control and/or pass points, bundle adjustment algorithm for aerial triangulation of space photography, and tests and results. The various procedures studied and developed produced a planimetric accuracy of approximately 20 m in the best case. Such a ground control accuracy would be sufficient for 1:100,000 mapping and even for 1:50,000 (reconnaissance) mapping. The Skylab photography appears to be useful in areas of the earth where there is no control of any type except the coordinates of some points which can be measured on small-scale maps. S.D.

A80-11704 # The SPOT remote sensing satellite - Assessment of the geometric quality of the images. R. Rosso (Centre National d'Etudes Spatiales, Toulouse, France). In: New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978. Ottawa, Canada, Canadian Institute of Surveying, 1979, p. 455-473. 11 refs.

The paper discusses the development and features of the French SPOT remote sensing satellite (SPOT standing for Satellite Probatoire d'Observation de la Terre, i.e., Earth Observation Test Satellite). Attention is given to an assessment of the geometric quality of the images using computer simulation with allowance for the satellite dynamics and ground data processing. The assessment of the geometric quality of the SPOT imagery is made by comparison with usual map projections. The simulation indicated the potential accuracy of the SPOT level 1 images and was effective in defining the ground data processing required. S.D.

A80-13358 Computer graphic feature analysis and selection. J. R. Jensen (Georgia, University, Athens, Ga.). *Photogrammetric Engineering and Remote Sensing*, vol. 45, Nov. 1979, p. 1507-1512. 19 refs.

Analysts conducting supervised land-cover classification often rely solely on statistical divergence or separability measures for feature selection. Consequently, they may fail to appreciate the relatively consistent spatial clustering and degree of overlap among training class spectra. A graphic method of analyzing training class statistics is presented which allows analysts to view parallelepipeds in

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

three-dimensional space and interactively vary viewing azimuth and elevation angles for optimum visual examination. Up to three channels may be examined at one time. It is hoped that the graphic method will supplement statistical measures, resulting in improved feature analysis and selection. (Author)

A80-14047 # Feature selection via entropy minimization - An example using Landsat satellite data. A. Zandonella (Telespazio S.p.A., Rome, Italy) and B. Sellman. (*Convegno sulle Metodologie di Trattamento dell'Informazione, 2nd, Trieste, Italy, Feb. 23, 24, 1979.*) *Società Astronomica Italiana, Memorie*, vol. 50, Sept. 1979, p. 503-513.

A methodology for enhancing the significant spectral features in Landsat data is introduced. The process, by which significant spectral features are determined, uses a minimum entropy model to guide subsequent analysis efforts. Classification results using traditional and minimum entropy method are presented and discussed.

(Author)

A80-14952 Simple generation of one-parameter pseudo-terrain surfaces. G. E. Carlson (Missouri-Rolla, University, Rolla, Mo.) and G. L. Bair (Texas Instruments, Inc., Dallas, Tex.). *IEEE Transactions on Aerospace and Electronic Systems*, vol. AES-15, Sept. 1979, p. 735-738. Navy-supported research.

A simple method for generating digital terrain surfaces as a function of only the terrain standard deviation is presented. This is accomplished by fitting a postulated autocorrelation model to actual terrain data. Observed relations between model parameters are used to obtain a one-parameter model. (Author)

A80-15772 # Some examples of the use of satellite imagery /Landsat/ for natural resource mapping in Western Sudan. D. E. Parry (Hunting Technical Services, Ltd., Boreham Wood, Herts., England). In: *Remote sensing applications in developing countries.* Birmingham, England, University of Aston, 1978, p. 1, 3-12. 15 refs.

The present paper describes the compilation of land systems, geomorphology, soils, vegetation and land use maps of some 80,000 sq km in the Southern Darfur Province of Western Sudan, from 1/250,000 scale color-composite bulk-processed Landsat 1 imagery. Manual methods of interpretation and map compilation were used and backed by field studies. Particular attention is given to the problem of locating interpreted boundaries in the field and other practical constraints likely to be encountered when using satellite imagery for regional studies in remote and inaccessible areas. The mapping examples include a comparative study of resource maps compiled from conventional aerial photography and ground survey with those compiled from satellite imagery of a part of the survey area. (Author)

A80-15773 # The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory. C. J. Lawrence (Department of the Environment, Transport and Road Research Laboratory, Crowthorne, Berks., England). In: *Remote sensing applications in developing countries.* Birmingham, England, University of Aston, 1978, p. 13, 15, 16.

The practice of using aerial photographs to map terrain and materials is well established, but the ability of land classification to predict soil conditions is most successful in areas of stable geomorphic environment, dry climate, simple geology and bold relief. Ethiopia for the most part possesses these attributes, and has, therefore, been the subject of a high level terrain classification at 1.2 million, using Landsat imagery. Geological, topographic and soils maps, and local experience provided background information. Sixty-seven 'natural regions' were defined, describing the geology, topography, climate and drainage of each region, with comments on

engineering soils and construction materials. The space imagery provided detail that was impossible to achieve by any other means, but a limitation was found to be the lack of resolution at the small scale used. A scale of 1:1 million or 1:500,000 would have considerably aided interpretation. (Author)

A80-20265 Application of multidata photography and remote sensing data to environmental monitoring in the State of Washington. R. B. Scott and T. W. D. Gregg (Washington, Dept. of Natural Resources, Olympia, Wash.). In: *American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings.* Falls Church, Va., American Society of Photogrammetry, 1978, p. 504-511. 9 refs.

A program involving the use of aerial photography and remote sensing data for resource management is detailed. The program, adopted by the Department of Natural Resources of the State of Washington, includes the acquisition, at various scales and emulsion types, of photographs of over 70 percent of the State on a 8-10 year schedule. Nearly a quarter of a million photographs dating back 25 years are on file now. Some applications of this multidata photography are: monitoring forest resource and forest management activities, forest fire detection, and monitoring beds of navigable waters and trespass in harbor areas. Remote sensing data collected by thermal scanning sensors are used for fire spotting and mapping, and multispectral Landsat data are used for forest inventory and productivity monitoring. V.L.

A80-20269 * Multiple-frame, full resolution Landsat mosaicking to standard map projections. A. L. Zobrist (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: *American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings.* Falls Church, Va., American Society of Photogrammetry, 1978, p. 608-616. 7 refs. Contract No. NAS7-100.

Landsat digital data are presently available by frames whose size and location are determined by satellite orbit. The utility of Landsat data was increased by the image processing support for JPL's planetary program which provided the basic software and procedures necessary for image mosaicking. The computer software has been extended to perform this task on Landsat Multi-spectral scanner imagery and a ten frame digital mosaic of the Southern California desert has been completed. Major processing steps include location of geographic points in the digital frame and of common geographic points in adjacent frames, conversion to a map projection, lateral 'rubber sheet' correction of the digital frames, brightness correction of adjacent frames, and mosaicking of the frames to eliminate overlap and produce a single large frame. (Author)

A80-15781 # The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java. A. H. J. Meijerink and N. H. W. Donker (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). In: *Remote sensing applications in developing countries.* Birmingham, England, University of Aston, 1978, p. 75, 77-83. 13 refs.

An approach to digital processing, as developed at ITC, is outlined and examples of its application to the Himalayas and Central Java are given. The central theme in the approach is the reduction of the dimensionality for generating color coded hard copies for interpretation and for carrying out automatic classification. Methods to achieve this aim are discussed. Black box methods are avoided and the interpreter guides all steps of the procedures by using the reduced feature space as a medium for decisions. As applied to land-use mapping of complex areas in the developing countries, the results indicate that where automatic classification partly fails visual interpretation, transfer of data from other sources, or temporal

data, can be done in the same line of operations. In both test areas the processed imagery form excellent base maps for incorporating results of selected field traverses. (Author)

A80-17514 Digital processing of aerial images; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979. Seminar sponsored by the Society of Photo-Optical Instrumentation Engineers. Edited by T. F. Wiener (U.S. Defense Advanced Research Projects Agency, Arlington, Va.) and E. L. Hall (Tennessee, University, Knoxville, Tenn.). Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 186), 1979. 272 p. \$36.
A80-17540)

This volume addresses problems associated with achieving image recording in the face of various types of distortion. Papers reporting recent and ongoing research and development activity in techniques and analysis, devices and systems, as well as future concepts, are presented. Six problem areas are considered: scene matching (two sessions), aerial image techniques, digital processing of aerial images, image understanding, feature operators, and synthetic reference image preparation. Topics of interest include scene matching with feature detection, optimum filters and windows for image registration, computer modeling of optical trackers, performance evaluation of image correlation techniques, measuring scene content from aerial images, edge and line enhancement by adaptive lattice filtering, and automatic stereo reconstruction of manmade targets. S.D.

A80-19542 Multispectral aerial photography for wetland vegetation mapping. W. G. Howland (McGill University, Montreal, Canada). *Photogrammetric Engineering and Remote Sensing*, vol. 46, Jan. 1980, p. 87-99. 19 refs.

Vegetation in a variety of wetland types in the Shelburne Pond, Vermont area was mapped using small scale aerial photographs. Color infrared, conventional color, and black-and-white multi-band photographs were studied using a zoom stereoscope and additive color enhancement techniques. The floristic composition of plant canopy associations and corresponding recognition characteristics are presented. Emphasis is given to ground control and a familiarity with plant ecology, as requisite elements in the interpretive process. Selected observations are made regarding the ecological significance of signature pattern. Film types were evaluated based on three parameters: association discrimination, size of minimum mapping unit, and ease of interpretation. Color infrared was found superior for this application, and conventional color was better than the color enhanced multi-band, which was at much smaller scale. However, the color enhanced multi-band imagery did offer more information about some plant groups than did color, especially where long wave reflectance was a key recognition element. The use of actinic infrared is recommended for future wetland vegetation investigations.

(Author)

A80-19923 # Orientation problem of SLAR imagery. A. Okamoto (Kyoto University, Kyoto, Japan). *Kyoto University, Faculty of Engineering, Memoirs*, vol. 41, July 1979, p. 293-307. 6 refs.

This report treats the orientation and restitution problem of SLAR imagery theoretically. The orientation problem is discussed for both single and stereo SLAR configurations. For the former, an analytical orientation method constructed on the geometrical basis of SLAR imagery already studied is proposed. For the latter, an orientation technique is developed to calculate the exterior orientation parameters of the antenna for stereo SLAR imageries simultaneously. With this method the analysis of SLAR imagery may be performed three-dimensionally and more accurately than before. In both cases, some functional form, such as polynomials or Fourier series, is used to model the behaviors of the exterior orientation elements of the antenna along the flight path, as in the analysis of MSS imagery. By linearizing the equations for the orientation problem of single SLAR imagery, error equations for the restitution

problem of SLAR imagery are obtained. Simple restitution methods of SLAR imagery for a flat terrain and also for a hilly ground surface are introduced, and some characteristics are clarified. (Author)

A80-20237 American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978. 624 p.

The papers deal with the application of aerial-photography, image-scanning, thermal infrared remote sensing, multirate photography, and radar technologies to environmental monitoring, digital mapping, and other photogrammetric applications. Among the topics covered are: the principles of thermal infrared remote sensing for heat cost determination; aerial photographic methods for the detection of submerged vegetation; remote sensing for monitoring resources for development and conservation of desert and semi-desert areas; a long-wave radar for geological analysis of vegetated terrain; densitometry in photogrammetry; and microprocessor and minicomputer assisted photogrammetric systems. V.P.

A80-20252 The National Map Accuracy Standards in the context of mapping with imagery data. S.-Y. Hsu (New York, State University, Binghamton, N.Y.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 296-301. 12 refs.

Compared to certain European countries, the United States National Map Accuracy Standards are by far the loosest. Even so the thematic maps in the United States have not been designed to meet the standards. The technological advancements in remote sensors, photogrammetric instruments, digital precision processing have laid a sound foundation for producing base maps that meet the standards for thematic mapping. The Landsat imagery at the scale of 1:250,000 is one of the excellent resources for preparing a new generation of precision thematic maps. To reach this goal, it is proposed that a rule be established requiring the cartographer to label in the map legends whether efforts have been made to utilize precision base maps for preparing the thematic map. (Author)

N80-10538*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO-SOYUZ TEST PROJECT. VOLUME 2: EARTH OBSERVATIONS AND PHOTOGRAPHY
Farouk El-Baz, ed. (Smithsonian Institution) and D. M. Warner, ed. (Smithsonian Institution) Washington 1979 700 p refs
Original contains color illustrations 2 Vol.
(Contract NAS9-13831)
(NASA-SP-412-Vol-2) Avail: NTIS HC A99/MF A01 CSCL 05B

Visual observations of the earth are presented along with the corresponding photographs and maps for specific regions.

N80-10539*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SUMMARY OF SIGNIFICANT RESULTS
Farouk El-Baz (Smithsonian Institution), Delia M. Warner, and R. Thomas Giulii In its Apollo-Soyuz Test Project, Vol. 2 1979 p 1-8 ref
Avail: NTIS HC A99/MF A01 CSCL 05B

A summary of the visual and photographic study of specific earth features is presented. The areas selected were in the fields of geology, desert studies, oceanography, hydrology, and meteorology. F.O.S.

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

N80-10561* Smithsonian Institution, Washington, D. C. **DETERMINING PHOTOGRAPH LOCATIONS OVER OCEANS**

S. McLafferty, M. Pryslak, and G. A. Maul (NOAA) *In* NASA. Johnson Space Center Apollo-Soyuz Test Project, Vol. 2 1979 p 359-370 refs

Avail: NTIS HC A99/MF A01 CSCL 08J

The methods used to quantitatively define the photo-locations of ocean photographs taken from the Apollo Soyuz spacecraft are described. They are based on photogrammetry, on a knowledge of the groundtracks of the spacecraft and the times during which the photographs were taken, and on a comparison with satellite imagery. Latitudes and longitudes with an estimated error of + or - 1 to + or - 3 seconds are calculated for the center points of photographs taken during mapping passes that lack photo-support data. A method is developed for determining the center points for photographs containing two or more recognizable features on landmasses. A map is provided which shows the Apollo groundtracks that correspond to the times when the photographs were taken. M.M.M.

N80-11534* Naval Ocean Systems Center, San Diego, Calif. **PROCESSING AND DISPLAY TECHNIQUES FOR MULTI-SPECTRAL SATELLITE IMAGERY Final Report, 1 Feb. - 30 Sep. 1978**

J. A. Roese Apr. 1979 39 p refs

(AD-A072509; NOSC/TR-439)

Avail: NTIS

HC A03/MF A01 CSCL 09/2

In recent years, the technology area of remote sensing by multispectral satellite sensors has evolved greatly. Imagery obtained by satellite means has been the basis for much work in the areas of environmental studies, resource planning, terrain mapping, weather prediction and military reconnaissance. This program effort has investigated the application of various image processing and display techniques for use with multispectral satellite imagery. Emphasis has been placed on the development and implementation of two-dimensional processing techniques applied in the domain of the original image. Two-dimensional transform domain image processing and display techniques were also adapted for use with satellite imagery. GRA

N80-12467 Technische Hochschule, Darmstadt (West Germany). Fachgebiet Fernerkundung und Photointerpretation.

ON MEASUREMENTS FROM AIRCRAFT Final Report

Joerg Albertz and Manfred Schroeder Jun. 1978 505 p refs
In GERMAN; ENGLISH summary Presented at Symp. Airborne Sensing Programme, Hanover, 29-31 Aug. 1977 Prepared in cooperation with DFVLR, Oberpfaffenhofen, West Germany (Contract BMFT-WE-0175)

(BMFT-FB-W-78-04) Avail: Issuing Activity

Some fifty papers are presented on the techniques developed and applied in the framework of the German remote sensing program pursued during the 1975 to 1977 period. Airborne multispectral imaging techniques were applied to the following disciplines: oceanography and coastal processes, urban and regional management, agriculture and forestry, geology and hydrology. Intensive research work in the fields of digital image processing and the spectral signatures of natural surfaces were associated with this program.

N80-12505 Forschungsgruppe fuer Informationsverarbeitung und Mustererkennung, Karlsruhe (West Germany).

DIGITAL PROCESSING PROCEDURE FOR TEXTURE ANALYSIS WITH REMOTE SENSING DATA [VERFAHREN DER DIGITALEN BILDVERARBEITUNG ZUR TEXTURANALYSE VON FERNERKUNDUNGSDATEN]

B. Barge *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 371-378 refs *In* GERMAN

Avail: Issuing Activity

Specific texture parameters were determined and an appropriate combination of parameters was selected in order to classify objects with the use of multispectral analysis. Forest and built-up regions were investigated. The methods employed involve gray scale evaluations, differentiating image data, line information and Fourier spectrum techniques. Preprocessing and image transformation procedures are applied. Some concrete examples and their treatments are presented. Author (ESA)

N80-13592* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

EARTH OBSERVATIONS DIVISION EARTH RESOURCES DATA ANALYSIS CAPABILITIES

F. Tragni, Principal Investigator Jul. 1979 86 p refs -Revised EREP

(Contract NAS9-15800)

(E80-10013; NASA-CR-160339; LEC-3949-Rev-D;

JSC-16030-Rev-D) Avail: NTIS HC A05/MF A01 CSCL 05B

N80-13596* Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

TEXAS APPLICATIONS SYSTEM VERIFICATION AND TRANSFER REMOTE SENSING INFORMATION SUB-SYSTEM: FUNCTIONAL DESIGN

M. L. Brown, Jr., Principal Investigator, A. M. Fails, M. V. Martin, A. S. Story, and E. A. Weisblatt Mar. 1979 405 p EREP (Contract NAS9-15800)

(E80-10017; NASA-CR-160342; LEC-13258; JSC-14785)

Avail: NTIS HC A18/MF A01 CSCL 05B

N80-15478* Lockheed Electronics Co., Houston, Tex.

CONSIDERATIONS FOR DESIGN OF FUTURE RESEARCH AND DEVELOPMENT INTERACTIVE IMAGE ANALYSIS SYSTEMS

T. B. Wilkinson, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 333-344 refs ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Future interactive image analysis systems must provide for the increased processing requirements imposed by a thermal channel to LANDSAT-3 and the increased number of spectral channels with significantly higher spatial resolution provided by the LANDSAT-D thematic mapper. Other design considerations must include the rapidly changing technology in memories and special purpose processors, as well as the analyst-machine interface and the human factors involved. The centralized and distributed system approaches are examined in relation to the optimum design configuration of future systems. A.R.H.

N80-15493* Texas A&M Univ., College Station.

ON THE CLUSTERING OF MULTIDIMENSIONAL PICTORIAL DATA

J. D. Bryant, Principal Investigator *In* NASA. Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979. p 647-659 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS9-14689)

Avail: NTIS HC A99/MF A01 CSCL 02C

Obvious approaches to reducing the cost (in computer resources) of applying current clustering techniques to the problem of remote sensing are discussed. The use of spatial information in finding fields and in classifying mixture pixels is examined.

and the AMOEBA clustering program is described. Internally, a pattern recognition program, from without, AMOEBA appears to be an unsupervised clustering program. It is fast and automatic. No choices (such as arbitrary thresholds to set split/combine sequences) need be made. The problem of finding the number of clusters is solved automatically. At the conclusion of the program, all points in the scene are classified; however, a provision is included for a reject classification of some points which, within the theoretical framework, cannot rationally be assigned to any cluster. A.R.H.

N80-15495*# Lockheed Electronics Co., Houston, Tex.
CLASSY: AN ADAPTIVE MAXIMUM LIKELIHOOD CLUSTERING ALGORITHM

R. K. Lenington and M. E. Rassbach, Principal Investigators (Elogic, Inc., Houston, Tex.) *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 671-689 refs ERTS

(Contract NAS9-15200)

Avail: NTIS HC A99/MF A01 CSCL 02C

The CLASSY clustering method alternates maximum likelihood iterative techniques for estimating the parameters of a mixture distribution with an adaptive procedure for splitting, combining, and eliminating the resultant components of the mixture. The adaptive procedure is based on maximizing the fit of a mixture of multivariate normal distributions to the observed data using its first through fourth central moments. It generates estimates of the number of multivariate normal components in the mixture as well as the proportion, mean vector, and covariance matrix for each component. The basic mathematical model for CLASSY and the actual operation of the algorithm as currently implemented are described. Results of applying CLASSY to real and simulated LANDSAT data are presented and compared with those generated by the iterative self-organizing clustering system algorithm on the same data sets. A.R.H.

N80-15496*# Houston Univ., Tex.
LINEAR FEATURE SELECTION WITH APPLICATIONS

H. P. Decell, Jr. and L. F. Guseman, Jr., Principal Investigators (Texas A and M Univ., College Station) *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 691-703 refs ERTS

(Contracts NAS9-15000; NAS9-14689)

Avail: NTIS HC A99/MF A01 CSCL 02C

Several ways in which feature selection techniques were used in LACIE are discussed. In all cases, the methods require some a priori information and assumptions; in most, the classification procedure (Bayes optimal) was chosen in advance. The transformations used for dimensionality reduction are linear, that is, the variables in feature space are always linear combinations of the original measurements. Several numerically tractable criteria developed for LACIE, which provide information about the probability of misclassification, are discussed. Recent results on linear feature selection techniques are included. Their use in LACIE is discussed. Related open questions are mentioned. A.R.H.

N80-15508*# Lockheed Electronics Co., Houston, Tex.
IMAGE AND NUMERICAL DISPLAY AIDS FOR MANUAL INTERPRETATION

R. A. Abotteen, Principal Investigator *In* NASA, Johnson Space Center Proc. of Tech. Sessions, Vol. 1 and 2 Jul. 1979 p 911-921 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A99/MF A01 CSCL 02C

Four color image display techniques, developed to aid in interpreting LANDSAT imagery, are described. These are the cluster image, the principal component transformation, the

principal component greenness transformation, and the color-coded spectral plot. Experimental results show that the four techniques are useful in selecting and/or identifying representative samples of signatures in a given LANDSAT scene. A.R.H.

N80-15540# Catholic Univ. of America, Washington, D. C.
 Dept. of Electrical Engineering.

CONCEPT DEVELOPMENT OF AUTOMATED IMAGE ANALYSIS. AUTOMATED CONTOUR RECOGNITION AND CLASSIFICATION IN AERIAL PHOTOGRAPHY BY MEANS OF ANGLES AND CURVATURE Final Report

Henning F. Harmuth 31 Aug. 1979 96 p refs

(Contract DAAK70-78-C-0147)

(AD-A074439; ETL-O194) Avail: NTIS HC A05/MF A01 CSCL 09/4

The automated contour recognition and classification in aerial photography requires a feature of contours that is invariant to shift, rotation and scaling. General polygons are characterized by their angles and their normalized sides. The normalization of the sides may be achieved by dividing either with the longest side or with the circumference of the polygon. For a curved contour, the simplest invariant under shift and rotation is the curvature. To make the curvature invariant to scaling, one may divide it by the largest curvature or multiply it with the length of the contour; the multiplication with the length of the contour is better because of the finite resolution of photographs and equipment. The principle of contour recognition and classification based on angles and curvature is worked out for practical displays that produce square patterns, such as liquid crystal or plasma tube displays. The mechanical and electronic design for experimental equipment is carried out based on a plasma tube display with 512 x 512 resolved points. GRA

N80-15547# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT ALEUTIAN ISLANDS NATIONAL WILDLIFE RANGE. PROJECT 8: CONSERVATION OF NATURAL AREAS AND OF THE GENETIC MATERIAL THEY CONTAIN

Janet Bonner, comp. 1979 45 p

(PB-297931/8) Avail: NTIS HC A03/MF A01 CSCL 08G

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 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

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A80-14196 # Airborne semiconductor radiometers (Samoletnyye radiometry na poluprovodnikovyykh priborakh). A. G. Semin, Iu. B. Khapin, and A. N. Sharapov. *Radiotekhnika*, vol. 34, Sept. 1979, p. 42-45. In Russian.

A number of microwave superheterodyne semiconductor radiometers with input mixers have been developed for remote sensing of the atmosphere and underlying surfaces. The radiometers operate at frequencies of 89, 37, and 20 GHz. This paper presents a brief description of radiometer units and subunits. B.J.

A80-15489 India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR'. O. P. N. Calla, G. Raju, S. S. Rana, and S. Balasubramanian (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). *Institution of Electronics and Telecommunication Engineers, Journal*, vol. 25, Aug. 1979, p. 321-324.

This paper describes the first remote sensing data obtained from the indigenous satellite, 'BHASKARA', using a passive microwave remote sensor. The payload, Satellite Microwave Radiometer (SAMIR), is a three-channel microwave radiometric system, two of them operating in the 19-GHz band and the third in the 22-GHz band. SAMIR is one of the primary payloads on-board Bhaskara and its chief objectives are investigations of sea state, water vapor and liquid water content in the atmosphere and over the oceans adjoining the Indian subcontinent. The overland data gives synoptic information to soil moisture, snow cover and biomass studies of interest to applications in earth resources. The characteristics of the payload and the data obtained in the initial operations of the satellite are presented. (Author)

A80-20266 Cooperative methods for acquisition of aerial photography. R. B. Scott, T. W. D. Gregg, and R. E. Heft (Washington, Dept. of Natural Resources, Olympia, Wash.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1978, p. 512-521.

The paper deals with a unique aerial photographic acquisition program that contracts the collection of several scales of photography over approximately seventy percent of the state on a repetitive basis. The program is designed to provide a wide range of photographic products to meet the needs of resource managers at a reduced cost. The discussion covers the history and evolution of the program, types of photographic materials collected, cooperative aspects and advantages, and the administration of the program. V.P.

A80-16559 Remote-sensing studies of taiga regions (Issledovanie taezhnykh landshaftov distantsionnymi metodami). Edited by A. S. Isaev. Novosibirsk, Izdatel'stvo Nauka, 1979. 222 p. In Russian.

The papers deal with applications of remote sensing from aircraft and satellites to the surveying of extended taiga regions. Some aspects of the theory of landscape-structural interpretation of satellite imagery are reviewed, and mathematical methods of processing information obtained from image interpretation are outlined. Attention is given to methodological aspects of mapping extended forest and marsh areas, soils, and fire devastated regions. V.P.

A80-16568 # Analysis of the spectral reflection characteristics of natural formations in remote sensing studies (Analiz spektral'nykh otrazhatel'nykh kharakteristik prirodnykh obrazovaniy pri distantsionnom issledovanii). I. A. Petrakovskii, R. G. Khlebopros, and A. S. Isaev. In: Remote-sensing studies of taiga regions. Novosibirsk, Izdatel'stvo Nauka, 1979, p. 201-213. 28 refs. In Russian.

The use and current status of multispectral recognition techniques for conducting wide-area environmental surveys are examined. It is shown that the difficulties arising due to changes in the reflection coefficient of a test site, caused by changes in position of the sun, can be eliminated by measuring the reflected radiation in a direction antiparallel to the direct solar rays. V.P.

A80-17431 * Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer. F. M. Zweibaum (Barnes Engineering Co., Stamford, Conn.) and E. W. Chapelle (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Real-time signal processing II; Proceedings of the Seminar, Washington, D.C., April 19, 20, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 242-255.

A standard high-speed, field-portable spectroradiometric measurement system built around a programmable microprocessor has been adapted to the form of a Reflectometer/Comparator. In this configuration, the instrument makes passive measurements of the absolute reflectance of agricultural plant canopies over a spectral range of 0.4 to 2.5 micrometers. Real-time absolute measurements are made possible by an optical chopper which constantly compares the target with the sun, and makes extensive measurements of solar reflectance from a variety of these targets. The paper describes the instrumentation and measurement procedures, reviews the software programming and discusses the results. (Author)

A80-17460 * Thematic mapper design description and performance prediction. J. C. Lansing, Jr., T. D. Wise (Santa Barbara Research Center, Goleta, Calif.), and E. D. Harney (Hughes Aircraft Co., El Segundo, Calif.). In: Space optics; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 224-234. Contract No. NAS5-24200.

The new generation of satellite-borne earth resources scanners, the Thematic Mapper, is being built for launch on the Landsat-D spacecraft. It will gather data for applications such as crop inventory, land use planning, forest management, and geology. This paper gives an overall design description, further discussion of principal design features, performance achievements where data are available, and system performance predictions. (Author)

A80-17462 * Multispectral Resource Sampler - An experimental satellite sensor for the mid-1980s. C. C. Schnetzler and L. L. Thompson (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Space optics; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 255-262.

An experimental pushbroom scan sensor, the Multispectral Resource Sampler (MRS), being developed by NASA for a future earth orbiting flight is presented. This sensor will provide new earth survey capabilities beyond those of current sensor systems, with a

08 INSTRUMENTATION AND SENSORS

ground resolution of 15 m over a swath width of 15 km in four bands. The four arrays are aligned on a common focal surface requiring no beamsplitters, thus causing a spatial separation on the ground which requires computer processing to register the bands. Along track pointing permits stereo coverage at variable base/height ratios and atmospheric correction experiments, while across track pointing will provide repeat coverage, from a Landsat-type orbit, of every 1 to 3 days. The MRS can be used for experiments in crop discrimination and status, rock discrimination, land use classification, and forestry. A.T.

A80-17463 Array technology as applied to future earth resources sensors. J. A. Hall and D. H. McCann (Westinghouse Defense and Electronic Systems Center, Baltimore, Md.). In: Space optics; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 263-272.

Schnetzler and Thompson have described the multispectral resource sampler - a visible and near visible sensor system for spaceborne assessment of earth resources, based on established technologies. In the present paper, it is shown how established technologies can be used to design an advanced earth resource sensor system in the 1985-1990 time frame. V.P.

A80-17515 Geometric preprocessing of sensor data used for image matching. J. E. Berry and J. K. Yoo (Goodyear Aerospace Corp., Akron, Ohio). In: Digital processing of aerial images; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1979, p. 2-11. 11 refs. Grant No. DAAK40-77-C-0107.

Preprocessing that enables accurate matching of two images taken by sensors located at different points in space is presented. Separation between the sensors results in perspective changes that appear as geometric distortion. Two methods for removing the distortion are described. One method applies to sensors that measure range. The second method applies to sensors that do not measure range. Descriptions of the applicable sensor data formats, rationale for the preprocessing approaches and transformations used to implement the approaches are included. Examples comparing images before and after preprocessing are shown. (Author)

A80-18774 The reduction and analysis of satellite magnetometer data. R. D. Regan (Phoenix Corp., McLean, Va.). *Geophysical Surveys*, vol. 3, Dec. 1979, p. 331-349. 18 refs.

The paper considers the reduction and interpretation of satellite magnetometer data and details its morphology. These data are useful in the compilation, reduction, and analysis of magnetic survey data; suitable analysis such as screening and reduction to common altitude and inclination and consideration of the vector nature of the background field can provide valuable information for crustal studies. However, the reduction and interpretation techniques for satellite magnetometer measurements differ from methods applied to conventional data; they require modifications of several standard techniques although the unequal spacing, in three dimensions, of the satellite data and the variation in direction and intensity of the main geomagnetic field pose some interpretation problems. The variation in altitude of the satellite measurements can also be used in some analyses. A.T.

A80-20244 * Using airborne radiometry to determine atmospheric effects in Landsat data. R. W. Dana (U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 117-129. 10 refs. NASA Order S-54053-A.

An empirical method was developed to measure how solar and atmospheric conditions affect Landsat images by comparing Landsat MSS data with terrain reflectance. Terrain reflectance was measured with a four-channel radiometer designed to measure radiance in wavelength bands matched to the Landsat MSS data. Other instrumentation included a digital data logger, an irradiance meter, and a video camera with recorder. Reflectance of many terrain elements which could be registered to the Landsat digital data were measured from a low-flying aircraft. Correlations of reflectance with Landsat radiance verified a linear atmospheric model with an additive (path radiance) term and a multiplicative (transmittance) term. Coefficients from this model permit the extension of spectral signatures in computer-aided classification of Landsat images. (Author)

A80-20250 The PDS differential rectifier - An economical approach to digital orthophotos. J. Horton (Perkin-Elmer Corp., Applied Optics Div., South Pasadena, Calif.). In: American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1978, p. 264-282.

The digital sampling and playback capabilities of the PDS Microdensitometer are utilized to differentially rectify photographic images to produce orthophotos, stereomates, and other simulated-perspective reconstructions. A method is described whereby the input imagery can be non-orthogonally scanned, eliminating the necessity of resampling the digitized pixel data, and thus enabling high-resolution reconstructions while obviating the need for a large capacity, therefore expensive, control computer. Examples are given of the performance which can be expected of this system, in terms of resolution vs. throughput. (Author)

N80-11547# Technical Research Centre of Finland. Espoo. Lab. of Land Use.

AUTOMATED EARTH RESOURCES SURVEYS USING SATELLITE AND AIRCRAFT SCANNER DATA: A FINNISH APPROACH

Einari Kilpeläe, Sipi Jaakkola, Risto Kuittinen, and Jouko Talvitie 1978 174 p refs Co-Sponsored by Finn. Natl. Fund for Res. and Develop., Acad. of Finland, Found. for Res. of Nat. Res., Min. of Trade and Ind., Sci. Comm. of Natl. Defence Original contains color illustrations (VTT-LU-15; ISBN-951-38-0723-1) Avail: NTIS HC A08/MF A01

A three-year multidisciplinary earth resources oriented remote sensing project was carried out to develop automated environment monitoring and natural resources inventory methods for Finnish conditions and to study the technical feasibility of such methods in the fields of water resources, geology, agriculture, and forestry. Both satellite (LANDSAT) and aircraft scanner data from several test sites in southern Finland were used in the study. Data acquisition and analysis procedures as well as the results obtained are discussed. The results justify more detailed remote sensing research on various problems in all fields cited. Author (ESA)

N80-12034# Office National d'Etudes et de Recherches Aérospatiales, Paris (France). **SPECTROMETER FOR THE FIRST SPACELAB PAYLOAD**

Jean Besson, Andre Girard, Marcel Ackerman, and Dirk Frimout (Inst. of Space Aeronomy, Brussels) In its La Rech. Aérospatiale, Bi-monthly Bull. No. 1978-6 Sep. 1979 p 77-93 refs Transl. into ENGLISH from La Rech. Aérospatiale, Bull. Bimestriel (Paris) no. 1978-6, Nov. - Dec. 1978 p 343-353 Presented at 29th Intern. Congr. of Astronautics, Dubrovnik, Yugoslavia, 1-8 Oct. 1978 Original language report was announced as A79-11279

Avail: NTIS HC A06/MF A01

The grille spectrometer for measuring stratospheric and mesospheric composition, which will be mounted on board permits infrared measurements of active atmospheric constituents in the altitude range where their local concentration is higher than 100 million mol/cu cm. The instrument operates in two modes: in absorption with the sun as a source and in emission in the spectral ranges corresponding to the thermal emission of atmospheric gases. The instrument consists of a sighting system (tiltable front mirror), a radiation collector, a monochromator with output optics and detectors, and electronic subassemblies for the instrument command and its connection with the Spacelab electronic system. Author (ESA)

N80-12468 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).

AIMS AND TASKS OF THE AIRCRAFT TEST PROGRAM [ZIELE UND AUFGABEN DES FLUGZEUGMESSPROGRAMMS]

Manfred Schroeder *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 11-22 refs In GERMAN

Avail: Issuing Activity

Studies were carried out for developing German remote sensing equipment for future participation in international satellite projects for global and regional environmental monitoring systems. Emphasis is given to work in the following fields: multispectral imaging techniques, development of systems for the digital treatment of images, applications to geoscience problems, evaluations for future technological developments, balanced organizational and interdisciplinary teams. Author (ESA)

N80-12469 Technische Universitaet, Hanover (West Germany). **ON THE CURRENT STATE OF REMOTE SENSING TECHNIQUES [ZUM GEGENWAERTIGEN STAND DER FERNKUNDUNG]**

G. Konecny *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 23-36 refs In GERMAN

Avail: Issuing Activity

Several different aspects of current work are discussed: radiation characteristics of various objects, choice of sensors, choice of platform, data processing (analog and digital), and the handling and interpretation of complex information. A specific problem which benefits from the exploitation of such techniques is then exposed: the Jade coast region. The economic importance of the region is underlined. It is concluded that a high resolution thermal sensor and an even higher resolution optical sensor are invaluable for coastal water and engineering studies.

Author (ESA)

N80-12515 Freiburg Univ. (West Germany). **THE MULTISPECTRAL SCANNER AS AN INSTRUMENT FOR SIGNATURE DETERMINATIONS**

P. G. Reichert *In* Tech. Hochschule On Meas. from Aircraft Jun. 1978 p 459-470 refs In GERMAN

Avail: Issuing Activity

The identification of objects by multispectral scanning supposes a knowledge of the spectral reflection characteristics of the surface investigated. The determination in situ of these characteristics has the disadvantage of requiring considerable apparatus and employing systems that enable only a few objects to be measured in a working day. A method of overcoming this difficulty is described, which enables various different objects in different regions to be studied under different image conditions. Examples are given. Author (ESA)

N80-12530*# Texas A&M Univ., College Station. Remote Sensing Center.

THE SYSTEM AND HARDWARE DESIGN OF REAL-TIME FAN BEAM SCATTEROMETER DATA PROCESSORS Final Report

John P. Claassen, Robert O. Stroud, Billy V. Clark, B. Randall Jean, and Richard W. Newton, Principal Investigator Mar. 1979 286 p refs EREP

(Contract NAS9-15311)

(E80-10028; NASA-CR-160350; RSC-3556) Avail: NTIS HC A13/MF A01 CSCL 14B

N80-12533*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

EXAMINATION OF LAMBERTIAN AND NON-LAMBERTIAN MODELS FOR SIMULATING THE TOPOGRAPHIC EFFECT ON REMOTELY SENSED DATA

Chris Justice and Brent N. Holben Sep. 1979 25 p refs

Submitted for publication

(NASA-TM-80557) Avail: NTIS HC A02/MF A01 CSCL 05B

As a preliminary step to developing a technique to eliminate the topographic effect from remotely sensed data, two radiance simulation models were examined and compared. A Lambertian and a non-Lambertian model were tested using hand-held radiometer measurements from a uniform surface at different slope angle aspect orientations. Linear correlation coefficients for the non-Lambertian model and the field spectra were calculated to be greater than 0.92 for all cases; whereas correlation coefficients for the Lambertian model ranged from 0.06 to 0.98. An assumption regarding an empirical constant within the non-Lambertian equation was found to be invalid and the model was improved by using subsets of the data to derive the empirical value. Author

N80-12534*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

INTERIM CALIBRATION REPORT FOR THE SMMR SIMULATOR

P. Gloersen and D. Cavalieri (Systems and Applied Sciences Corp., Riverdale, Md.) Sep. 1979 22 p refs

(NASA-TM-80564) Avail: NTIS HC A02/MF A01 CSCL 14B

The calibration data obtained during the fall 1978 Nimbus-G underflight mission with the scanning multichannel microwave radiometer (SMMR) simulator on board the NASA CV-990 aircraft were analyzed and an interim calibration algorithm was developed. Data selected for the analysis consisted of in flight sky, first-year sea ice, and open water observations, as well as ground based observations of fixed targets with varied temperatures of selected instrument components. For most of the SMMR channels, a good fit to the selected data set was obtained with the algorithm. K.L.

N80-13608# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Bereich fuer Projektraegerschaften.

THE GEOSCIENTIFIC AIRBORNE REMOTE SENSING PROGRAM Final Report

Manfred Wahl Bonn Bundesmin. fuer Forsch. u. Technology Sep. 1978 233 p refs In GERMAN; ENGLISH summary

Original contains color illustrations

(Contract BMFT-WE-0175)

(BMFT-FB-W-78-31) Avail: NTIS HC A11/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 48.75

The Airborne Remote Sensing program, carried out from 1974 to 1977 in the Federal Republic of Germany, is part of an international operational system of earth observation satellites. Within five selected test areas, numerous flights were performed using different multispectral sensors. The data were systematically evaluated using advanced image processing procedures. The extensive results verify the significant contribution of remote sensing to the solution of application-oriented problems, such as environmental monitoring, and justify the continuation of this space program. Author (ESA)

08 INSTRUMENTATION AND SENSORS

N80-13610# Centre National d'Etudes Spatiales, Paris (France).
Direction des Programmes et de la Politique Industrielle.

SPOT, FRENCH PREOPERATIONAL REMOTE SENSING SATELLITE SYSTEM

Alan A. Scribot 1978 15 p refs Presented at 22d COSPAR
Plenary Meeting, Bangalore, India, May-Jun. 1979

Avail: NTIS HC A02/MF A01

The SPOT remote sensing satellite system is described, including mission objectives, choice of orbit parameters for the first SPOT mission, the SPOT system architecture, the payload and choice of sensor parameters, the standard platform, and the ground segment. The payload consists of two high resolution visible sensors scanning 60 km each with 20 m resolution in several bands and 10 m resolution in the 0.5 to 0.9 micron (panchromatic) band. SPOT is suited for vegetation and water studies, cartographic applications, and geology. Author (ESA)

N80-14444# European Space Agency, Paris (France). Director-
ate of Planning and Future Programmes.

THE EARTHNET PROGRAMME

L. Mareli *In its* Satellite Remote Sensing: Appl. in Agroclimatol.
and Agrometeorol. 1979 p 20-27

Avail: NTIS HC A09/MF A01

A European network for the acquisition, preprocessing, archiving, and distribution of remote sensing satellite data is described. Emphasis is placed on distribution of LANDSAT data and increased utilization of space derived remote sensing imagery. Establishment of a basic capacity to handle data from both American and European remote sensing satellites, to provide high standard products tailored to the needs of users, and to include second generation remote sensing missions such as LANDSAT-D, Seasat-B and C, space shuttle based remote sensing experiments, and planned European remote sensing missions for the first Spacelab flight is outlined. J.M.S.

N80-14448# European Space Operations Center, Darmstadt
(West Germany). Meteosat Data Management Dept.

METEOSAT AND REMOTE SENSING APPLICATION

K. G. Lenhart *In* ESA Satellite Remote Sensing: Appl. in
Agroclimatol. and Agrometeorol. 1979 p 61-72

Avail: NTIS HC A09/MF A01

The main characteristics of Meteosat and its associated ground system are described. The spacecraft orbit and attitude, mission objectives, and radiometer capabilities and image processing on the ground are discussed along with near real time image dissemination and the data collection platform sub-system. Remote sensing applications of Meteosat data are surveyed. J.M.S.

N80-15380*# General Electric Co., Philadelphia, Pa. Space
Sciences Lab.

PRESSURE MODULATOR RADIOMETER (PMR) TESTS

E. L. G. Odell, F. M. Cosmi, A. E. Kreft, G. W. Racette, T. J.
Maresca, F. O. Pancoast, D. J. Rutecki, and W. C. Yager 25 Sep.
1979 81 p

(Contract NAS1-15044)

(NASA-CR-159175) Avail: NTIS HC A05/MF A01 CSCL
14B

The pressure modulator technique was evaluated for monitoring pollutant gases in the Earth's atmosphere of altitude levels corresponding to the mid and lower troposphere. Using an experimental set up and a 110 cm sample cell, pressure modulator output signals resulting from a range of gas concentrations in the sample cell were examined. Then a 20 cm sample cell was modified so that trace gas properties in the atmosphere could be simulated in the laboratory. These gas properties were measured using an infrared sensor. R.E.S.

N80-15538*# National Aeronautics and Space Administration,
Lewis Research Center, Cleveland, Ohio.

POSSIBLE METHODS FOR DISTINGUISHING ICEBERGS FROM SHIPS BY AERIAL REMOTE SENSING

Walton L. Howes Dec. 1979 36 p refs
(NASA-TM-79310; E-266) Avail: NTIS HC A03/MF A01 CSCL
08L

The simplest methods for aerial remote sensing which are least affected by atmospheric opacities are summarized. Radar is preferred for targets off the flight path, and microwave radiometry for targets along the flight path. Radar methods are classified by ability to resolve targets. Techniques which do not require target resolution are preferred. Among these techniques, polarization methods appear most promising, specifically those which differentiate the expected relatively greater depolarization by icebergs from that by ships or which detect doubly-reversed circular polarization. R.C.T.

09 GENERAL

Includes economic analysis.

A80-14792 Landsat applications in Georgia - A successful example of technology transfer between NASA and state government. B. O. Rado (Georgia, Dept. of Natural Resources, Atlanta, Ga.) and L. E. Jordan, III (Georgia Institute of Technology, Atlanta, Ga.). In: Space - The best is yet to come; Proceedings of the Sixteenth Space Congress, Cocoa Beach, Fla., April 25-27, 1979. Cocoa Beach, Fla., Canaveral Council of Technical Societies, 1979, p. 6-8 to 6-14.

Following a formal request by the State of Georgia for technology transfer assistance, NASA agreed to a plan (the Regional Application Program) with the following two objectives: phase I, to determine the feasibility of using Landsat-derived landcover information for resource management applications using NASA's computers and programs, essentially cost-free to the state; and phase II, to transfer the NASA application technology and computer software to Georgia. Landcover classifications of interest, as determined by Georgia's Department of Natural Resources, included high- and low-density urban, bare ground, agricultural production lands row crops, pasture or grasslands, forested areas, production forests, marshes, and surface water. The accuracy attained in locating each type of landcover is discussed. Other considerations involved determining the best time of year for visually separating each type of landcover from the others, and choosing the graphic display format, including the number of colors it contains. J.P.B.

A80-15771 Remote sensing applications in developing countries. Edited by W. G. Collins (Aston, University, Birmingham, England) and J. L. van Genderen (Fairey Surveys, Ltd., Maidenhead, Berks., England). Birmingham, England, University of Aston, 1978. 103 p.

Papers are presented on applications of remote sensing to the exploitation, management and monitoring of the resources of developing nations. Specific topics include the use of Landsat imagery for natural resources mapping in western Sudan, the use of remote sensing for transport planning and highway engineering in developing nations, a photointerpretation study of erosion in rural Lesotho, reconnaissance soil mapping in India using Landsat imagery, side-looking airborne radar, satellite imagery and aerial photography for a forest survey in the Amazon basin, digital analysis of radar imagery for vegetation detection in Nigeria and an assessment of LACIE and related crop inventory methodologies. A.L.W.

A80-16394 # The use of space - International cooperation in the area of space applications (Kosmos-zemle - Mezhdunarodnoe sotrudnichestvo v oblasti prikladnogo izpol'zovaniia kosmonavtiki). A. D. Koval' and Iu. A. Tiurin. Moscow, Izdatel'stvo Znanie, 1979. 112 p. In Russian.

The book deals with the international aspects of space activity. The discussion is centered on the use of space for remote sensing of earth resources, for purposes of national economy, and for communications, navigation, geodetic, and meteorological applications. Attention is given to a new industrial discipline - the manufacture of products in space. The influence of space research on science and technology is reviewed. V.P.

A80-17993 # Constructing a network of earth resource satellites (O zadache postroeniia seti ISZ dlia issledovaniia prirodnykh resursov zemli). V. S. Komstantinov, A. A. Lebedev, V. A. Strel'tsov, and M. M. Khrustalev. *Kosmicheskie Issledovaniia*, vol. 17, Nov.-Dec. 1979, p. 945-948. 6 refs. In Russian.

The problem is formulated of developing a system of earth resource satellites capable of providing answers to numerous economic questions. The system must consist of several autonomous subsystems, and is required to function under a variety of conditions. A method, based on an optimization theory for multipurpose systems, is proposed to solve the problem. V.P.

N80-10537*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EDUCATOR'S GUIDE FOR MISSION TO EARTH: LANDSAT VIEWS THE WORLD

Margaret A. Tindal 1978 56 p refs Original contains color illustrations (NASA-SP-360) Avail: NTIS MF A01. SOD HC CSCL 08B

This teacher's guide is specifically designed to provide information and suggestions for using LANDSAT imagery to teach basic concepts in several content areas. Content areas include: (1) Earth science and geology; (2) environmental studies; (3) geography; and (4) social and urban studies. R.E.S.

N80-10587# Hawaii Ad Hoc Committee on Remote Sensing. Honolulu.

LANDSAT PROJECT, STATE OF HAWAII: A PRELIMINARY REPORT

Dec. 1978 41 p (PB-296712/3; NOAA-79050811) Avail: NTIS HC A03/MF A01 CSCL 13B

The past, present and potential future application of satellite remote sensing technology is examined as a possible means for meeting growing land use and environment-related information needs of the State of Hawaii. GRA

N80-11530# Committee on Science and Technology (U. S. House).

EARTH RESOURCES DATA AND INFORMATION SERVICE

Washington GPO 1979 222 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 96th Congr., 1st Sess., No. 24, 2-3 May 1979 (GPO-49-530) Avail: Subcomm. on Space Sci. and Applications

The implementation of and an earth resources data and information service is discussed. Policy issues surrounding the remote sensing of earth resources are presented. The role of the government versus the role of the private sector, the needs of private industry, state and local governments, and the international community are examined in relation to the formation of the earth resources and data information service. A.W.H.

N80-11533*# Battelle Columbus Labs., Ohio.
AN ECONOMIC ANALYSIS OF FIVE SELECTED LANDSAT ASSISTED INFORMATION SYSTEMS IN OREGON Final Report

S. Solomon and K. M. Maher Oct. 1979 30 p refs (Contract NASw-2800) (NASA-CR-162434; BCL-OA-TFR-79-5) Avail: NTIS HC A03/MF A01 CSCL 05B

A comparative cost analysis was performed on five LANDSAT-based information systems. In all cases, the LANDSAT system

09 GENERAL

was found to have cost advantages over its alternative. The information sets generated by LANDSAT and the alternative method are not identical but are comparable in terms of satisfying the needs of the sponsor. The information obtained from the LANDSAT system in some cases is said to lack precision and detail. On the other hand, it was found to be superior in terms of providing information on areas that are inaccessible and unobtainable through conventional means. There is therefore a trade-off between precision and detail, and considerations of costs. The projects examined were concerned with locating irrigation circles in Morrow County; monitoring tansy ragwort infestation; inventoring old growth Douglas fir near Spotted Owl habitats; inventoring vegetation and resources in all state-owned lands; and determining and use for Columbia River water policies.

A.R.H.

N80-11995# Committee on Space Research (COSPAR), Berne (Switzerland).

SPACE RESEARCH IN SWITZERLAND, 1978

1979 22 p Presented at 22d COSPAR Plenary Meeting, Bangalore, India, May/June, 1979 Sponsored by Swiss Natl. Sci. Found.

Avail: NTIS HC A02/MF A01

Swiss space research is summarized. Research was undertaken using instruments flown on balloons, rockets, and satellites, often participating in international cooperation programs. Main subjects include satellite geodesy, middle atmosphere studies, magnetosphere studies, solar wind composition, investigations on fine materials and rocks returned from the moon, solar physics, astronomic photometry, and earth resources studies.

Author (ESA)

N80-12722# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.

REPORT TO THE CONGRESS ON COASTAL ZONE MANAGEMENT. TRANSITION QUARTER AND FISCAL YEAR 1977

Jan. 1979 113 p

(PB-298537/2; NOAA-79061803)

Avail: NTIS

HC A06/MF A01 CSCL 13B

This report contains separate sections on: identification of the state programs approved during the preceding Federal fiscal year and a description of those programs; listing of the states participating and a description of the status of each state's program and its accomplishments during the preceding Federal fiscal year; itemization of the allocation of funds to the various coastal states and a breakdown of the major projects and areas; an identification of any state programs which have been reviewed and disapproved and which grants have been terminated and a statement for the reasons for such action; activities and projects which are not consistent with an approved state management program; and a summary of regulations issued by the Secretary or in effect during the preceding Federal fiscal year.

GRA

N80-14165# Centre National d'Etudes Spatiales, Toulouse (France).

FRENCH SPACE PROGRAMS [PROGRAMME SPATIAL FRANCAIS. RAPPORT AU COSPAR]

1979 154 p refs In FRENCH; ENGLISH summary Presented at 22d COSPAR Assembly, Bangalore, India, May - June, 1979 Prepared in cooperation with Comite Natl. Franc. de Rech. dans l'Espace, Paris

Avail: NTIS HC A08/MF A01

French activities during 1979 in space research and correlated programs are summarized. The work accomplished in the fields of astronomy, solar system, planet studies, interplanetary medium, ionosphere and magnetospheric physics, aeronomy, meteorology, earth resources, geodesy, life sciences, and material sciences are discussed.

Author (ESA)

N80-14449# European Space Agency, Paris (France).

THE ESA REMOTE SENSING PROGRAM: PRESENT ACTIVITIES AND FUTURE PLANS

J. Plevin and I. Pryke *In its Satellite Remote Sensing: Appl. in Agroclimatol. and Agrometeorol.* 1979 p 74-87 refs Presented at ISP/IUERO Symp., Freiburg, July 1978

Avail: NTIS HC A09/MF A01

The activities of the European Space Agency (ESA) concerning access to and development of remote sensing facilities are reviewed. European regional needs and priorities are emphasized, but aid programs to developing countries are also envisaged. Preparation of remote sensing experiments for use in Spacelab is discussed. The development of a metric camera and the microwave remote sensing experiment scheduled for the First Spacelab Payload are cited as examples. The organization of the Earthnet Program is then covered and ESA studies relating to the definition of other remote sensing satellite systems are summarized.

Author (ESA)

N80-14971*# National Aeronautics and Space Administration, Washington, D. C.

A REVIEW OF NASA INTERNATIONAL PROGRAMS

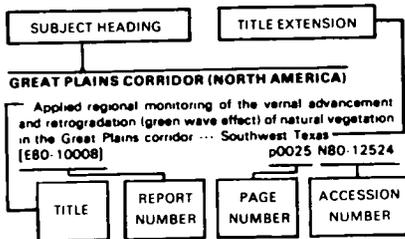
1 Jan. 1979 112 p refs

(NASA-TM-80845) Avail: NTIS HC A06/MF A01 CSCL 05A

A synoptic overview of NASA's international activities to January 1979 is presented. The cooperating countries and international organizations are identified. Topics covered include (1) cooperative arrangements for ground-based, spaceborne, airborne, rocket-borne, and balloon-borne ventures, joint development, and aeronautical R & D; (2) reimbursable launchings; (3) tracking and data acquisition; and (4) personnel exchanges. International participation in NASA's Earth resources investigations is summarized in the appendix. A list of automatic picture transmission stations is included.

A.R.H.

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

ACCURACY

- Accuracy assessment: The statistical approach to performance evaluation in LACIE --- Great Plains corridor, United States p0013 N80-15459
- Accuracy assessment system and operation p0014 N80-15472
- Accuracy and performance of LACIE area estimates --- wheat yield in the U.S. Great Plains States p0016 N80-15487
- Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
- Accuracy and performance of LACIE crop development models p0016 N80-15489

AERONOMY

- French space programs p0058 N80-14165

AEROSPACE TECHNOLOGY TRANSFER

- Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792
- The use of space - International cooperation in the area of space applications --- Russian book p0057 A80-16394

AFRICA

- Remote sensing applications in developing countries p0057 A80-15771
- The reduction and analysis of satellite magnetometer data p0054 A80-18774
- Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259
- Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556

AGRICULTURE

- The application of Landsat-MSS imagery for agricultural planning in tropical rain and swamp forest zones p0002 A80-14375
- Examples of aerial photo-interpretation in soil surveys for an agricultural land development project in north-east Brazil p0003 A80-15560
- A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area /Lesotho/ p0003 A80-15775
- Some applications of remote sensing in agricultural resources with reference to India p0003 A80-15776
- The contribution of Landsat imagery to reconnaissance soil mapping in north-west India p0003 A80-15777
- Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431

- Spectral classification of tomato disease severity levels p0005 A80-20254
- Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259
- A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring p0003 A80-20267
- Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
- Spectral reflectance of certain weeds p0004 A80-20754
- Remote sensing applied to agricultural resources. Citations from the international aerospace abstracts data base [NTIS/PS-79/0733/0] p0006 N80-10588
- Lodging of grain crops and its detection by aerial photography p0006 N80-10994
- On measurements from aircraft --- conference, Hanover, 29-31 August 1977 [BMFT-FB-W-78-04] p0050 N80-12467
- Phenology as a factor in the determination of different forms in vegetation by remote sensing p0007 N80-12499
- Applicability of multiscanning techniques in establishing inventories for agricultural farming and forestry p0007 N80-12500
- What are the advantages of multispectral classification? --- for crop identification p0007 N80-12501
- Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England [E80-10022] p0007 N80-12525
- Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America p0008 N80-13589
- Large Area Crop Inventory Experiment (LACIE). List spectral keys study --- Kansas [E80-10012] p0008 N80-13591
- Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593
- Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595
- Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018] p0009 N80-13597
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598
- The mapping of important farmland using remote sensor and socio-economic variables --- Ontario County, New York p0009 N80-14424
- Overview of agrometeorology --- influence of meteorological parameters on crop growth p0009 N80-14441
- The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445
- Remote sensing applied to agriculture p0010 N80-14446
- Crop weather models: Concepts and applications p0010 N80-14450
- Agroclimatological methods involving remote sensing techniques p0010 N80-14451
- Crop environment monitoring: The remote sensing systems p0010 N80-14452
- Crop monitoring and prediction using satellite data p0011 N80-14455
- Satellite remote sensing in hazard monitoring and disaster evaluation p0011 N80-14458
- Satellite remote sensing for agricultural advisories and planning p0011 N80-14457
- Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030] p0011 N80-15448
- LACIE large area acreage estimation --- United States of America p0012 N80-15453
- USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467

- Application of LANDSAT digital data for monitoring drought --- South Dakota p0016 N80-15483
 - Feature extraction applied to agricultural crops as seen by LANDSAT p0017 N80-15497
 - The application test system: An approach to technology transfer --- USDA aerospace and remote sensing information requirements p0020 N80-15520
 - Functional definition and design of a USDA system p0020 N80-15521
 - The application test system: Technical approach and system design p0020 N80-15523
 - Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
 - Remote sensing of agricultural resources. A bibliography with abstracts [NTIS/PS-79/0993/0] p0021 N80-15542
 - Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549
- #### AGROCLIMATOLOGY
- Lodging of grain crops and its detection by aerial photography p0006 N80-10994
 - Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589
 - Satellite Remote Sensing: Applications in Agrometeorology and Agrometeorology [ESA-SP-1020] p0009 N80-14440
 - Overview of agrometeorology --- influence of meteorological parameters on crop growth p0009 N80-14441
 - Overview of remote sensing for agrometeorology and agrometeorology p0010 N80-14442
 - The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445
 - Remote sensing applied to agriculture p0010 N80-14446
 - Crop weather models: Concepts and applications p0010 N80-14450
 - Agroclimatological methods involving remote sensing techniques p0010 N80-14451
 - Crop monitoring and prediction using satellite data p0011 N80-14455
 - Satellite remote sensing for agricultural advisories and planning p0011 N80-14457
 - Development of LACIE CCEA-1 weather/wheat yield models --- regression analysis p0012 N80-15457
 - Growth stage estimation --- crop calendars p0012 N80-15458
 - CCEA second-generation wheat yield model for hard red wheat in North Dakota p0019 N80-15513
 - Natural sampling strategy p0019 N80-15516
- #### AGROMETEOROLOGY
- Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation --- Russian book p0041 A80-10125
 - Satellite Remote Sensing: Applications in Agrometeorology and Agrometeorology [ESA-SP-1020] p0009 N80-14440
 - Overview of agrometeorology --- influence of meteorological parameters on crop growth p0009 N80-14441
 - Overview of remote sensing for agrometeorology and agrometeorology p0010 N80-14442
 - Crop weather models: Concepts and applications p0010 N80-14450
 - Agroclimatological methods involving remote sensing techniques p0010 N80-14451
 - Crop environment monitoring: The remote sensing systems p0010 N80-14452
 - Crop environment monitoring: The assessment of environmental phenomena using satellite remote sensing data p0010 N80-14454
 - Crop monitoring and prediction using satellite data p0011 N80-14455
 - Satellite remote sensing in hazard monitoring and disaster evaluation p0011 N80-14458
 - Development of LACIE CCEA-1 weather/wheat yield models --- regression analysis p0012 N80-15457
 - Operation of the yield estimation subsystem p0014 N80-15468
 - Data base design for a worldwide multicrop information system p0020 N80-15522
- #### AIR POLLUTION
- Spectrometer for the first Spacelab payload p0054 N80-12034

- Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts
[NTIS/PS-79/0842/9] p0025 N80-13614
Pressure Modulator Radiometer (PMR) tests
[NASA-CR-159175] p0056 N80-15380
- AIR QUALITY**
Environmental monitoring systems p0023 A80-14705
- AIR SEA ICE INTERACTIONS**
Use of satellites in polar meteorology p0035 A80-11750
- AIR WATER INTERACTIONS**
New developments in satellite oceanography and current measurements p0035 A80-10731
- AIRBORNE EQUIPMENT**
A light aircraft camera Pod - The Enviro-Pod p0024 A80-20251
- AIRBORNE SURVEILLANCE RADAR**
Inexpensive radar mapping by Ericsson Star p0047 A80-11190
Possible methods for distinguishing icebergs from ships by aerial remote sensing
[NASA-TM-79310] p0056 N80-15538
- ALABAMA**
Measured emissivity of soils in the southeast United States p0022 A80-15057
- ALASKA**
Passive microwave studies of frozen lakes p0042 A80-20247
- ALBEDO**
Albedo of vegetated surfaces - Its variability with differing irradiances p0002 A80-15051
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Cachment, north west of London, U.K.
[E80-10008] p0044 N80-12522
- ALEUTIAN ISLANDS (US)**
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain
[PB-297931/8] p0051 N80-15547
- ALTIMETERS**
A study of possible sea state information in the sample and hold gate statistics for the GEOS-3 satellite altimeter
[NASA-CR-156858] p0038 N80-13753
- AMAZON REGION (SOUTH AMERICA)**
The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 A80-15778
South American river morphology and hydrology p0043 N80-10574
- ANDES MOUNTAINS (SOUTH AMERICA)**
Snow hydrology studies p0043 N80-10575
- ANDESITE**
Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Golfield test areas, Nevada
[E80-10035] p0034 N80-15529
- ANGOLA**
ASTP photographs of southeastern Angola p0033 N80-10557
- ANNUAL VARIATIONS**
Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
- ANTARCTIC REGIONS**
Use of satellites in polar meteorology p0035 A80-11750
- APOLLO SOYUZ TEST PROJECT**
Apollo-Soyuz test project. Volume 2: Earth observations and photography
[NASA-SP-412-VOL-2] p0049 N80-10538
Summary of significant results p0049 N80-10539
Geologic analysis of ASTP photographs of parts of southern California p0031 N80-10540
Evaluation of satellite images of the Levantine Rift zone p0031 N80-10542
- ARCHITECTURE (COMPUTERS)**
A look at computer system selection criteria p0015 N80-15480
Cost and performance characteristics of data system configurations for processing remotely sensed data p0015 N80-15481
- ARCTIC OCEAN**
Long-term tracking of arctic icebergs
[AD-A072473] p0037 N80-10583
SEASAT demonstration experiments with the offshore oil, gas and mining industries
[NASA-CR-162423] p0038 N80-11532
- ARCTIC REGIONS**
Detection of arctic water supplies with geophysical techniques
[AD-A072157] p0043 N80-11538
Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-airpod data buoy
[AD-A074731] p0039 N80-14664
- ARGENTINA**
Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559
- ARID LANDS**
The use of Landsat imagery to monitor desert encroachment in arid areas p0024 A80-20241
- Mapping vegetation with low cover density from Landsat data p0008 A80-20257
- Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259
- Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556
Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas
[E80-10008] p0025 N80-12524
- ARIZONA**
Satellite snow-cover observations in Arizona p0041 A80-20264
Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560
Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona
[E80-10005] p0033 N80-12521
U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed
[PB-297442/6] p0044 N80-12547
- ARKANSAS**
Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258
Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
- ASIA**
The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java p0048 A80-15781
- ASSEMBLER ROUTINES**
LACIE/ERIPS software system summary p0015 N80-15477
- ATLANTIC OCEAN**
Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar p0036 A80-15893
Gulf stream boundary eddies off the east coast of Florida p0036 A80-16247
Antipodal seas --- astronaut observation of ocean features p0036 N80-10564
Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565
Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 N80-10567
ASTP at Barbados: Mesoscale pools of Amazon River water in the western tropical Atlantic p0037 N80-10568
Estimate of total reflectance from the Orinoco River outflow --- from Apollo Soyuz Test Project photographs
p0037 N80-10569
Long-term tracking of arctic icebergs
[AD-A072473] p0037 N80-10583
SEASAT demonstration experiments with the offshore oil, gas and mining industries
[NASA-CR-162423] p0038 N80-11532
Ocean chlorophyll studies from a U-2 aircraft platform
[NASA-TM-80574] p0038 N80-12535
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] p0026 N80-15526
Technical papers on airborne laser hydrography
[PB-299321/0] p0045 N80-15546
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data
[ORO-5444-1] p0039 N80-15603
- ATMOSPHERIC ATTENUATION**
Using airborne radiometry to determine atmospheric effects in Landsat data p0054 A80-20244
Space research in Switzerland, 1978 p0058 N80-11995
Development of an airborne gamma radiation system for snow surveys
[EGG-1183-1679] p0044 N80-13606
- ATMOSPHERIC BOUNDARY LAYER**
Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri
[E80-10025] p0044 N80-12527
- ATMOSPHERIC COMPOSITION**
Spectrometer for the first Spacelab payload p0054 N80-12034
Overview of remote sensing for agrimeteorology p0010 N80-14442
Pressure Modulator Radiometer (PMR) tests
[NASA-CR-159175] p0056 N80-15380
- ATMOSPHERIC OPTICS**
Albedo of vegetated surfaces - Its variability with differing irradiances p0002 A80-15051
- AUSTRALIA**
A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data p0042 A80-20194
Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blanche area, South Australia --- identification of folds, faults, and lineaments p0032 N80-10550
Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560
- B**
- BARBADOS**
ASTP at Barbados: Mesoscale pools of Amazon River water in the western tropical Atlantic p0037 N80-10568
- BARITE**
Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Golfield test areas, Nevada
[E80-10035] p0034 N80-15529
- BARLEY**
Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota
[E80-10014] p0008 N80-13593
- BARREN LAND**
Earth feature identification and tracking technology development p0028 A80-17403
Mapping vegetation with low cover density from Landsat data p0006 A80-20257
Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England
[E80-10022] p0007 N80-12525
The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing --- Buckinghamshire, England p0009 N80-13599
Beauce TELLUS project --- France
[E80-10024] p0009 N80-13600
- BARREN LANDS**
The use of Landsat imagery to monitor desert encroachment in arid areas p0024 A80-20241
- BARS (LANDFORMS)**
Quantitative determination of morphological structures in sand bank regions from image structure analysis p0033 N80-12482
Making morphological maps of sand banks from aerial photographs p0033 N80-12483
- BATHYMETERS**
Technical papers on airborne laser hydrography
[PB-299321/0] p0045 N80-15546
- BAYES THEOREM**
On evaluating clustering procedures for use in classification p0017 N80-15494
- BEACHES**
Use of Apollo-Soyuz photographs in coastal studies p0037 N80-10573
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] p0026 N80-15526
- BEAUFORT SEA (NORTH AMERICA)**
SEASAT demonstration experiments with the offshore oil, gas and mining industries.
[NASA-CR-162423] p0038 N80-11532
- BEETS**
On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region p0007 N80-12512
- BELGIUM**
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] p0007 N80-12523
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries
[E80-10019] p0009 N80-13598
- BERING SEA**
SEASAT demonstration experiments with the offshore oil, gas and mining industries
[NASA-CR-162423] p0038 N80-11532
- BIBLIOGRAPHIES**
Remote sensing applied to agricultural resources. Citations from the international aerospace abstracts data base
[NTIS/PS-79/0733/0] p0006 N80-10588
Remote sensing applied to hydrology. A bibliography with abstracts
[NTIS/PS-79/0845/2] p0043 N80-11553
Remote sensing applied to geology and mineralogy. A bibliography with abstracts
[NTIS/PS-79/0844/5] p0034 N80-13612
Remote sensing applied to geology. Citations from the International Aerospace Abstracts data base
[NTIS/PS-79/0822/1] p0034 N80-13613
Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts
[NTIS/PS-79/0842/9] p0025 N80-13614
Remote sensing applied to urban and regional planning. A bibliography with abstracts
[NTIS/PS-79/0843/7] p0025 N80-13615
Remote sensing of agricultural resources. A bibliography with abstracts
[NTIS/PS-79/0993/0] p0021 N80-15542
- BIOLOGICAL EFFECTS**
Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management
[ASME PAPER 79-ENAS-41] p0041 A80-15265

- International Decade of Ocean Exploration, volume 7 --- information on oceanography programs dealing with marine environments
[NOAA-S/7-78-211-VOL-7] p0039 N80-15772
- BIOMASS**
India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' --- microwave radiometer
p0053 A80-15489
A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring
p0003 A80-20267
Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas
[E80-10008] p0025 N80-12524
Crop monitoring and prediction using satellite data
p0011 N80-14455
- BIOSPHERE**
U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed
[PB-297442/6] p0044 N80-12547
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain
[PB-297931/8] p0051 N80-15547
- BIRDS**
An economic analysis of five selected LANDSAT assisted information systems in Oregon
[NASA-CR-162434] p0057 N80-11533
- BLIGHT**
Spectral classification of tomato disease severity levels
p0005 A80-20254
Lodging of grain crops and its detection by aerial photography
p0006 N80-10994
- BOTSWANA**
The use of remote sensing for transport planning and highway engineering in developing countries
p0023 A80-15774
Remote sensing of Playa lakes as a source of climatic data
p0042 A80-20245
- BRAZIL**
The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications
p0027 A80-11899
A study of moisture conditions in the Pantanal of Brazil using satellite imagery
p0041 A80-15055
Examples of aerial photo-interpretation in soil surveys for an agricultural land development project in north-east Brazil
p0003 A80-15560
The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin
p0003 A80-15778
Volcanic landforms and astroblemes
p0032 N80-10551
Riachao Ring, Brazil: A possible meteorite crater discovered by the Apollo astronauts
p0032 N80-10552
- BRIGHTNESS**
Large Area Crop Inventory Experiment (LACIE). List spectral keys study --- Kansas
[E80-10012] p0008 N80-13591
Analysis of scanner data for crop inventories --- North Dakota
[E80-10040] p0021 N80-15534
- BRIGHTNESS TEMPERATURE**
Optical methods for investigating oceans and inland basins --- Russian book
p0035 A80-10116
Plant canopy information extraction from composite scene reflectance of row crops
p0001 A80-13141
Measured emissivity of soils in the southeast United States
p0002 A80-15057
A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data
p0042 A80-20194
Passive microwave studies of frozen lakes
p0042 A80-20247
Interim calibration report for the SMMR simulator
[NASA-TM-80564] p0055 N80-12534
Beauce TELLUS project --- France
[E80-10024] p0009 N80-13600
- BRUSH (BOTANY)**
Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas
[E80-10008] p0025 N80-12524
- BUILDINGS**
Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos
p0023 A80-20025
- BUOYS**
Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-airdrop data buoy
[AD-A074731] p0039 N80-14664
- C**
- CALENDARS**
Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America
[E80-10011] p0008 N80-13590
- Growth stage estimation --- crop calendars
p0012 N80-15458
- CALIBRATING**
Interim calibration report for the SMMR simulator
[NASA-TM-80564] p0055 N80-12534
- CALIFORNIA**
Chlorophyll gradient map from high-altitude ocean-color-scanner data
p0035 A80-13129
Multiple-frame, full resolution Landsat mosaicking to standard map projections
p0048 A80-20269
Geologic analysis of ASTP photographs of parts of southern California
p0031 N80-10540
Crustal deformation in central California: Multi-wavelength geodetic observations and interpretations
p0029 N80-14605
A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery
[AD-A074186] p0039 N80-14663
- CAMERAS**
Calculation of the spectral irradiance in spaceborne photography of the earth
p0005 A80-20195
- CAMEROON**
The application of Landsat-MSS-imagery for agricultural planning in tropical rain and swamp forest zones
p0002 A80-14375
- CANADA**
Landsat imagery - A cartographic reference base
p0028 A80-11706
Snow hydrology studies
p0043 N80-10575
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] p0011 N80-15448
Econometric models for predicting confusion crop ratios
p0011 N80-15450
USDA analyst review of the LACIE IMAGE-100 hybrid system test
p0014 N80-15467
The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE
p0016 N80-15482
LACIE area, yield, and production estimate characteristics: Canada
p0016 N80-15486
Accuracy and performance of LACIE crop development models
p0016 N80-15489
Use of thermal infrared and colour infrared imagery to detect crop moisture stress --- Alberta, Canada
[E80-10036] p0021 N80-15530
HCMM/soil moisture experiment --- Alberta, Canada
[E80-10037] p0021 N80-15531
- CENTRAL PROCESSING UNITS**
The system and hardware design of real-time fan beam scatterometer data processors
[E80-10028] p0055 N80-12530
Considerations for design of future research and development interactive image analysis systems
p0050 N80-15478
Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks
p0015 N80-15479
- CHAD**
Land use mapping in the Sahel zone using Landsat
p0023 A80-15782
- CHESAPEAKE BAY (US)**
Use of Apollo-Soyuz photographs in coastal studies
p0037 N80-10573
Technical papers on airborne laser hydrography
[PB-299321/0] p0045 N80-15546
- CHILE**
Snow hydrology studies
p0043 N80-10575
- CHINESE PEOPLES REPUBLIC**
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium
[E80-10030] p0011 N80-15448
- CHLOROPHYLLS**
Chlorophyll gradient map from high-altitude ocean-color-scanner data
p0035 A80-13129
Remote sensing for water quality and biological measurements in coastal waters
p0036 A80-19541
Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data
p0042 A80-20243
Ocean chlorophyll studies from a U-2 aircraft platform
[NASA-TM-80574] p0038 N80-12535
- CHLOROPHYLLS**
The study of the ocean from space --- Russian book
p0036 A80-20095
- CITIES**
Assessment of the urban heat island effect through the use of satellite data
p0023 A80-15556
A suggested method for delimiting urbanized areas using digital Landsat data
p0024 A80-20246
Digital processing procedure for texture analysis with remote sensing data
p0050 N80-12505
- CLASSIFICATIONS**
Large Area Crop Inventory Experiment (LACIE). List spectral keys study --- Kansas
[E80-10012] p0008 N80-13591
Classification and mensuration of LACIE segments
p0012 N80-15455
The classification and mensuration subsystem --- wheat
p0013 N80-15485
On evaluating clustering procedures for use in classification
p0017 N80-15494
Linear feature selection with applications
p0051 N80-15496
- Analysis of scanner data for crop inventories --- North Dakota
[E80-10040] p0021 N80-15534
- CLIMATE**
The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory
p0048 A80-15773
- CLOUD COVER**
Earth feature identification and tracking technology development
p0028 A80-17403
Visual observations over oceans
p0036 N80-10583
Crop environment monitoring: The assessment of environmental phenomena using satellite remote sensing data
p0010 N80-14454
- CLOUD PHOTOGRAPHY**
Interpreting ASTP photographs of the ocean and locating the area photographed, case study of the Gulf of Mexico
p0036 N80-10562
Processing and display techniques for multispectral satellite imagery
[AD-A072509] p0050 N80-11534
Overview of remote sensing for agronomy and agrometeorology
p0010 N80-14442
Meteosat and remote sensing application
p0056 N80-14448
- CLUMPS**
On the clustering of multidimensional pictorial data
p0050 N80-15493
On evaluating clustering procedures for use in classification
p0017 N80-15494
- COASTAL ECOLOGY**
Multispectral aerial photography for wetland vegetation mapping
p0049 A80-19542
On measurements from aircraft --- conference, Hanover, 29-31 August 1977
[BMFT-FB-W-78-04] p0050 N80-12467
- COASTAL PLAINS**
Report to the Congress on coastal zone management. Transition quarter and fiscal year 1977
[PB-298537/2] p0058 N80-12722
- COASTAL WATER**
Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis de Maumusson
p0041 A80-10370
Chlorophyll gradient map from high-altitude ocean-color-scanner data
p0035 A80-13129
Gulf stream boundary eddies off the east coast of Florida
p0036 A80-16247
Remote sensing for water quality and biological measurements in coastal waters
p0036 A80-19541
Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey
p0035 A80-20260
Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts
p0042 N80-10567
Estimate of total reflectance from the Orinoco River outflow --- from Apollo Soyuz Test Project photographs
p0037 N80-10589
Suspended-sediment dispersal patterns of river deltas photographed by ASTP
p0043 N80-10572
Use of Apollo-Soyuz photographs in coastal studies
p0037 N80-10573
Impact of Great Lakes water level fluctuations on coastal wetlands
[PB-296403/9] p0043 N80-10590
On the current state of remote sensing techniques
p0055 N80-12469
Research into determining chemical parameters at the surface of the sea by remote sensing
p0038 N80-12479
Determination of the optical properties of the sea in the German bight
p0038 N80-12516
Strategies for the surveillance of coastal waters of the Federal Republic of Germany
[BMFT-FB-M-77-11] p0045 N80-13726
- COASTS**
New technology for mapping: Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978
p0027 A80-11695
Earth feature identification and tracking technology development
p0028 A80-17403
Use of Apollo-Soyuz photographs in coastal studies
p0037 N80-10573
Report to the Congress on coastal zone management. Transition quarter and fiscal year 1977
[PB-298537/2] p0058 N80-12722
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia
[E80-10031] p0026 N80-15526
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] p0020 N80-15527
Technical papers on airborne laser hydrography
[PB-299321/0] p0045 N80-15546
- COLOR**
Large Area Crop Inventory Experiment (LACIE). List spectral keys study --- Kansas
[E80-10012] p0008 N80-13591
Generation of uniform chromaticity scale imagery from LANDSAT data
p0018 N80-15507

COLORADO

Interactive analysis methods for resource mapping p0028 A80-11709
 Passive microwave studies of frozen lakes p0042 A80-20247
 Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- Colorado and Washington [E80-10009] p0008 N80-13588
 Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
 Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594
 Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595
COLORIMETRY
 Colorimetric consideration of transparencies for a typical LACIE scene p0018 N80-15506
COMPUTER GRAPHICS
 Advances in digital image display and simulation from digital terrain data bases p0047 A80-11696
 Integration of LANDSAT CCT data and digital terrain data in cartographic application p0027 A80-11703
 Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture p0001 A80-11708
 Interactive analysis methods for resource mapping p0028 A80-11709
 Computer graphic feature analysis and selection --- for viewing parallelepipeds in 3-d space p0047 A80-13358
 Feature selection via entropy minimization - An example using Landsat satellite data p0048 A80-14047
 Standardization of cartographic field and aerial and space photography data for automatic map generation p0028 A80-15182
 Processing and display techniques for multispectral satellite imagery [AD-A072509] p0050 N80-11534
 On the use of digital photogrammetric measurements in the compilation of topographic maps [SER-1-ORIGINAL-REPT-76] p0029 N80-14462
 Concepts leading to the IMAGE-100 hybrid interactive system p0014 N80-15466
 USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467
 Cartography: LACIE's spatial processor p0015 N80-15474
 Man-machine interfaces in LACIE/ERIPS p0015 N80-15476
 LACIE/ERIPS software system summary p0015 N80-15477
 Considerations for design of future research and development interactive image analysis systems p0050 N80-15478
 Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks p0015 N80-15479
 Feature extraction applied to agricultural crops as seen by LANDSAT p0017 N80-15497
 An evaluation of procedure 1 p0018 N80-15502
 Image and numerical display aids for manual interpretation p0051 N80-15508
COMPUTER PROGRAMS
 The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications p0027 A80-11699
 Concept for the automatic registration of satellite images with a digital map data base p0027 A80-11701
 The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports p0014 N80-15469
 Man-machine interfaces in LACIE/ERIPS p0015 N80-15476
 LACIE/ERIPS software system summary p0015 N80-15477
 On the clustering of multidimensional pictorial data p0050 N80-15493
 CLASSY: An adaptive maximum likelihood clustering algorithm p0051 N80-15495
 Methods of extending crop signatures from one area to another p0017 N80-15500
 Signature extension methods in crop area estimation p0018 N80-15501
 Generation of uniform chromaticity scale imagery from LANDSAT data p0018 N80-15507
 A programmed labeling approach to image interpretation p0019 N80-15509
COMPUTER SYSTEMS DESIGN
 A look at computer system selection criteria p0015 N80-15480
COMPUTERIZED SIMULATION
 The SPOT remote sensing satellite - Assessment of the geometric quality of the images p0047 A80-11704
 Simple generation of one-parameter pseudoterrain surfaces p0048 A80-14952

CONDUCTIVE HEAT TRANSFER

TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach p0007 N80-12526 [E80-10023]
CONFERENCES
 New technology for mapping: Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978 p0027 A80-11695
 Remote sensing applications in developing countries p0057 A80-15771
 Digital processing of aerial images: Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979 p0049 A80-17514
 American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings p0049 A80-20237
 On measurements from aircraft --- conference, Hanover, 29-31 August 1977 [BMFT-FB-W-78-04] p0050 N80-12467
 Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030] p0011 N80-15448

CONGRESSIONAL REPORTS

Earth resources data and information service [GPO-49-530] p0057 N80-11530
 Report to the Congress on coastal zone management. Transition quarter and fiscal year 1977 [PB-298537/2] p0058 N80-12722

CONTINENTAL SHELVES

The structure and variability of shelf sea fronts as observed by an undulating CTD system --- Conductivity and Temperature Detector p0035 A80-20938

CONTOURS

Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature [AD-A074439] p0051 N80-15540

CORN

Look direction modulation function of the radar backscattering coefficient of agricultural fields p0002 A80-13357
 Crop identification with L-band radar p0005 A80-19543
 Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops p0006 N80-12497
 On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region p0007 N80-12512
 Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549

COST ANALYSIS

Resource modeling: A reality for program cost analysis p0020 N80-15524

COST EFFECTIVENESS

Economic evaluation: Concepts, selected studies, system costs, and a proposed program p0017 N80-15490
 The application test system: Technical approach and system design p0020 N80-15523

COTTON

The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445

CROP GROWTH

Estimating leaf-area index of wheat with Landsat data p0002 A80-15053
 Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431
 Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England [E80-10022] p0007 N80-12525
 The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
 Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589
 Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
 Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures [REPT-1003] p0009 N80-13616
 Overview of agrometeorology --- influence of meteorological parameters on crop growth p0009 N80-14441
 The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445
 Crop weather models: Concepts and applications p0010 N80-14450
 Agroclimatological methods involving remote sensing techniques p0010 N80-14451
 Crop environment monitoring: The remote sensing systems p0010 N80-14452
 Crop monitoring and prediction using satellite data p0011 N80-14455

Growth stage estimation --- crop calendars

p0012 N80-15458
 The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482
 Accuracy and performance of LACIE crop development models p0016 N80-15489
 The application test system: An approach to technology transfer --- USDA aerospace and remote sensing information requirements p0020 N80-15520

CROP IDENTIFICATION

Wheat spectral reflectance - Interactions between crop configuration, sun elevation, and azimuth angle p0001 A80-13136
 Look direction modulation function of the radar backscattering coefficient of agricultural fields p0002 A80-13357
 Computer graphic feature analysis and selection --- for viewing parallelepipeds in 3-d space p0047 A80-13358
 Albedo of vegetated surfaces - Its variability with differing irradiances p0002 A80-15051
 Some applications of remote sensing in agricultural resources with reference to India p0003 A80-15776
 Crop identification with L-band radar p0005 A80-19543
 A seasonal verification of the Suits spectral reflectance model for wheat p0005 A80-19544
 Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach [VT-LU-15] p0054 N80-11547
 Classification of agricultural land with the aid of remote sensing methods p0006 N80-12495
 Aerial photography of agricultural farming land p0006 N80-12496
 Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops p0006 N80-12497
 Phenology as a factor in the determination of different forms in vegetation by remote sensing p0007 N80-12499
 What are the advantages of multispectral classification? --- for crop identification p0007 N80-12501
 On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region p0007 N80-12512
 The determination of land usages for planning and cartography p0025 N80-12517
 A study of the tolerance block approach to special stratification --- winter wheat in Kansas [E80-10027] p0008 N80-12529
 Large Area Crop Inventory Experiment (LACIE). List spectral keys study --- Kansas [E80-10012] p0008 N80-13591
 Remote sensing applied to agriculture p0010 N80-14446
 Manual interpretation of LANDSAT data p0013 N80-15460
 Methods for segment wheat area estimation p0017 N80-15491
 On evaluating clustering procedures for use in classification p0017 N80-15494
 Feature extraction applied to agricultural crops as seen by LANDSAT p0017 N80-15497
 The vegetative index number and crop identification p0018 N80-15503
 Manual LANDSAT data analysis for crop type identification p0018 N80-15504
 Design, implementation, and results of LACIE field research p0020 N80-15519
CROP INVENTORIES
 Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876
 Some applications of remote sensing in agricultural resources with reference to India p0003 A80-15776
 An assessment of LACIE and related methodologies for conducting crop inventories p0004 A80-15783
 Applicability of multispectral techniques in establishing inventories for agricultural farming and forestry p0007 N80-12500
 A study of the tolerance block approach to special stratification --- winter wheat in Kansas [E80-10027] p0008 N80-12529
 Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
 Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593
 Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594
 Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595
 Remote sensing applied to agriculture p0010 N80-14446
 Agroclimatological methods involving remote sensing techniques p0010 N80-14451

- Crop monitoring and prediction using satellite data p0011 N80-14455
- Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030] p0011 N80-15448
- Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449
- Econometric models for predicting confusion crop ratios p0011 N80-15450
- LACIE sampling design p0011 N80-15451
- LACIE large area acreage estimation --- United States of America p0012 N80-15453
- Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts --- wheat p0012 N80-15454
- Classification and mensuration of LACIE segments p0012 N80-15455
- Development of LACIE CCEA-1 weather/wheat yield models --- regression analysis p0012 N80-15457
- Accuracy assessment: The statistical approach to performance evaluation in LACIE --- Great Plains corridor, United States p0013 N80-15459
- Operation of the yield estimation subsystem p0014 N80-15468
- The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports p0014 N80-15469
- LACIE area, yield, and production estimate characteristics: U.S. Great Plains p0016 N80-15484
- LACIE area, yield, and production estimate characteristics: U.S.S.R. p0016 N80-15485
- LACIE area, yield, and production estimate characteristics: Canada p0016 N80-15486
- Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
- Economic evaluation: Concepts, selected studies, system costs, and a proposed program p0017 N80-15490
- Estimating crop proportions from remotely sensed data p0017 N80-15492
- On the clustering of multidimensional pictorial data p0050 N80-15493
- Signature extension methods in crop area estimation p0018 N80-15501
- An evaluation of procedure 1 p0018 N80-15502
- LACIE analyst interpretation keys p0018 N80-15505
- A programmed labeling approach to image interpretation p0019 N80-15509
- A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511
- The law of the minimum and an application to wheat yield estimation p0019 N80-15512
- New developments in sampling and aggregation for remotely sensed surveys p0019 N80-15515
- Multiyear estimates for the LACIE sampling plans p0019 N80-15517
- Weighted aggregation p0020 N80-15518
- Analysis of scanner data for crop inventories --- North Dakota [E80-10040] p0021 N80-15534
- Remote sensing of agricultural resources. A bibliography with abstracts [NTIS/PS-79/0993/0] p0021 N80-15542
- Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549
- CROP VIGOR**
- Spectral classification of tomato disease severity levels p0005 A80-20254
- Spectral reflectance of certain weeds p0004 A80-20754
- Lodging of grain crops and its detection by aerial photography p0006 N80-10994
- Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops p0006 N80-12497
- Crop weather models: Concepts and applications p0010 N80-14450
- Application of LANDSAT digital data for monitoring drought --- South Dakota p0016 N80-15483
- CRUDE OIL**
- SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-162423] p0038 N80-11532
- CRUSTAL FRACTURES**
- System for real-time crustal deformation monitoring [NASA-CASE-NPO-14124-1] p0029 N80-14603
- Crustal deformation in central California: Multi-wavelength geodetic observations and interpretations p0029 N80-14605
- D**
- DATA ACQUISITION**
- Environmental monitoring systems p0023 A80-14705
- The Earthnet programme --- for the acquisition and distribution of LANDSAT satellite data p0056 N80-14444
- Acquisition and preprocessing of LANDSAT data p0013 N80-15481
- Ancillary data acquisition for LACIE p0013 N80-15482
- DATA BASES**
- Advances in digital image display and simulation from digital terrain data bases p0047 A80-11696
- Concept for the automatic registration of satellite images with a digital map data base p0027 A80-11701
- Future remote sensing tasks in regional planning p0025 N80-12484
- LACIE data-handling techniques p0013 N80-15483
- The acquisition, storage, and dissemination of LANDSAT and other LACIE support data p0013 N80-15484
- LACIE status and tracking p0014 N80-15470
- The LACIE data bases: Design considerations p0015 N80-15475
- Data base design for a worldwide multicrop information system p0020 N80-15522
- US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain [PB-297931/8] p0051 N80-15547
- DATA COLLECTION PLATFORMS**
- SPOT, French preoperational remote sensing satellite system p0056 N80-13610
- Snow mapping from space platforms p0045 N80-13611
- Meteosat and remote sensing application p0056 N80-14448
- DATA CONVERSION ROUTINES**
- The application test system: Experiences to date and future plans p0020 N80-15525
- DATA MANAGEMENT**
- LACIE status and tracking p0014 N80-15470
- The application test system: Experiences to date and future plans p0020 N80-15525
- DATA PROCESSING**
- On the current state of remote sensing techniques p0055 N80-12469
- Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- Colorado and Washington [E80-10009] p0008 N80-13588
- Earth observations division Earth resources data analysis capabilities [E80-10013] p0050 N80-13592
- Texas applications system verification and transfer remote sensing information subsystem: Functional design [E80-10017] p0050 N80-13596
- LACIE data-handling techniques p0013 N80-15483
- The classification and mensuration subsystem --- wheat p0013 N80-15485
- Accuracy assessment system and operation p0014 N80-15472
- Cartography: LACIE's spatial processor p0015 N80-15474
- DATA PROCESSING EQUIPMENT**
- Cost and performance characteristics of data system configurations for processing remotely sensed data p0015 N80-15481
- DATA PROCESSING TERMINALS**
- Man-machine interfaces in LACIE/ERIPS p0015 N80-15476
- LACIE/ERIPS software system summary p0015 N80-15477
- DATA REDUCTION**
- The reduction and analysis of satellite magnetometer data p0054 A80-18774
- Earth observations division Earth resources data analysis capabilities [E80-10013] p0050 N80-13592
- Manual interpretation of LANDSAT data p0013 N80-15460
- Manual LANDSAT data analysis for crop type identification p0018 N80-15504
- DATA RETRIEVAL**
- Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 A80-15265
- DATA SAMPLING**
- The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest p0002 A80-15559
- Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449
- LACIE sampling design p0011 N80-15451
- LACIE area sampling frame and sample selection p0012 N80-15452
- LACIE large area acreage estimation --- United States of America p0012 N80-15453
- New developments in sampling and aggregation for remotely sensed surveys p0019 N80-15515
- Natural sampling strategy p0019 N80-15516
- Multiyear estimates for the LACIE sampling plans p0019 N80-15517
- Weighted aggregation p0020 N80-15518
- DATA STORAGE**
- The acquisition, storage, and dissemination of LANDSAT and other LACIE support data p0013 N80-15464
- The LACIE data bases: Design considerations p0015 N80-15475
- DATA SYSTEMS**
- LACIE data-handling techniques p0013 N80-15463
- Operation of the yield estimation subsystem p0014 N80-15468
- The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports p0014 N80-15469
- Cost and performance characteristics of data system configurations for processing remotely sensed data p0015 N80-15481
- DAYTIME**
- Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Cachment, north west of London, U.K. [E80-10006] p0044 N80-12522
- DECIDUOUS TREES**
- Analysis of plant community structure and successional stage using multispectral and multitemporal aerial photography --- in Rock Creep Park, Washington, D.C. p0005 A80-20238
- DECISION MAKING**
- A look at computer system selection criteria p0015 N80-15480
- DELAWARE**
- Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526
- DELAWARE BAY (US)**
- Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520
- DELTA**
- Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
- Detection of a probable ancestral delta of the Nile River p0033 N80-10571
- Suspended-sediment dispersal patterns of river deltas photographed by ASTP p0043 N80-10572
- DESERTS**
- American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings p0049 A80-20237
- The use of Landsat imagery to monitor desert encroachment in arid areas p0024 A80-20241
- Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259
- Summary of significant results p0049 N80-10539
- Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
- Photolineaments in the ASTP stereopair of the western desert of Egypt p0032 N80-10546
- Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547
- Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blanche area, South Australia --- identification of folds, faults, and lineaments p0032 N80-10550
- Color zoning in the western desert of Egypt p0024 N80-10553
- Orbital observations of sand distribution in the western desert of Egypt p0024 N80-10554
- Preliminary analysis of color variations of sand deposits in the western desert of Egypt p0032 N80-10555
- Color of desert surfaces in the Arabian peninsula p0033 N80-10558
- Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559
- Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560
- DEVELOPING NATIONS**
- Remote sensing applications in developing countries p0057 A80-15771
- The use of remote sensing for transport planning and highway engineering in developing countries p0023 A80-15774
- DIGITAL DATA**
- LACIE registration processing p0012 N80-15456
- Acquisition and preprocessing of LANDSAT data p0013 N80-15481
- Application of LANDSAT digital data for monitoring drought --- South Dakota p0016 N80-15483
- DIGITAL TECHNIQUES**
- Digital analysis of radar imagery for vegetation detection in Nigeria p0004 A80-15780
- The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java p0048 A80-15781
- Digital processing of aerial images: Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979 p0049 A80-17514
- Geometric preprocessing of sensor data used for image matching p0054 A80-17515
- Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos p0023 A80-20025
- A suggested method for delimiting urbanized areas using digital Landsat data p0024 A80-20246
- The PDS differential rectifier - An economical approach to digital orthophotos p0054 A80-20250

DISASTERS

On the use of digital photogrammetric measurements in the compilation of topographic maps
[SER-1-ORIGINAL-REPT-76] p0029 N80-14462

DISASTERS

Satellite remote sensing in hazard monitoring and disaster evaluation p0011 N80-14456

DISPLAY DEVICES

Advances in digital image display and simulation from digital terrain data bases p0047 A80-11696

Processing and display techniques for multispectral satellite imagery p0050 N80-11534

Concepts leading to the IMAGE-100 hybrid interactive system p0014 N80-15466

Image and numerical display aids for manual interpretation p0051 N80-15508

Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature p0051 N80-15540

[AD-A074439] p0051 N80-15540

DISTRIBUTED PARAMETER SYSTEMS

Considerations for design of future research and development interactive image analysis systems p0050 N80-15478

DISTRICT OF COLUMBIA

Analysis of plant community structure and successional stage using multispectral and multitemporal aerial photography --- in Rock Creep Park, Washington, D.C. p0005 A80-20238

Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia p0026 N80-15526

DOCUMENT STORAGE

LACIE data-handling techniques p0013 N80-15463

The acquisition, storage, and dissemination of LANDSAT and other LACIE support data p0013 N80-15464

DRAINAGE PATTERNS

Use of satellite infrared data for geomorphology studies p0041 A80-15054

A study of moisture conditions in the Pantanal of Brazil using satellite imagery p0041 A80-15055

The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory p0048 A80-15773

The contribution of Landsat imagery to reconnaissance soil mapping in north-west India p0003 A80-15777

A hydrological analysis of east Australian floods using Nimbus-5 electrical scanning radiometer data p0042 A80-20194

DRAINAGE PATTERNS

South American river morphology and hydrology p0043 N80-10574

DROUGHT

Satellite remote sensing in hazard monitoring and disaster evaluation p0011 N80-14456

Application of LANDSAT digital data for monitoring drought --- South Dakota p0016 N80-15483

DUNES

The use of Landsat imagery to monitor desert encroachment in arid areas p0024 A80-20241

The application of remote sensing techniques for the enforcement of the Michigan Sand Dune Management and Protection Act p0023 A80-20263

Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560

DUST

Geophysics, astronomy and space, no. 450 p0033 N80-11527

[JPRS-73948] p0033 N80-11527

E

EARTH ATMOSPHERE

Space research in Switzerland, 1978 p0058 N80-11995

French space programs p0058 N80-14165

EARTH CRUST

Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements p0027 A80-10172

The reduction and analysis of satellite magnetometer data p0054 A80-18774

Geophysics, astronomy and space, no. 450 p0033 N80-11527

[JPRS-73948] p0033 N80-11527

System for real-time crustal deformation monitoring [NASA-CASE-NPO-14124-1] p0029 N80-14603

Crustal deformation in central California: Multi-wavelength geodetic observations and interpretations p0029 N80-14605

EARTH MOVEMENTS

Geodynamics from satellites [AAS PAPER 79-243] p0031 A80-16427

EARTH OBSERVATIONS (FROM SPACE)

The study of the ocean from space --- Russian book p0036 A80-20095

Mapping vegetation with low cover density from Landsat data p0006 A80-20257

EARTH RESOURCES

Some aspects of determining object coordinates from scanner photographs p0047 A80-10173

Space research in Switzerland, 1978 p0058 N80-11995

EARTH RESOURCES INFORMATION SYSTEM

Earth resources data and information service [GPO-49-530] p0057 N80-11530

EARTH RESOURCES SURVEY PROGRAM

A review of NASA international programs [NASA-TM-80845] p0058 N80-14971

EARTH SURFACE

Earth feature identification and tracking technology development p0028 A80-17403

SPOT, French preoperational remote sensing satellite system p0056 N80-13610

Overview of remote sensing for agricultural and agrometeorology p0010 N80-14442

Physical background of remote sensing --- multispectral reconnaissance of the Earth surface p0029 N80-14443

ECOLOGICAL

Remote-sensing studies of taiga regions --- Russian book p0053 A80-16559

Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-16565

Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography p0004 A80-16566

Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia p0026 N80-15526

ECONOMETRICS

Economic models for predicting confusion crop ratios p0011 N80-15450

Economic evaluation: Concepts, selected studies, system costs, and a proposed program p0017 N80-15490

ECONOMIC ANALYSIS

An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-162434] p0057 N80-11533

ECOSYSTEMS

Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management p0041 A80-15265

Analysis of plant community structure and successional stage using multispectral and multitemporal aerial photography --- in Rock Creep Park, Washington, D.C. p0005 A80-20238

Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240

Impact of Great Lakes water level fluctuations on coastal wetlands p0043 N80-10590

Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia p0026 N80-15526

EDUCATION

Educator's guide for Mission to Earth: LANDSAT views the world p0057 N80-10537

[NASA-SP-360] p0057 N80-10537

The application test system: Experiences to date and future plans p0020 N80-15525

EFFICIENCY

LACIE applications evaluation system efficiency report p0015 N80-15473

EGYPT

Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545

Photolineaments in the ASTP stereopair of the western desert of Egypt p0032 N80-10546

Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547

Color zoning in the western desert of Egypt p0024 N80-10553

Orbital observations of sand distribution in the western desert of Egypt p0024 N80-10554

Preliminary analysis of color variations of sand deposits in the western desert of Egypt p0032 N80-10555

Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556

Detection of a probable ancestral delta of the Nile River p0033 N80-10571

ENERGY BUDGETS

Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri p0044 N80-12527

Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France p0009 N80-13597

[E80-10018] p0009 N80-13597

Beauce TELLUS project --- France p0009 N80-13600

[E80-10024] p0009 N80-13600

ENGLAND

Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England p0007 N80-12525

[E80-10022] p0007 N80-12525

The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing --- Buckinghamshire, England p0009 N80-13599

[E80-10021] p0009 N80-13599

ENVIRONMENT EFFECTS

Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia p0026 N80-15526

ENVIRONMENTAL MANAGEMENT

Interactive analysis methods for resource mapping p0028 A80-11709

LANDSAT project State of Hawaii: A preliminary report p0057 N80-10587

[PB-296712/3] p0057 N80-10587

Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts p0025 N80-13614

[NTIS/PS-79/0842/9] p0025 N80-13614

ENVIRONMENTAL MODELS

Crop weather models: Concepts and applications p0010 N80-14450

ENVIRONMENT PROTECTION

The application of remote sensing techniques for the enforcement of the Michigan Sand Dune Management and Protection Act p0023 A80-20263

ENVIRONMENTAL MONITORING

Microwave radiometric methods and the problem of forest and peat fires p0002 A80-14580

Environmental monitoring systems p0023 A80-14705

Monitoring of euphotic depth from aircraft p0041 A80-15056

Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management p0041 A80-15265

[ASME PAPER 79-ENAS-41] p0041 A80-15265

The use of space - International cooperation in the area of space applications --- Russian book p0057 A80-16394

Analysis of the spectral reflection characteristics of natural formations in remote sensing studies p0053 A80-16568

American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978. Proceedings p0049 A80-20237

A light aircraft camera Pod - The Enviro-Pod p0024 A80-20251

The application of remote sensing techniques for the enforcement of the Michigan Sand Dune Management and Protection Act p0023 A80-20263

Application of multitemporal photography and remote sensing data to environmental monitoring in the State of Washington p0048 A80-20265

Educator's guide for Mission to Earth: LANDSAT views the world p0057 N80-10537

[NASA-SP-360] p0057 N80-10537

Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach p0054 N80-11547

[VT-LU-15] p0054 N80-11547

Space research in Switzerland, 1978 p0058 N80-11995

Aims and tasks of the aircraft test program p0055 N80-12468

The Geoscientific Airborne Remote Sensing Program [BMFT-FB-W-78-31] p0055 N80-13608

Satellite Remote Sensing: Applications in Agrometeorology and Agrometeorology [ESA-SP-1020] p0009 N80-14440

The Earthnet programme --- for the acquisition and distribution of LANDSAT satellite data p0056 N80-14444

Crop environment monitoring: The remote sensing systems p0010 N80-14452

Crop environment monitoring: The assessment of environmental phenomena using satellite remote sensing data p0010 N80-14454

Satellite remote sensing in hazard monitoring and disaster evaluation p0011 N80-14456

Satellite remote sensing for agricultural advisories and planning p0011 N80-14457

System for real-time crustal deformation monitoring [NASA-CASE-NPO-14124-1] p0029 N80-14603

Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-airdrop data buoy [AD-A074731] p0039 N80-14664

A review of NASA international programs [NASA-TM-80845] p0058 N80-14971

International Decade of Ocean Exploration, volume 7 --- information on oceanography programs dealing with marine environments [NOAA-S/T-78-211-VOL-7] p0039 N80-15772

EROSION

Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography p0028 A80-16561

ESTIMATES

Accuracy and performance of LACIE area estimates --- wheat yield in the U.S. Great Plains States p0016 N80-15487

ESTIMATION

Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449

LACIE large area acreage estimation --- United States of America p0012 N80-15453

Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts --- wheat p0012 N80-15454

- Growth stage estimation --- crop calendars
p0012 N80-15458
- Accuracy assessment: The statistical approach to performance evaluation in LACIE --- Great Plains corridor, United States
p0013 N80-15459
- The classification and mensuration subsystem --- wheat
p0013 N80-15465
- LACIE area, yield, and production estimate characteristics: U.S.S.R.
p0016 N80-15485
- LACIE area, yield, and production estimate characteristics: Canada
p0016 N80-15486
- Methods for segment wheat area estimation
p0017 N80-15491
- Estimating crop proportions from remotely sensed data
p0017 N80-15492
- CLASSY: An adaptive maximum likelihood clustering algorithm
p0051 N80-15495
- Signature extension methods in crop area estimation
p0018 N80-15501
- Status of yield estimation technology: A review of second-generation model development and evaluation
p0019 N80-15510
- A universal model for estimating wheat yields [CONTRIB-78-268-A]
p0019 N80-15511
- The law of the minimum and an application to wheat yield estimation
p0019 N80-15512
- CCEA second-generation wheat yield model for hard red wheat in North Dakota
p0019 N80-15513
- Prediction of wheat phenological development: A state-of-the-art review
p0019 N80-15514
- New developments in sampling and aggregation for remotely sensed surveys
p0019 N80-15515
- Natural sampling strategy
p0019 N80-15516
- Multiyear estimates for the LACIE sampling plans
p0019 N80-15517
- Weighted aggregation
p0020 N80-15518
- ESTUARIES**
- Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis de Maumusson
p0041 A80-10370
- Monitoring of deltaic wetland processes with seasonal aerial photography
p0042 A80-20240
- Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey
p0035 A80-20260
- Determination of the optical properties of the sea in the German bight
p0038 N80-12516
- Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004]
p0044 N80-12520
- Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts [NTIS/PS-79/0842/9]
p0025 N80-13614
- ETHIOPIA**
- The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory
p0048 A80-15773
- The use of remote sensing for transport planning and highway engineering in developing countries
p0023 A80-15774
- EUROPE**
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007]
p0007 N80-12523
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019]
p0009 N80-13598
- EUROPEAN SPACE PROGRAMS**
- The ESA remote sensing program: Present activities and future plans
p0058 N80-14449
- EUTROPHICATION**
- Monitoring of euphotic depth from aircraft
p0041 A80-15056
- Interpretation of water quality using remote sensing techniques
p0044 N80-12493
- EVAPORATION**
- Principals of mapping hydrological parameters from natural systems, using satellite photography
p0042 A80-18564
- Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Catchment, north west of London, U.K. [E80-10006]
p0044 N80-12522
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019]
p0009 N80-13598
- EVAPOTRANSPIRATION**
- The application of thermal infrared remote sensing data to soil moisture and evaporation determination
p0010 N80-14447
- EVAPOTRANSPIRATION**
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007]
p0007 N80-12523
- Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England [E80-10022]
p0007 N80-12525
- TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach [E80-10023]
p0007 N80-12526
- Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018]
p0009 N80-13597
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019]
p0009 N80-13598
- The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing --- Buckinghamshire, England [E80-10021]
p0009 N80-13599
- Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures [REPT-1003]
p0009 N80-13616
- Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project [E80-10020]
p0045 N80-15447
- EXPERIMENTAL DESIGN**
- Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030]
p0011 N80-15448
- F**
- FACTOR ANALYSIS**
- Linear feature selection with applications
p0051 N80-15496
- Feature extraction applied to agricultural crops as seen by LANDSAT
p0017 N80-15497
- FARM CROPS**
- Plant canopy information extraction from composite scene reflectance of row crops
p0001 A80-13141
- Crop identification with L-band radar
p0005 A80-19543
- Phenology as a factor in the determination of different forms in vegetation by remote sensing
p0007 N80-12499
- On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region
p0007 N80-12512
- Beauce TELLUS project --- France [E80-10024]
p0009 N80-13600
- Overview of agrometeorology --- influence of meteorological parameters on crop growth
p0009 N80-14441
- The agro-ecological zones project --- agrometric and land suitability assessment for various crops
p0010 N80-14445
- Use of thermal infrared and colour infrared imagery to detect crop moisture stress --- Alberta, Canada [E80-10036]
p0021 N80-15530
- HCMM/soil moisture experiment --- Alberta, Canada [E80-10037]
p0021 N80-15531
- Remote sensing of agricultural resources. A bibliography with abstracts [NTIS/PS-79/0993/0]
p0021 N80-15542
- Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7]
p0021 N80-15549
- FARM LANDS**
- Look direction modulation function of the radar backscattering coefficient of agricultural fields
p0002 A80-13357
- FARMLANDS**
- Landsat applications in Georgia - A successful example of technology transfer between NASA and state government
p0057 A80-14792
- A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area / Lesotho/
p0003 A80-15775
- The use of Landsat imagery to monitor desert encroachment in arid areas
p0024 A80-20241
- Dual polarized long wavelength radar for discrimination of agricultural land use
p0003 A80-20268
- An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-182434]
p0057 N80-11533
- Classification of agricultural land with the aid of remote sensing methods
p0006 N80-12495
- Aerial photography of agricultural farming land
p0008 N80-12496
- Applicability of multiscanning techniques in establishing inventories for agricultural farming and forestry
p0007 N80-12500
- What are the advantages of multispectral classification? --- for crop identification
p0007 N80-12501
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007]
p0007 N80-12523
- Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England [E80-10022]
p0007 N80-12525
- Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri [E80-10025]
p0044 N80-12527
- Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014]
p0008 N80-13593
- Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016]
p0009 N80-13595
- Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures [REPT-1003]
p0009 N80-13616
- The mapping of important farmland using remote sensor and socio-economic variables --- Ontario County, New York
p0009 N80-14424
- Overview of remote sensing for agrimatology and agrometeorology
p0010 N80-14442
- Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7]
p0021 N80-15549
- FINLAND**
- Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach [VT-LU-15]
p0054 N80-11547
- FIRE FIGHTING**
- Remote sensing methods applied to the solution of the forest fire problem
p0004 A80-16567
- FLOOD DAMAGE**
- Satellite remote sensing in hazard monitoring and disaster evaluation
p0011 N80-14456
- FLOOD PLAINS**
- Remote sensing applied to hydrology. A bibliography with abstracts [NTIS/PS-79/0845/2]
p0043 N80-11553
- FLOOD RAIS**
- A study of moisture conditions in the Pantanal of Brazil using satellite imagery
p0041 A80-15055
- FLOODS**
- A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data
p0042 A80-20194
- Monitoring of deltaic wetland processes with seasonal aerial photography
p0042 A80-20240
- FLORIDA**
- Measured emissivity of soils in the southeast United States
p0002 A80-15057
- Gulf stream boundary eddies off the east coast of Florida
p0036 A80-16247
- Land cover classification from Landsat data: Phase 3 of a joint DOE/NASA demonstration [AD-A071723]
p0024 N80-11535
- Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data [NASA-TP-1553]
p0021 N80-15535
- Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1]
p0039 N80-15603
- FOLDS (GEOLOGY)**
- Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images --- identification of folds, faults, and lineaments
p0032 N80-10548
- Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blanche area, South Australia --- identification of folds, faults, and lineaments
p0032 N80-10550
- FOLIAGE**
- Estimating leaf-area index of wheat with Landsat data
p0002 A80-15053
- Analysis of plant community structure and successional stage using multispectral and multitemporal aerial photography --- in Rock Creep Park, Washington, D.C.
p0005 A80-20238
- Spectral vegetation relationships in a tropical rain forest
p0005 A80-20249
- FOREST FIRE DETECTION**
- Microwave radiometric methods and the problem of forest and peat fires
p0002 A80-14580
- Remote sensing methods applied to the solution of the forest fire problem
p0004 A80-16567
- Application of multitemporal photography and remote sensing data to environmental monitoring in the State of Washington
p0048 A80-20265
- FOREST MANAGEMENT**
- Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture
p0001 A80-11708
- System of landscape-statistical methods for stocktaking and mapping of forests
p0004 A80-16562
- A analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography
p0004 A80-16566
- Remote sensing methods applied to the solution of the forest fire problem
p0004 A80-16567
- On measurements from aircraft --- conference, Hanover, 29-31 August 1977 [BMFT-FB-W-78-04]
p0050 N80-12467

Applicability of multiscanning techniques in establishing inventories for agricultural farming and forestry p0007 N80-12500

FORESTS

Digital processing of multispectral color aerial photographs of forest land p0001 A80-10171
Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters p0001 A80-10877

Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792
The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 A80-15778

Problems of remote sensing in the tropics - An appraisal of the Nigerian situation with regard to forest resources p0004 A80-15779

Remote-sensing studies of taiga regions --- Russian book p0053 A80-18559
Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-18560

Principles of studying mountainous forest landscapes in the Baikalsk basin, using aerial and satellite photography p0028 A80-18561

Remote identification of the spatial structure of forest phytocoenoses p0004 A80-18563
Principals of mapping hydrological parameters from natural systems, using satellite photography p0042 A80-18564

Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-18565
Crop identification with L-band radar p0005 A80-19543

Fixed-base large-scale photographs for forest sampling p0005 A80-20024
The use of Landsat imagery to monitor desert encroachment in arid areas p0024 A80-20241

A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248
Application of multidata photography and remote sensing data to environmental monitoring in the State of Washington p0048 A80-20285

Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach [VT-LU-15] p0054 N80-11547
Texture analysis as a recognition parameter for different types of forests p0006 N80-12498

Phenology as a factor in the determination of different forms in vegetation by remote sensing p0007 N80-12499
Digital processing procedure for texture analysis with remote sensing data p0050 N80-12505

Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri [E80-10025] p0044 N80-12527
Forest resource information system, phase 3 [E80-10026] p0007 N80-12528

Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- Colorado and Washington [E80-10009] p0008 N80-13588

The mapping of important farmland using remote sensor and socio-economic variables --- Ontario County, New York p0009 N80-14424
Forester's guide to aerial photo interpretation --- timber inventory p0009 N80-14425

Remote sensing of agricultural resources. A bibliography with abstracts [NTIS/PS-79/0993/0] p0021 N80-15542

FRANCE
Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis de Maumusson p0041 A80-10370
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523

TELLUS newsletter 1 --- Beauce, France [E80-10029] p0008 N80-12531
Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018] p0009 N80-13597

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598
Beauce TELLUS project --- France [E80-10024] p0009 N80-13600

FRENCH SPACE PROGRAMS
The SPOT remote sensing satellite - Assessment of the geometric quality of the images p0047 A80-11704
SPOT, French preoperational remote sensing satellite system p0056 N80-13610
French space programs p0058 N80-14185

FROST
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598

FUNGI

Lodging of grain crops and its detection by aerial photography p0006 N80-10994

G

GAMMA RAY SPECTRA

Development of an airborne gamma radiation system for snow surveys [EGG-1183-1679] p0044 N80-13606

GAMMA RAYS

Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation --- Russian book p0041 A80-10125

GEOCHRONOLOGY

Detection of a probable ancestral delta of the Nile River p0033 N80-10571

GEODESY

The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications p0027 A80-11699

The use of space - International cooperation in the area of space applications --- Russian book p0057 A80-16394
Space research in Switzerland, 1978 p0058 N80-11995

Aims and tasks of the aircraft test program p0055 N80-12468
French space programs p0058 N80-14185

Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446

Crustal deformation in central California: Multi-wavelength geodetic observations and interpretations p0029 N80-14605

GEODETTIC SURVEYS
The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications p0027 A80-11699

Method for increasing the accuracy of an airborne geodetic radio rangefinder p0028 A80-15176
System for real-time crustal deformation monitoring [NASA-CASE-NPO-14124-1] p0029 N80-14603

Crustal deformation in central California: Multi-wavelength geodetic observations and interpretations p0029 N80-14605

GEODYNAMICS
Geodynamics from satellites [AAS PAPER 79-243] p0031 A80-16427

GEOGRAPHY
Educator's guide for Mission to Earth: LANDSAT views the world [NASA-SP-360] p0057 N80-10537

GEOIDS
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446

GEOLOGICAL FAULTS
Geologic analysis of ASTP photographs of parts of southern California p0031 N80-10540
Evaluation of satellite images of the Levantine Rift zone p0031 N80-10542

Analysis of Skylab and astp photographs of the Levantine (Dead Sea) fault zone p0031 N80-10543
Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544

Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
Photolineaments in the ASTP stereostrip of the western desert of Egypt p0032 N80-10546

Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images --- identification of folds, faults, and lineaments p0032 N80-10548
East-West pervasive lineaments in central and southeastern Spain p0032 N80-10549

Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blanche area, South Australia --- identification of folds, faults, and lineaments p0032 N80-10550

Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559
Geophysics, astronomy and space, no. 450 [JPRS-73946] p0033 N80-11527

Remote sensing applied to geology and mineralogy. A bibliography with abstracts [NTIS/PS-79/0844/5] p0034 N80-13612
Crustal deformation in central California: Multi-wavelength geodetic observations and interpretations p0029 N80-14605

GEOLOGICAL SURVEYS
Use of satellite infrared data for geomorphology studies p0041 A80-15054
The use of remote sensing for transport planning and highway engineering in developing countries p0023 A80-15774

Apollo-Soyuz test project. Volume 2: Earth observations and photography [NASA-SP-412-VOL-2] p0049 N80-10538

Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10005] p0033 N80-12521

U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed [PB-297442/6] p0044 N80-12547
SPOT, French preoperational remote sensing satellite system p0056 N80-13610

Remote sensing applied to geology and mineralogy. A bibliography with abstracts [NTIS/PS-79/0844/5] p0034 N80-13612
Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0822/1] p0034 N80-13613

Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Golfield test areas, Nevada [E80-10035] p0034 N80-15529

GEOLOGY
Geophysics, astronomy and space, no. 450 [JPRS-73946] p0033 N80-11527

GEOMAGNETISM
Geodynamics from satellites [AAS PAPER 79-243] p0031 A80-16427
The reduction and analysis of satellite magnetometer data p0054 A80-18774

GEO MORPHOLOGY
Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements p0027 A80-10172
Use of satellite infrared data for geomorphology studies p0041 A80-15054

Some examples of the use of satellite imagery /Landsat/ for natural resource mapping in Western Sudan p0048 A80-15772
The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory p0048 A80-15773

The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 A80-15778
Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-18560
Principles of studying mountainous forest landscapes in the Baikalsk basin, using aerial and satellite photography p0028 A80-18561

South American river morphology and hydrology p0043 N80-10574
Quantitative determination of morphological structures in sand bank regions from image structure analysis p0033 N80-12482

Making morphological maps of sand banks from aerial photographs p0033 N80-12483
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598

GEORGIA
Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792
Measured emissivity of soils in the southeast United States p0002 A80-15057

GEOS SATELLITES (ESA)
Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543

GEOS 3 SATELLITE
A study of possible sea state information in the sample and hold gate statistics for the GEOS-3 satellite altimeter [NASA-CR-156858] p0038 N80-13753

GEO THERMAL RESOURCES
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission [E80-10033] p0034 N80-15528

GERMANY
Terrestrial aerial photogrammetric surveying of large open pit mines in the Rhein lignite district p0031 A80-14373
On measurements from aircraft --- conference, Hanover, 29-31 August 1977 [BMFT-FB-W-78-04] p0050 N80-12467
Aims and tasks of the aircraft test program p0055 N80-12468
On the current state of remote sensing techniques p0055 N80-12469

Research into determining chemical parameters at the surface of the sea by remote sensing p0038 N80-12479
Quantitative determination of morphological structures in sand bank regions from image structure analysis p0033 N80-12482
Making morphological maps of sand banks from aerial photographs p0033 N80-12483
Interpretation of IR and MSS data for town areas p0025 N80-12485
Classification of agricultural land with the aid of remote sensing methods p0006 N80-12495

SUBJECT INDEX

Aerial photography of agricultural farming land p0006 N80-12496

Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops p0006 N80-12497

Texture analysis as a recognition parameter for different types of forests p0006 N80-12498

Phenology as a factor in the determination of different forms in vegetation by remote sensing p0007 N80-12499

Applicability of multiscanning techniques in establishing inventories for agricultural farming and forestry p0007 N80-12500

What are the advantages of multispectral classification? --- for crop identification p0007 N80-12501

On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region p0007 N80-12512

The multispectral scanner as an instrument for signature determinations p0055 N80-12515

Determination of the optical properties of the sea in the German bight p0038 N80-12516

The determination of land usages for planning and cartography p0025 N80-12517

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries p0007 N80-12523

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries p0009 N80-13598

The Geoscientific Airborne Remote Sensing Program [BMFT-FB-W-78-31] p0055 N80-13608

Strategies for the surveillance of coastal waters of the Federal Republic of Germany [BMFT-FB-M-77-11] p0045 N80-13726

GLACIAL DRIFT

Use of satellite infrared data for geomorphology studies p0041 A80-15054

GLACIERS

Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-18560

Snow hydrology studies p0043 N80-10575

GOVERNMENT PROCUREMENT

Cooperative methods for acquisition of aerial photography p0053 A80-20266

GOVERNMENT/INDUSTRY RELATIONS

Forest resource information system, phase 3 [E80-10026] p0007 N80-12528

GRAINS (FOOD)

Spectral reflectance of certain weeds p0004 A80-20754

Lodging of grain crops and its detection by aerial photography p0006 N80-10994

The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532

Large Area Crop Inventory Experiment (LACIE). List spectral keys study. --- Kansas p0008 N80-13591

Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota p0008 N80-13593

Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota p0009 N80-13594

Crop monitoring and prediction using satellite data p0011 N80-14455

Econometric models for predicting confusion crop ratios p0011 N80-15450

Classification and mensuration of LACIE segments p0012 N80-15455

LACIE area, yield, and production estimate characteristics: U.S. Great Plains p0016 N80-15484

On evaluating clustering procedures for use in classification p0017 N80-15494

LACIE analyst interpretation keys p0018 N80-15505

Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510

CCEA second-generation wheat yield model for hard red wheat in North Dakota p0019 N80-15513

Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514

Analysis of scanner data for crop inventories --- North Dakota [E80-10040] p0021 N80-15534

GRASSLANDS

The application of Landsat-MSS imagery for agricultural planning in tropical rain and swamp forest zones p0002 A80-14375

Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England [E80-10022] p0007 N80-12525

Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018] p0009 N80-13597

The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing --- Buckinghamshire, England [E80-10021] p0009 N80-13599

Crop monitoring and prediction using satellite data p0011 N80-14455

GRAVIMETRY

Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446

GRAVITATIONAL FIELDS

Geodynamics from satellites [AAS PAPER 79-243] p0031 A80-18427

GREAT PLAINS CORRIDOR (NORTH AMERICA)

An assessment of LACIE and related methodologies for conducting crop inventories p0004 A80-15783

Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524

Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589

Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590

Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593

Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594

Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595

Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030] p0011 N80-15448

Accuracy assessment: The statistical approach to performance evaluation in LACIE --- Great Plains corridor, United States p0013 N80-15459

The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482

LACIE area, yield, and production estimate characteristics: U.S. Great Plains p0016 N80-15484

Accuracy and performance of LACIE area estimates --- wheat yield in the U.S. Great Plains States p0016 N80-15487

Accuracy and performance of LACIE crop development models p0016 N80-15489

A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511

GREEN WAVE EFFECT

Plant canopy information extraction from composite scene reflectance of row crops p0001 A80-13141

Estimating leaf-area index of wheat with Landsat data p0002 A80-15053

A seasonal verification of the Suits spectral reflectance model for wheat p0005 A80-19544

Spectral vegetation relationships in a tropical rain forest p0005 A80-20249

A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring p0003 A80-20267

Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524

The vegetative index number and crop identification p0018 N80-15503

Image and numerical display aids for manual interpretation p0051 N80-15508

A programmed labeling approach to image interpretation p0019 N80-15509

GREENLAND

Long-term tracking of arctic icebergs [AD-A072473] p0037 N80-10583

GROUND STATIONS

The Earthnet programme --- for the acquisition and distribution of LANDSAT satellite data p0056 N80-14444

GROUND TRUTH

An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy p0028 A80-20253

Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589

Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593

Ancillary data acquisition for LACIE p0013 N80-15462

HEAT CAPACITY MAPPING MISSION

Accuracy assessment system and operation p0014 N80-15472

Heat Capacity Mapping Mission (HCMM) [E80-10039] p0045 N80-15533

Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549

GROUND WATER

Detection of arctic water supplies with geophysical techniques [AD-A072157] p0043 N80-11538

HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution [E80-10002] p0044 N80-12518

GULF OF ALASKA

SEASAT: Gulf of Alaska experiment. Surface truth data inventory [PB-294616] p0038 N80-12546

GULF OF MEXICO

Interpreting ASTP photographs of the ocean and locating the area photographed, case study of the Gulf of Mexico p0036 N80-10562

SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-162423] p0038 N80-11532

Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1] p0039 N80-15603

GULF STREAM

Gulf stream boundary eddies off the east coast of Florida p0036 A80-16247

Ocean wave spectrometer measurements in the gulf stream experiment [AD-A074369] p0039 N80-14665

H

HABITATS

An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-162434] p0057 N80-11533

HAIL

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598

HARBORS

Application of multidata photography and remote sensing data to environmental monitoring in the State of Washington p0048 A80-20265

HAWAII

LANDSAT project, State of Hawaii: A preliminary report [PB-296712/3] p0057 N80-10587

HEAT BALANCE

Principals of mapping hydrological parameters from natural systems, using satellite photography p0042 A80-16564

HEAT BUDGET

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598

HEAT CAPACITY MAPPING MISSION

HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution [E80-10002] p0044 N80-12518

Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520

Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10005] p0033 N80-12521

Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Catchment, north west of London, U.K. [E80-10008] p0044 N80-12522

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523

Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England [E80-10022] p0007 N80-12525

TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach [E80-10023] p0007 N80-12526

Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri [E80-10025] p0044 N80-12527

TELLUS newsletter 1 --- Beauce, France [E80-10029] p0008 N80-12531

- Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France
 [E80-10018] p0009 N80-13597
 Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries
 [E80-10019] p0009 N80-13598
 The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing --- Buckinghamshire, England
 [E80-10021] p0009 N80-13599
 Beauce TELLUS project --- France
 [E80-10024] p0009 N80-13600
 The application of thermal infrared remote sensing data to soil moisture and evaporation determination
 p0010 N80-14447
 Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
 [E80-10020] p0045 N80-15447
 Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
 [E80-10032] p0020 N80-15527
 Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission
 [E80-10033] p0034 N80-15528
 Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Golfield test areas, Nevada
 [E80-10035] p0034 N80-15529
 HCMM/soil moisture experiment --- Alberta, Canada
 [E80-10037] p0021 N80-15531
 Heat Capacity Mapping Mission (HCMM)
 [E80-10039] p0045 N80-15533
- HEAT ISLANDS**
 Assessment of the urban heat island effect through the use of satellite data
 p0023 A80-15556
- HIGHWAYS**
 The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory
 p0048 A80-15773
 The use of remote sensing for transport planning and highway engineering in developing countries
 p0023 A80-15774
- HIMALAYA**
 The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java
 p0048 A80-15781
- HUMIDITY**
 Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Cachment, north west of London, U.K.
 [E80-10006] p0044 N80-12522
- HURRICANES**
 Satellite remote sensing in hazard monitoring and disaster evaluation
 p0011 N80-14456
- HYDROGEOLOGY**
 Detection of a probable ancestral delta of the Nile River
 p0033 N80-10571
 Suspended-sediment dispersal patterns of river deltas photographed by ASTP
 p0043 N80-10572
- HYDROGRAPHY**
 Optical methods for investigating oceans and inland basins --- Russian book
 p0035 A80-10116
 Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
 [E80-10004] p0044 N80-12520
 Operating scenario for a Hydrographic Airborne Laser Soudner (HALS)
 [AD-A073872] p0038 N80-14390
 Technical papers on airborne laser hydrography
 [PB-299321/0] p0045 N80-15546
- HYDROLOGY**
 Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation --- Russian book
 p0041 A80-10125
 Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maunusson
 p0041 A80-10370
 Principals of mapping hydrological parameters from natural systems, using satellite photography
 p0042 A80-16564
 A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data
 p0042 A80-20194
 Apollo-Soyuz test project. Volume 2: Earth observations and photography
 [NASA-SP-412-VOL-2] p0049 N80-10538
 Summary of significant results
 p0049 N80-10539
 South American river morphology and hydrology
 p0043 N80-10574
 Snow hydrology studies
 p0043 N80-10575
 LANDSAT project. State of Hawaii: A preliminary report
 [PB-296712/3] p0057 N80-10587
- Impact of Great Lakes water level fluctuations on coastal wetlands
 [PB-296403/9] p0043 N80-10590
 Remote sensing applied to hydrology. A bibliography with abstracts
 [NTIS/PS-79/0845/2] p0043 N80-11553
 On measurements from aircraft --- conference, Hanover, 29-31 August 1977
 [BMFT-FB-W-78-04] p0050 N80-12467
 Space Observations for water resources: A potential to be developed
 p0044 N80-13609
 SPOT, French preoperational remote sensing satellite system
 p0056 N80-13610
 Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
 [E80-10020] p0045 N80-15447
 Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
 [E80-10032] p0020 N80-15527
- HYDROLOGY MODELS**
 Crop weather models: Concepts and applications
 p0010 N80-14450
- ICE**
 New developments in satellite oceanography and current measurements
 p0035 A80-10731
- ICE ENVIRONMENTS**
 Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-icebird data buoy
 [AD-A074731] p0039 N80-14664
- ICE MAPPING**
 Inexpensive radar mapping by Ericsson Star
 p0047 A80-11190
 Earth feature identification and tracking technology development
 p0028 A80-17403
 The study of the ocean from space --- Russian book
 p0036 A80-20095
 Passive microwave studies of frozen lakes
 p0042 A80-20247
 Detection of arctic water supplies with geophysical techniques
 [AD-A072157] p0043 N80-11538
- ICE REPORTING**
 Long-term tracking of arctic icebergs
 [AD-A072473] p0037 N80-10583
 SEASAT demonstration experiments with the offshore oil, gas and mining industries
 [NASA-CR-162423] p0038 N80-11532
 Remote sensing applied to hydrology. A bibliography with abstracts
 [NTIS/PS-79/0845/2] p0043 N80-11553
- ICEBERGS**
 Long-term tracking of arctic icebergs
 [AD-A072473] p0037 N80-10583
 Possible methods for distinguishing icebergs from ships by aerial remote sensing
 [NASA-TM-79310] p0056 N80-15538
- IDAHO**
 Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America
 [E80-10010] p0008 N80-13589
- ILLINOIS**
 Crop weather models: Concepts and applications
 p0010 N80-14450
- IMAGE**
 Orientation problem of SLAR imagery
 p0049 A80-19923
- IMAGE PROCESSING**
 Digital processing of multispectral color aerial photographs of forest land
 p0001 A80-10171
 Some aspects of determining object coordinates from scanner photographs
 p0047 A80-10173
 Selection of Landsat MSS data for inventories of earth resources
 p0047 A80-10876
 New technology for mapping: Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978
 p0027 A80-11695
 Advances in digital image display and simulation from digital terrain data bases
 p0047 A80-11696
 The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications
 p0027 A80-11699
 Concept for the automatic registration of satellite images with a digital map data base
 p0027 A80-11701
 Integration of LANDSAT CCT data and digital terrain data in cartographic application
 p0027 A80-11703
 Plant canopy information extraction from composite scene reflectance of row crops
 p0001 A80-13141
 Computer graphic feature analysis and selection --- for viewing parallelepipeds in 3-d space
 p0047 A80-13358
 Feature selection via entropy minimization - An example using Landsat satellite data
 p0048 A80-14047
 A study of moisture conditions in the Pantanal of Brazil using satellite imagery
 p0041 A80-15055
 Standardization of cartographic field and aerial and space photography data for automatic map generation
 p0028 A80-15182
- Digital analysis of radar imagery for vegetation detection in Nigeria
 p0004 A80-15780
 The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java
 p0048 A80-15781
 Remote-sensing studies of taiga regions --- Russian book
 p0053 A80-16559
 Mapping the soil cover of taiga landscapes by remote sensing techniques
 p0004 A80-16565
 Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography
 p0004 A80-16566
 Earth feature identification and tracking technology development
 p0028 A80-17403
 Array technology as applied to future earth resources sensors
 p0054 A80-17463
 Digital processing of aerial images: Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979
 p0049 A80-17514
 Geometric preprocessing of sensor data used for image matching
 p0054 A80-17515
 Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos
 p0023 A80-20025
 A suggested method for delimiting urbanized areas using digital Landsat data
 p0024 A80-20246
 The PDS differential rectifier - An economical approach to digital orthophotos
 p0054 A80-20250
 Satellite snow-cover observations in Arizona
 p0041 A80-20264
 Multiple-frame, full resolution Landsat mosaicking to standard map projections
 p0048 A80-20269
 Processing and display techniques for multispectral satellite imagery
 [AD-A072509] p0050 N80-11534
 Digital processing procedure for texture analysis with remote sensing data
 p0050 N80-12505
 Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- Colorado and Washington
 [E80-10009] p0008 N80-13588
 Earth observations division Earth resources data analysis capabilities
 [E80-10013] p0050 N80-13592
 The Geoscientific Airborne Remote Sensing Program [BMFT-FB-W-78-31] p0055 N80-13608
 Satellite Remote Sensing: Applications in Agroclimatology and Agrometeorology
 [ESA-SP-1020] p0009 N80-14440
 The Earthnet programme --- for the acquisition and distribution of LANDSAT satellite data
 p0056 N80-14444
 Meteosat and remote sensing application
 p0056 N80-14448
 LACIE registration processing
 p0012 N80-15456
 Acquisition and preprocessing of LANDSAT data
 p0013 N80-15461
 LACIE data-handling techniques
 p0013 N80-15463
 The classification and mensuration subsystem --- wheat
 p0013 N80-15485
 Concepts leading to the IMAGE-100 hybrid interactive system
 p0014 N80-15486
 USDA analyst review of the LACIE IMAGE-100 hybrid system test
 p0014 N80-15487
 Cartography: LACIE's spatial processor
 p0015 N80-15474
 The LACIE data bases: Design considerations
 p0015 N80-15475
 LACIE/ERIPS software system summary
 p0015 N80-15477
 Considerations for design of future research and development interactive image analysis systems
 p0050 N80-15478
 Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks
 p0015 N80-15479
 Cost and performance characteristics of data system configurations for processing remotely sensed data
 p0015 N80-15481
 On the clustering of multidimensional pictorial data
 p0050 N80-15493
 Signature extension methods in crop area estimation
 p0018 N80-15501
 Colorimetric consideration of transparencies for a typical LACIE scene
 p0018 N80-15506
 Generation of uniform chromaticity scale imagery from LANDSAT data
 p0018 N80-15507
 Design, implementation, and results of LACIE field research
 p0020 N80-15519
 Functional definition and design of a USDA system
 p0020 N80-15521
 Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature
 [AD-A074439] p0051 N80-15540
- IMAGE RECONSTRUCTION**
 Advances in digital image display and simulation from digital terrain data bases
 p0047 A80-11696
 Integration of LANDSAT CCT data and digital terrain data in cartographic application
 p0027 A80-11703
 Landsat imagery - A cartographic reference base
 p0028 A80-11708
 Digital processing of aerial images: Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979
 p0049 A80-17514

SUBJECT INDEX

The PDS differential rectifier - An economical approach to digital orthophotos p0054 A80-20250

IMAGE RESOLUTION
 The SPOT remote sensing satellite - Assessment of the geometric quality of the images p0047 A80-11704
 Latin American experiences in utilizing satellite imagery for cartographic purposes p0027 A80-11705
 Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos p0023 A80-20025
 Using airborne radiometry to determine atmospheric effects in Landsat data p0054 A80-20244
 Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258
 Satellite snow-cover observations in Arizona p0041 A80-20264

IMAGING TECHNIQUE
 Aims and tasks of the aircraft test program p0055 N80-12468

IMAGING TECHNIQUES
 Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876
 Proposed parameters for an automated mapping satellite /MAPSAT/ system p0027 A80-11698
 Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture p0001 A80-11708
 Look direction modulation function of the radar backscattering coefficient of agricultural fields p0002 A80-13357
 Computer graphic feature analysis and selection --- for viewing parallelepipeds in 3-d space p0047 A80-13358
 Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467
 Image and numerical display aids for manual interpretation p0051 N80-15508

INDIA
 Remote sensing applications in developing countries p0057 A80-15771
 Some applications of remote sensing in agricultural resources with reference to India p0003 A80-15776
 The contribution of Landsat imagery to reconnaissance soil mapping in north-west India p0003 A80-15777
 Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium p0011 N80-15448
 A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511

INDIAN OCEAN
 India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' --- microwave radiometer p0053 A80-15489
 Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446

INDIAN SPACE PROGRAM
 India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' --- microwave radiometer p0053 A80-15489

INDIANA
 Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America p0008 N80-13589
 Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590

INDONESIA
 The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest p0002 A80-15559
 The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java p0048 A80-15781

INDUSTRIAL WASTES
 Research into determining chemical parameters at the surface of the sea by remote sensing p0038 N80-12479

INFESTATION
 Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography p0004 A80-16566
 An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-162434] p0057 N80-11533
 Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops p0006 N80-12497

INFORMATION DISSEMINATION
 Cooperative methods for acquisition of aerial photography p0053 A80-20266
 Earth resources data and information service [GPO-49-530] p0057 N80-11530
 U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed [PB-297442/6] p0044 N80-12547
 The Earthnet programme --- for the acquisition and distribution of LANDSAT satellite data p0056 N80-14444
 The ESA remote sensing program: Present activities and future plans p0058 N80-14449
 LACIE data-handling techniques p0013 N80-15463

The acquisition, storage, and dissemination of LANDSAT and other LACIE support data p0013 N80-15464
 US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain [PB-297931/8] p0051 N80-15547

INFORMATION MANAGEMENT
 Data base design for a worldwide multicrop information system p0020 N80-15522

INFORMATION SYSTEMS
 An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-162434] p0057 N80-11533
 Forest resource information system, phase 3 [E80-10026] p0007 N80-12528
 Texas applications system verification and transfer remote sensing information subsystem: Functional design [E80-10017] p0050 N80-13596
 The Earthnet programme --- for the acquisition and distribution of LANDSAT satellite data p0056 N80-14444
 Economic evaluation: Concepts, selected studies, system costs, and a proposed program p0017 N80-15490
 Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526

INFRARED IMAGERY
 Use of satellite infrared data for geomorphology studies p0041 A80-15054
 Measured emissivity of soils in the southeast United States p0002 A80-15057
 Gulf stream boundary eddies off the east coast of Florida p0036 A80-16247
 Remote sensing methods applied to the solution of the forest fire problem p0004 A80-16567
 Satellite snow-cover observations in Arizona p0041 A80-20264
 The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
 A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery p0039 N80-14663
 Use of thermal infrared and colour infrared imagery to detect crop moisture stress --- Alberta, Canada [E80-10036] p0021 N80-15530
 US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain [PB-297931/8] p0051 N80-15547

INFRARED PHOTOGRAPHY
 Some aspects of determining object coordinates from scanner photographs p0047 A80-10173
 Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593

INFRARED SPECTROMETERS
 Spectrometer for the first Spacelab payload p0054 N80-12034

INLAND WATERS
 Optical methods for investigating oceans and inland basins --- Russian book p0035 A80-10116

INSTRUMENT ORIENTATION
 Orientation problem of SLAR imagery p0049 A80-19923

INTERNAL WAVES
 Observations of internal-wave surface signatures in ASTP photographs p0037 N80-10570

INTERNATIONAL COOPERATION
 The use of space - International cooperation in the area of space applications --- Russian book p0057 A80-16394
 A review of NASA international programs [NASA-TM-80845] p0058 N80-14971

IOWA
 Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549

IRAN
 Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544

IRRADIANCE
 Albedo of vegetated surfaces - Its variability with differing irradiances p0002 A80-15051
 Calculation of the spectral irradiance in spaceborne photography of the earth p0005 A80-20195

ISLANDS
 Volcanic landforms and astroblemes p0032 N80-10551

ISRAEL
 Evaluation of satellite images of the Levantine Rift zone p0031 N80-10542
 Analysis of Skylab and astp photographs of the Levantine (Dead Sea) fault zone p0031 N80-10543

ITALY
 Monitoring of euphotic depth from aircraft p0041 A80-15056

LAND MANAGEMENT

An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy p0028 A80-20253
 Volcanic landforms and astroblemes p0032 N80-10551
 Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523
 Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598
 Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project [E80-10020] p0045 N80-15447

K

KALUHARI BASIN (AFRICA)
 Remote sensing of Playa lakes as a source of climatic data p0042 A80-20245

KANSAS
 Estimating leaf-area index of wheat with Landsat data p0002 A80-15053
 A study of the tolerance block approach to special stratification --- winter wheat in Kansas [E80-10027] p0008 N80-12529
 Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
 Large Area Crop Inventory Experiment (LACIE). List spectral keys study --- Kansas [E80-10012] p0008 N80-13591
 Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595

KUWAIT
 Color of desert surfaces in the Arabian peninsula p0033 N80-10558

L

LAKE ERIE
 Impact of Great Lakes water level fluctuations on coastal wetlands [PB-296403/9] p0043 N80-10590

LAKE HURON
 Impact of Great Lakes water level fluctuations on coastal wetlands [PB-296403/9] p0043 N80-10590

LAKE ICE
 Passive microwave studies of frozen lakes p0042 A80-20247

LAKE MICHIGAN
 Impact of Great Lakes water level fluctuations on coastal wetlands [PB-296403/9] p0043 N80-10590

LAKES
 Optical methods for investigating oceans and inland basins --- Russian book p0035 A80-10116
 Monitoring of euphotic depth from aircraft p0041 A80-15056
 Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-16560
 Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography p0028 A80-16561
 Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data p0042 A80-20243
 Remote sensing of Playa lakes as a source of climatic data p0042 A80-20245
 Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547
 Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556
 Detection of arctic water supplies with geophysical techniques [AD-A072157] p0043 N80-11538

LAND MANAGEMENT
 Examples of aerial photo-interpretation in soil surveys for an agricultural land development project in north-east Brazil p0003 A80-15560
 A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area /Lesotho/ p0003 A80-15775
 The contribution of Landsat imagery to reconnaissance soil mapping in north-west India p0003 A80-15777
 Land use mapping in the Sahel zone using Landsat p0023 A80-15782

LAND USE

The use of Landsat imagery to monitor desert encroachment in arid areas p0024 A80-20241
 Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259
 The application of remote sensing techniques for the enforcement of the Michigan Sand Dune Management and Protection Act p0023 A80-20263
 On measurements from aircraft --- conference, Hanover, 29-31 August 1977 p0050 N80-12467
 [BMFT-FB-W-78-04] p0050 N80-12467
 The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445

LAND USE
 The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications p0027 A80-11699
 Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture p0001 A80-11708
 Interactive analysis methods for resource mapping p0028 A80-11709
 Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792
 Remote sensing applications in developing countries p0057 A80-15771
 Some examples of the use of satellite imagery /Landsat/ for natural resource mapping in Western Sudan p0048 A80-15772
 Some applications of remote sensing in agricultural resources with reference to India p0003 A80-15776
 The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java p0048 A80-15781
 Land use mapping in the Sahel zone using Landsat p0023 A80-15782
 Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data p0042 A80-20243
 A suggested method for delimiting urbanized areas using digital Landsat data p0024 A80-20246
 Compositing natural resource and land use information in Spearfish, South Dakota - A land capability study p0024 A80-20255
 The integration of Landsat with other natural resource data for 208 water quality planning in South Dakota p0041 A80-20261
 LANDSAT project, State of Hawaii: A preliminary report [PB-296712/3] p0057 N80-10587
 Remote sensing applied to agricultural resources. Citations from the international aerospace abstracts data base [NTIS/PS-79/0733/0] p0006 N80-10588
 Land cover classification from Landsat data: Phase 3 of a joint DOE/NASA demonstration [AD-A071723] p0024 N80-11535
 Study in remote sensing for land use [AD-A071802] p0024 N80-11537
 Interpretation of IR and MSS data for town areas p0025 N80-12485
 Digital processing procedure for texture analysis with remote sensing data p0050 N80-12505
 The determination of land usages for planning and cartography p0025 N80-12517
 TELLUS newsletter 1 --- Beauce, France [E80-10029] p0008 N80-12531
 Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589
 Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595
 Remote sensing applied to urban and regional planning. A bibliography with abstracts [NTIS/PS-79/0842/1] p0025 N80-13615
 The mapping of important farmland using remote sensor and socio-economic variables --- Ontario County, New York p0009 N80-14424
 The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445
 Ancillary data acquisition for LACIE p0013 N80-15462
 On the clustering of multidimensional pictorial data p0050 N80-15493
 Data base design for a worldwide multicrop information system p0020 N80-15522
 Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526
 Remote sensing of agricultural resources. A bibliography with abstracts [NTIS/PS-79/0993/0] p0021 N80-15542

LANDFORMS

ASTP photographs of southeastern Angola p0033 N80-10557

LARGE AREA CROP INVENTORY EXPERIMENT
 An assessment of LACIE and related methodologies for conducting crop inventories p0004 A80-15783
 A study of the tolerance block approach to special stratification --- winter wheat in Kansas [E80-10027] p0008 N80-12529
 Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589
 Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
 Large Area Crop Inventory Experiment (LACIE). List spectral keys study --- Kansas [E80-10012] p0008 N80-13591
 Earth observations division Earth resources data analysis capabilities [E80-10013] p0050 N80-13592
 Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593
 Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594
 Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595
 Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030] p0011 N80-15448
 Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449
 Econometric models for predicting confusion crop ratios p0011 N80-15450
 LACIE sampling design p0011 N80-15451
 LACIE area sampling frame and sample selection p0012 N80-15452
 LACIE large area acreage estimation --- United States of America p0012 N80-15453
 Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts --- wheat p0012 N80-15454
 Classification and mensuration of LACIE segments p0012 N80-15455
 LACIE registration processing p0012 N80-15456
 Development of LACIE CCEA-1 weather/wheat yield models --- regression analysis p0012 N80-15457
 Growth stage estimation --- crop calendars p0012 N80-15458
 Accuracy assessment: The statistical approach to performance evaluation in LACIE --- Great Plains corridor, United States p0013 N80-15459
 Manual interpretation of LANDSAT data p0013 N80-15460
 Acquisition and preprocessing of LANDSAT data p0013 N80-15461
 Ancillary data acquisition for LACIE p0013 N80-15462
 LACIE data-handling techniques p0013 N80-15463
 The acquisition, storage, and dissemination of LANDSAT and other LACIE support data p0013 N80-15464
 The classification and mensuration subsystem --- wheat p0013 N80-15465
 Concepts leading to the IMAGE-100 hybrid interactive system p0014 N80-15466
 USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467
 Operation of the yield estimation subsystem p0014 N80-15468
 The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports p0014 N80-15469
 LACIE status and tracking p0014 N80-15470
 LACIE quality assurance p0014 N80-15471
 Accuracy assessment system and operation p0014 N80-15472
 LACIE applications evaluation system efficiency report p0015 N80-15473
 Cartography: LACIE's spatial processor p0015 N80-15474
 The LACIE data bases: Design considerations p0015 N80-15475
 Man-machine interfaces in LACIE/ERIPS p0015 N80-15476
 LACIE/ERIPS software system summary p0015 N80-15477
 Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks p0015 N80-15479
 A look at computer system selection criteria p0015 N80-15480
 Cost and performance characteristics of data system configurations for processing remotely sensed data p0015 N80-15481

The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482
 Application of LANDSAT digital data for monitoring drought --- South Dakota p0016 N80-15483
 LACIE area, yield, and production estimate characteristics: U.S. Great Plains p0016 N80-15484
 LACIE area, yield, and production estimate characteristics: U.S.S.R. p0016 N80-15485
 LACIE area, yield, and production estimate characteristics: Canada p0016 N80-15486
 Accuracy and performance of LACIE area estimates --- wheat yield in the U.S. Great Plains States p0016 N80-15487
 Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
 Accuracy and performance of LACIE crop development models p0016 N80-15489
 Economic evaluation: Concepts, selected studies, system costs, and a proposed program p0017 N80-15490
 Methods for segment wheat area estimation p0017 N80-15491
 Estimating crop proportions from remotely sensed data p0017 N80-15492
 On evaluating clustering procedures for use in classification p0017 N80-15494
 CLASSY: An adaptive maximum likelihood clustering algorithm p0051 N80-15495
 Linear feature selection with applications p0051 N80-15496
 Development of partitioning as an aid to spectral signature extension p0017 N80-15499
 Methods of extending crop signatures from one area to another p0017 N80-15500
 Signature extension methods in crop area estimation p0018 N80-15501
 An evaluation of procedure 1 p0018 N80-15502
 The vegetative index number and crop identification p0018 N80-15503
 Manual LANDSAT data analysis for crop type identification p0018 N80-15504
 LACIE analyst interpretation keys p0018 N80-15505
 Colorimetric consideration of transparencies for a typical LACIE scene p0018 N80-15506
 Generation of uniform chromaticity scale imagery from LANDSAT data p0018 N80-15507
 Image and numerical display aids for manual interpretation p0051 N80-15508
 A programmed labeling approach to image interpretation p0019 N80-15509
 Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510
 A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511
 The law of the minimum and an application to wheat yield estimation p0019 N80-15512
 CCEA second-generation wheat yield model for hard red wheat in North Dakota p0019 N80-15513
 Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514
 New developments in sampling and aggregation for remotely sensed surveys p0019 N80-15515
 Natural sampling strategy p0019 N80-15516
 Multiyear estimates for the LACIE sampling plans p0019 N80-15517
 Weighted aggregation p0020 N80-15518
 Design, implementation, and results of LACIE field research p0020 N80-15519
 The application test system: An approach to technology transfer --- USDA aerospace and remote sensing information requirements p0020 N80-15520
 Functional definition and design of a USDA system p0020 N80-15521
 Data base design for a worldwide multicrop information system p0020 N80-15522
 The application test system: Technical approach and system design p0020 N80-15523
 Resource modeling: A reality for program cost analysis p0020 N80-15524
 The application test system: Experiences to date and future plans p0020 N80-15525
 Analysis of scanner data for crop inventories --- North Dakota [E80-10040] p0021 N80-15534
 Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549

LASER APPLICATIONS
 Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546

LASER RANGE FINDERS
 Recording the contour of a region with an airborne laser profilograph p0028 A80-20200

LASERS
 Operating scenario for a Hydrographic Airborne Laser Sounder (HALS) [AD-A073872] p0038 N80-14390

LAW (JURISPRUDENCE)
 A multispectral look at oil pollution detection monitoring and law enforcement [NASA-TM-80573] p0025 N80-12622

SUBJECT INDEX

LEAST SQUARES METHOD
 Multiyear estimates for the LACIE sampling plans p0019 N80-15517

LEBANON
 Evaluation of satellite images of the Levantine Rift zone p0031 N80-10542
 Analysis of Skylab and astp photographs of the Levantine (Dead Sea) fault zone p0031 N80-10543

LEGUMINOUS PLANTS
 The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445

LESOTHO
 A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area / Lesotho/ p0003 A80-15775

LIBYA
 The use of Landsat imagery to monitor desert encroachment in arid areas p0024 A80-20241
 Volcanic landforms and astroblemes p0032 N80-10551
 Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556

LIGNITE
 Terrestrial aerial photogrammetric surveying of large open pit mines in the Rhein lignite district p0031 A80-14373

LIMNOLOGY
 Optical methods for investigating oceans and inland basins --- Russian book p0035 A80-10116
 Remote sensing of Playa takes as a source of climatic data p0042 A80-20245
 Passive microwave studies of frozen lakes p0042 A80-20247

LITHOLOGY
 Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Golfield test areas, Nevada [E80-10035] p0034 N80-15529

LITTORAL DRIFT
 Use of Apollo-Soyuz photographs in coastal studies p0037 N80-10573

LUXEMBOURG
 Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523
 Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598

M

MAGNETIC ANOMALIES
 The reduction and analysis of satellite magnetometer data p0054 A80-18774

MAGNETIC SIGNATURES
 The reduction and analysis of satellite magnetometer data p0054 A80-18774

MAGNETIC VARIATIONS
 Geodynamics from satellites [AAS PAPER 79-243] p0031 A80-16427

MALTA
 Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565

MAN ENVIRONMENT INTERACTIONS
 Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526

MAN MACHINE SYSTEMS
 Man-machine interfaces in LACIE/ERIPS p0015 N80-15476
 Considerations for design of future research and development: interactive image analysis systems p0050 N80-15478
 Signature extension methods in crop area estimation p0018 N80-15501

MANAGEMENT METHODS
 LACIE quality assurance p0014 N80-15471
 Resource modeling: A reality for program cost analysis p0020 N80-15524

MANAGEMENT PLANNING
 The application test system: Experiences to date and future plans p0020 N80-15525

MAPPING
 Proposed parameters for an automated mapping satellite /MAPSAT/ system p0027 A80-11698
 Concept for the automatic registration of satellite images with a digital map data base p0027 A80-11701
 The practical contribution of space imagery to topographical mapping p0027 A80-11702
 Integration of LANDSAT CCT data and digital terrain data in cartographic application p0027 A80-11703
 Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture p0001 A80-11708
 Interactive analysis methods for resource mapping p0028 A80-11709
 Multispectral aerial photography for wetland vegetation mapping p0049 A80-19542

The determination of land usages for planning and cartography p0025 N80-12517
 Earth observations division Earth resources data analysis capabilities p0050 N80-13592
 [E80-10013] SPOT, French preoperational remote sensing satellite system p0056 N80-13610
 Cartography: LACIE's spatial processor p0015 N80-15474

MAPS
 Latin American experiences in utilizing satellite imagery for cartographic purposes p0027 A80-11705
 Landsat imagery - A cartographic reference base p0028 A80-11706
 Standardization of cartographic field and aerial and space photography data for automatic map generation p0028 A80-15182
 Some examples of the use of satellite imagery /Landsat/ for natural resource mapping in Western Sudan p0048 A80-15772
 The National Map Accuracy Standards in the context of mapping with imagery data p0049 A80-20252

MARINE BIOLOGY
 Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
 Impact of Great Lakes water level fluctuations on coastal wetlands [PB-296403/9] p0043 N80-10590

MARINE ENVIRONMENTS
 Inexpensive radar mapping by Ericsson Star p0047 A80-11190

MARINE ENVIRONMENTS
 Visual observations over oceans p0036 N80-10563
 International Decade of Ocean Exploration, volume 7 --- information on oceanography programs dealing with marine environments [NOAA-S/T-78-211-VOL-7] p0039 N80-15772

MARINE METEOROLOGY
 SEASAT: Gulf of Alaska experiment. Surface truth data inventory [PB-294816] p0038 N80-12546

MARINE METEOROLOGY
 India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' --- microwave radiometer p0053 A80-15489

MARINE RESOURCES
 Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey p0035 A80-20260
 International Decade of Ocean Exploration, volume 7 --- information on oceanography programs dealing with marine environments [NOAA-S/T-78-211-VOL-7] p0039 N80-15772

MARITIME SATELLITES
 New developments in satellite oceanography and current measurements p0035 A80-10731

MARSHLAND
 Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-16560

MARSHLANDS
 The application of Landsat-MSS-imagery for agricultural planning in tropical rain and swamp forest zones p0002 A80-14375
 Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792
 Remote-sensing studies of taiga regions --- Russian book p0053 A80-16559
 Use of Apollo-Soyuz photographs in coastal studies p0037 N80-10573

MARYLAND
 Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526

MASSACHUSETTS
 Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 N80-10567

MATHEMATICAL MODELS
 Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data p0055 N80-12533
 Accuracy and performance of LACIE crop development models p0016 N80-15489
 CLASSY: An adaptive maximum likelihood clustering algorithm p0051 N80-15495
 Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510
 A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511
 The law of the minimum and an application to wheat yield estimation p0019 N80-15512
 CCEA second-generation wheat yield model for hard red wheat in North Dakota p0019 N80-15513
 Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514
 Resource modeling: A reality for program cost analysis p0020 N80-15524

MAXIMUM LIKELIHOOD ESTIMATES
 CLASSY: An adaptive maximum likelihood clustering algorithm p0051 N80-15495

MINERAL DEPOSITS
 Multiyear estimates for the LACIE sampling plans p0019 N80-15517

MEASURE AND INTEGRATION
 Classification and mensuration of LACIE segments p0012 N80-15455

MEDITERRANEAN SEA
 Antipodal seas --- astronaut observation of ocean features p0036 N80-10564
 Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565
 Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527

MEGALOPOLISES
 Assessment of the urban heat island effect through the use of satellite data p0023 A80-15556

MESOSCALE PHENOMENA
 A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery [AD-A074186] p0039 N80-14663
 Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project [E80-10020] p0045 N80-15447

METEORITE CRATERS
 Riechao Ring, Brazil: A possible meteorite crater discovered by the Apollo astronauts p0032 N80-10552

METEORITIC DAMAGE
 Volcanic landforms and astroblemes p0032 N80-10551

METEOROLOGICAL PARAMETERS
 Overview of agrometeorology --- influence of meteorological parameters on crop growth p0009 N80-14441
 Crop environment monitoring: The assessment of environmental phenomena using satellite remote sensing data p0010 N80-14454

METEOROLOGY
 Apollo-Soyuz test project. Volume 2: Earth observations and photography [NASA-SP-412-VOL-2] p0049 N80-10538
 Summary of significant results p0049 N80-10539
 French space programs p0058 N80-14165

METEOSAT SATELLITE
 Meteosat and remote sensing application p0056 N80-14448

MEXICO
 Volcanic landforms and astroblemes p0032 N80-10551

MICHIGAN
 A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248
 The application of remote sensing techniques for the enforcement of the Michigan Sand Dune Management and Protection Act p0023 A80-20263

MICRODIFFUSIOMETERS
 The PDS differential rectifier - An economical approach to digital orthophotos p0054 A80-20250

MICROPROCESSORS
 Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431

MICROWAVE EMISSION
 Microwave radiometric methods and the problem of forest and peat fires p0002 A80-14580
 Passive microwave studies of frozen lakes p0042 A80-20247

MICROWAVE IMAGERY
 Remote sensing methods applied to the solution of the forest fire problem p0004 A80-16567

MICROWAVE RADIOMETERS
 Airborne semiconductor radiometers p0053 A80-14196
 Microwave radiometric methods and the problem of forest and peat fires p0002 A80-14580
 India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' --- microwave radiometer p0053 A80-15489
 Interim calibration report for the SMMR simulator [NASA-TM-80564] p0055 N80-12534
 Possible methods for distinguishing icebergs from ships by aerial remote sensing [NASA-TM-79310] p0056 N80-15538

MILITARY AIR FACILITIES
 Study in remote sensing for land use [AD-A071802] p0024 N80-11537

MILLET
 The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445

MINERAL DEPOSITS
 Preliminary analysis of color variations of sand deposits in the western desert of Egypt p0032 N80-10555
 Detection of a probable ancestral delta of the Nile River p0033 N80-10571
 LANDSAT project, State of Hawaii: A preliminary report [PB-296712/3] p0057 N80-10587
 Remote sensing applied to geology and mineralogy. A bibliography with abstracts [NTIS/PS-79/0844/5] p0034 N80-13612

MINERAL EXPLORATION

- SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-182423] p0038 N80-11532
- Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Goldfield test areas, Nevada [E80-10035] p0034 N80-15529
- MINE (EXCAVATION)**
- Terrestrial aerial photogrammetric surveying of large open pit mines in the Rhein lignite district p0031 A80-14373
- MINIMA**
- The law of the minimum and an application to wheat yield estimation p0019 N80-15512
- MINING**
- The application of remote sensing techniques for the enforcement of the Michigan Sand Dune Management and Protection Act p0023 A80-20263
- SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-182423] p0038 N80-11532
- MINNESOTA**
- Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data p0042 A80-20243
- Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520
- Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589
- Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
- Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594
- Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595
- Econometric models for predicting confusion crop ratios p0011 N80-15450
- Manual interpretation of LANDSAT data p0013 N80-15460
- MISSISSIPPI DELTA (LA)**
- Estimate of total reflectance from the Orinoco River outflow --- from Apollo Soyuz Test Project photographs p0037 N80-10569
- MISSOURI**
- A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248
- Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri [E80-10025] p0044 N80-12527
- MISSOURI RIVER (UD)**
- Use of satellite infrared data for geomorphology studies p0041 A80-15054
- MOISTURE**
- Remote sensing applied to agricultural resources. Citations from the international aerospace abstracts data base [NTIS/PS-79/0733/0] p0006 N80-10588
- MOISTURE CONTENT**
- Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation --- Russian book p0041 A80-10125
- A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring p0003 A80-20267
- Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
- TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach [E80-10023] p0007 N80-12526
- MOJAVE DESERT**
- Multiple-frame, full resolution Landsat mosaicking to standard map projections p0048 A80-20269
- MONSOONS**
- Satellite remote sensing in hazard monitoring and disaster evaluation p0011 N80-14456
- MONTANA**
- Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589
- Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
- Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594

- Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595
- Econometric models for predicting confusion crop ratios p0011 N80-15450
- MONTENEGRIN (CA)**
- Chlorophyll gradient map from high-altitude ocean-color-scanner data p0035 A80-13129
- MOZAIC**
- Multiple-frame, full resolution Landsat mosaicking to standard map projections p0048 A80-20269
- MOUNTAINS**
- Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography p0028 A80-18561
- Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blancha area, South Australia --- identification of folds, faults, and lineaments p0032 N80-10550
- Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 A80-10559
- Snow hydrology studies p0043 N80-10575
- Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524
- MULTISPECTRAL BAND SCANNERS**
- Thematic mapper design description and performance prediction p0053 A80-17460
- Multispectral Resource Sampler - An experimental satellite sensor for the mid-1980s p0053 A80-17462
- Array technology as applied to future earth resources sensors p0054 A80-17463
- The multispectral scanner as an instrument for signature determinations p0055 N80-12515
- MULTISPECTRAL PHOTOGRAPHY**
- Multispectral aerial photography for wetland vegetation mapping p0049 A80-19542
- Analysis of plant community structure and successional stage using multispectral and multitemporal photography --- in Rock Creek Park, Washington, D.C. p0005 A80-20238
- Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549
- MULTIVARIATE STATISTICAL ANALYSIS**
- CLASSY: An adaptive maximum likelihood clustering algorithm p0051 N80-15495
- An evaluation of procedure 1 p0018 N80-15502

N

NATURAL GAS

- SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-182423] p0038 N80-11532
- NEBRASKA**
- Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
- Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595
- NEPAL**
- The use of remote sensing for transport planning and highway engineering in developing countries p0023 A80-15774
- Some applications of remote sensing in agricultural resources with reference to India p0003 A80-15776
- NETHERLANDS**
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598
- NEVADA**
- Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Goldfield test areas, Nevada [E80-10035] p0034 N80-15529
- NEW ENGLAND (US)**
- Assessment of the urban heat island effect through the use of satellite data p0023 A80-15556
- NEW JERSEY**
- Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey p0035 A80-20260

- Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526
- NEW YORK**
- Assessment of the urban heat island effect through the use of satellite data p0023 A80-15556
- A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248
- The mapping of important farmland using remote sensor and socio-economic variables --- Ontario County, New York p0009 N80-14424
- NEW ZEALAND**
- Snow hydrology studies p0043 N80-10575
- NIGERIA**
- Problems of remote sensing in the tropics - An appraisal of the Nigerian situation with regard to forest resources p0004 A80-15779
- Digital analysis of radar imagery for vegetation detection in Nigeria p0004 A80-15780
- NIGHT**
- Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Cachment, north west of London, U.K. [E80-10006] p0044 N80-12522
- NIMBUS SATELLITE**
- Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543
- NIMBUS 5 SATELLITE**
- A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data p0042 A80-20194
- NOISE POLLUTION**
- Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts [NTIS/PS-79/0842/9] p0025 N80-13614
- NORTH AMERICA**
- An assessment of LACIE and related methodologies for conducting crop inventories p0004 A80-15783
- SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-182423] p0038 N80-11532
- Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524
- Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589
- Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030] p0011 N80-15448
- The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482
- NORTH DAKOTA**
- Use of satellite infrared data for geomorphology studies p0041 A80-15054
- Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589
- Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
- Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593
- Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594
- Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595
- Econometric models for predicting confusion crop ratios p0011 N80-15450
- Manual interpretation of LANDSAT data p0013 N80-15460
- CCEA second-generation wheat yield model for hard red wheat in North Dakota p0019 N80-15513
- Analysis of scanner data for crop inventories --- North Dakota [E80-10040] p0021 N80-15534
- NORTH SEA**
- SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-182423] p0038 N80-11532
- NUTRITIONAL REQUIREMENTS**
- Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops p0006 N80-12497

O

OATS

- Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops p0006 N80-12497
 Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593

OCEAN BOTTOM

- Geophysics, astronomy and space, no. 450 [JPRS-73946] p0033 N80-11527
 International Decade of Ocean Exploration, volume 7 --- information on oceanography programs dealing with marine environments [NOAA-S/T-78-211-VOL-7] p0039 N80-15772

OCEAN CURRENTS

- New developments in satellite oceanography and current measurements p0035 A80-10731
 Antipodal seas --- astronaut observation of ocean features p0036 A80-10564
 Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565
 Long-term tracking of arctic icebergs [AD-A072473] p0037 N80-10583

OCEAN DATA ACQUISITIONS SYSTEMS

- Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467
 The structure and variability of shelf sea fronts as observed by an undulating CTD system --- Conductivity and Temperature Detector p0035 A80-20938
 Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-airdrop data buoy [AD-A074731] p0039 N80-14664

OCEAN SURFACE

- New developments in satellite oceanography and current measurements p0035 A80-10731
 Inexpensive radar mapping by Ericsson Star p0047 A80-11190
 Use of satellites in polar meteorology p0035 A80-11750
 Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467
 Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar p0036 A80-15893
 The study of the ocean from space --- Russian book p0038 A80-20095
 Summary of significant results p0049 N80-10539
 Determining photograph locations over oceans p0050 N80-10561
 Visual observations over oceans p0036 A80-10563
 Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565
 Observations of internal-wave surface signatures in ASTP photographs p0037 N80-10570
 Research into determining chemical parameters at the surface of the sea by remote sensing p0038 N80-12479
 SEASAT: Gulf of Alaska experiment. Surface truth data inventory p0038 N80-12546
 Overview of remote sensing for agrimatology and agrometeorology p0010 N80-14442
 Meteosat and remote sensing application p0056 N80-14448
 A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery [AD-A074186] p0039 N80-14663
 Ocean wave spectrometer measurements in the gulf stream experiment [AD-A074369] p0039 N80-14665
 Shape of the ocean surface and implications for the Earth's interior. GEOS-3 results [NASA-CR-156859] p0029 N80-15446
 Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543
 Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1] p0039 N80-15603
- OCEAN THERMAL ENERGY CONVERSION**
 Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543
 Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1] p0039 N80-15603
- OCEANOGRAPHIC PARAMETERS**
 Optical methods for investigating oceans and inland basins --- Russian book p0035 A80-10116
 The study of the ocean from space --- Russian book p0036 A80-20095
 The structure and variability of shelf sea fronts as observed by an undulating CTD system --- Conductivity and Temperature Detector p0035 A80-20938
 Antipodal seas --- astronaut observation of ocean features p0036 A80-10564
 Ocean wave spectrometer measurements in the gulf stream experiment [AD-A074369] p0039 N80-14665
- OCEANOGRAPHY**
 Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson p0041 A80-10370

- New developments in satellite oceanography and current measurements p0035 A80-10731
 Chlorophyll gradient map from high-altitude ocean-color-scanner data p0035 A80-13129
 Remote sensing for water quality and biological measurements in coastal waters p0036 A80-19541
 ASTP at Barbados: Mesoscale pools of Amazon River water in the western tropical Atlantic p0037 N80-10568
 Observations of internal-wave surface signatures in ASTP photographs p0037 N80-10570
 On measurements from aircraft --- conference, Hanover, 29-31 August 1977 [BMFT-FB-W-78-04] p0050 N80-12467
 SEASAT: Gulf of Alaska experiment. Surface truth data inventory [PB-294616] p0038 N80-12546
 Operating scenario for a Hydrographic Airborne Laser Sounder (HALS) [AD-A073872] p0038 N80-14390
 Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
 International Decade of Ocean Exploration, volume 7 --- information on oceanography programs dealing with marine environments [NOAA-S/T-78-211-VOL-7] p0039 N80-15772

OCEANS

- Geodynamics from satellites [AAS PAPER 79-243] p0031 A80-16427
 Interpreting ASTP photographs of the ocean and locating the area photographed, case study of the Gulf of Mexico p0036 N80-10562
 Ocean color observations --- by astronauts p0037 N80-10566

OFFSHORE ENERGY SOURCES

- SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-162423] p0038 N80-11532

OIL POLLUTION

- The study of the ocean from space --- Russian book p0036 A80-20095
 A multispectral look at oil pollution detection monitoring and law enforcement [NASA-TM-80573] p0025 N80-12622
 Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts [NTIS/PS-79/0842/9] p0025 N80-13614
- OIL SLECKS**
 Inexpensive radar mapping by Ericsson Star p0047 A80-11190
 Airborne semiconductor radiometers p0053 A80-14196
 A multispectral look at oil pollution detection monitoring and law enforcement [NASA-TM-80573] p0025 N80-12622

OKLAHOMA

- Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
 Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
 Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594
 Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595

OMAN

- Color of desert surfaces in the Arabian peninsula p0033 N80-10558

OPERATING SYSTEMS (COMPUTERS)

- Concepts leading to the IMAGE-100 hybrid interactive system p0014 N80-15466
 USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467
 Operation of the yield estimation subsystem p0014 N80-15468
 LACIE status and tracking p0014 N80-15470

OPTICAL DATA PROCESSING

- Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876

OPTICAL RADAR

- Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546

OREGON

- An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-162434] p0057 N80-11533

ORTHOPHOTOGRAPHY

- The PDS differential rectifier - An economical approach to digital orthophotos p0054 A80-20250
 Cooperative methods for acquisition of aerial photography p0053 A80-20266

OUTLIERS (LANDFORMS)

- Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595

P

PACIFIC OCEAN

- Chlorophyll gradient map from high-altitude ocean-color-scanner data p0035 A80-13129
 Antipodal seas --- astronaut observation of ocean features p0036 A80-10564
 SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-162423] p0038 N80-11532
 Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535
 A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery [AD-A074186] p0039 N80-14663

PANORAMIC CAMERAS

- A light aircraft camera Pod - The Enviro-Pod p0024 A80-20251

PARKS

- Analysis of plant community structure and successional stage using multispectral and multitemp aerial photography --- in Rock Creep Park, Washington, D.C. p0005 A80-20238

PATTERN RECOGNITION

- Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876
 Computer graphic feature analysis and selection --- for viewing parallelepipeds in 3-d space p0047 A80-13358
 Feature selection via entropy minimization - An example using Landsat satellite data p0048 A80-14047
 The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 A80-15778
 Earth feature identification and tracking technology development p0028 A80-17403
 Digital processing of aerial images; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979 p0049 A80-17514
 Geometric preprocessing of sensor data used for image matching p0054 A80-17515
 Multispectral aerial photography for wetland vegetation mapping p0049 A80-19542
 Analysis of plant community structure and successional stage using multispectral and multitemp aerial photography --- in Rock Creep Park, Washington, D.C. p0005 A80-20238
 Spectral reflectance of certain weeds p0004 A80-20754
 Classification of agricultural land with the aid of remote sensing methods p0006 N80-12495
 Aerial photography of agricultural farming land p0006 N80-12496
 Texture analysis as a recognition parameter for different types of forests p0006 N80-12498
 What are the advantages of multispectral classification? --- for crop identification p0007 N80-12501
 Digital processing procedure for texture analysis with remote sensing data p0050 N80-12505
 A study of the tolerance block approach to special stratification --- winter wheat in Kansas [E80-10027] p0008 N80-12529
 Classification and mensuration of LACIE segments p0012 N80-15455
 Manual interpretation of LANDSAT data p0013 N80-15460
 The classification and mensuration subsystem --- wheat p0013 N80-15465
 Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks p0015 N80-15479
 On the clustering of multidimensional pictorial data p0050 N80-15493
 On evaluating clustering procedures for use in classification p0017 N80-15494
 CLASSY: An adaptive maximum likelihood clustering algorithm p0051 N80-15495
 Linear feature selection with applications p0051 N80-15496
 Feature extraction applied to agricultural crops as seen by LANDSAT p0017 N80-15497
 Methods of extending crop signatures from one area to another p0017 N80-15500
 An evaluation of procedure 1 p0018 N80-15502
 LACIE analyst interpretation keys p0018 N80-15505
 Image and numerical display aids for manual interpretation p0051 N80-15508
 A programmed labeling approach to image interpretation p0019 N80-15509
 Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature [AD-A074439] p0051 N80-15540
- PATTERN REGISTRATION**
 Concept for the automatic registration of satellite images with a digital map data base p0027 A80-11701

- Multispectral Resource Sampler - An experimental satellite sensor for the mid-1980s p0053 A80-17462
 LACIE area sampling frame and sample selection p0012 N80-15452
 LACIE registration processing p0012 N80-15456
 Acquisition and preprocessing of LANDSAT data p0013 N80-15461
 Accuracy assessment system and operation p0014 N80-15472
 Cartography: LACIE's spatial processor p0015 N80-15474
 LACIE/ERIPS software system summary p0015 N80-15477
- PEAT**
 Microwave radiometric methods and the problem of forest and peat fires p0002 A80-14580
- PENINSULAS**
 Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar p0038 A80-15893
- PENNSYLVANIA**
 Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526
- PERMAFROST**
 Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-16560
 Detection of arctic water supplies with geophysical techniques [AD-A072157] p0043 N80-11538
- PHENOLOGY**
 Classification of agricultural land with the aid of remote sensing methods p0006 N80-12495
 Phenology as a factor in the determination of different forms in vegetation by remote sensing p0007 N80-12499
 Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589
 Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10011] p0008 N80-13590
 Growth stage estimation --- crop calendars p0012 N80-15458
 Ancillary data acquisition for LACIE p0013 N80-15462
 Application of LANDSAT digital data for monitoring drought --- South Dakota p0016 N80-15483
 Accuracy and performance of LACIE crop development models p0016 N80-15489
 LACIE analyst interpretation keys p0018 N80-15505
 CCEA second-generation wheat yield model for hard red wheat in North Dakota p0019 N80-15513
 Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514
- PHOTO INTERPRETATION**
 Some examples of the use of satellite imagery / Landsat/ for natural resource mapping in Western Sudan p0048 A80-15772
- PHOTO GEOLOGY**
 Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements p0027 A80-10172
 The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory p0048 A80-15773
 The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 A80-15778
 Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography p0028 A80-16561
 American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings p0049 A80-20237
 Remote sensing of Playa lakes as a source of climatic data p0042 A80-20245
 Compositing natural resource and land use information in Spearfish, South Dakota - A land capability study p0024 A80-20255
 Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258
 Educator's guide for Mission to Earth: LANDSAT views the world [NASA-SP-360] p0057 N80-10537
 Apollo-Soyuz test project. Volume 2: Earth observations and photography [NASA-SP-412-VOL-2] p0049 N80-10538
 Summary of significant results p0049 N80-10539
 Geologic analysis of ASTP photographs of parts of southern California p0031 N80-10540
 Evaluation of satellite images of the Levantine Rift zone p0031 N80-10542
 Analysis of Skylab and astp photographs of the Levantine (Dead Sea) fault zone p0031 N80-10543
 Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544
 Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
- Photolineaments in the ASTP stereostrip of the western desert of Egypt p0032 N80-10546
 Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547
 Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images --- identification of folds, faults, and lineaments p0032 N80-10548
 East-West pervasive lineaments in central and southeastern Spain p0032 N80-10549
 Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blanche area, South Australia --- identification of folds, faults, and lineaments p0032 N80-10550
 Volcanic landforms and astroblemes p0032 N80-10551
 Riachao Ring, Brazil: A possible meteorite crater discovered by the Apollo astronauts p0032 N80-10552
 Color zoning in the western desert of Egypt p0024 N80-10553
 ASTP photographs of southeastern Angola p0033 N80-10557
 Color of desert surfaces in the Arabian peninsula p0033 N80-10558
 Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559
 Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560
 Detection of a probable ancestral delta of the Nile River p0033 N80-10571
 Suspended-sediment dispersal patterns of river deltas photographed by ASTP p0043 N80-10572
 Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach [VTT-LU-15] p0054 N80-11547
 On measurements from aircraft --- conference, Hanover, 29-31 August 1977 [BMFT-FB-W-78-04] p0050 N80-12467
 Remote sensing applied to geology and mineralogy. A bibliography with abstracts [NTIS/PS-79/0844/5] p0034 N80-13612
 Remote sensing applied to geology. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0822/1] p0034 N80-13613
 Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
 Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission [E80-10033] p0034 N80-15528
 Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Golfield test areas, Nevada [E80-10035] p0034 N80-15529
- PHOTOGRAMMETRY**
 Some aspects of determining object coordinates from scanner photographs p0047 A80-10173
 New technology for mapping: Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978 p0027 A80-11695
 Terrestrial aerial photogrammetric surveying of large open pit mines in the Rhein lignite district p0031 A80-14373
 Fixed-base large-scale photographs for forest sampling p0005 A80-20024
 Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos p0023 A80-20025
 American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings p0049 A80-20237
 Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data p0042 A80-20243
 Using airborne radiometry to determine atmospheric effects in Landsat data p0054 A80-20244
 A light aircraft camera Pod - The Enviro-Pod p0024 A80-20251
 The National Map Accuracy Standards in the context of mapping with imagery data p0049 A80-20252
 Determining photograph locations over oceans p0050 N80-10561
 Forester's guide to aerial photo interpretation --- timber inventory p0009 N80-14425
 On the use of digital photogrammetric measurements in the compilation of topographic maps [SER-1-ORIGINAL-REPT-76] p0029 N80-14462
 Cartography: LACIE's spatial processor p0015 N80-15474
- PHOTOINTERPRETATION**
 Digital processing of multispectral color aerial photographs of forest land p0001 A80-10171
 Some aspects of determining object coordinates from scanner photographs p0047 A80-10173
 Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876
 Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters p0001 A80-10877
 Plant canopy information extraction from composite scene reflectance of row crops p0001 A80-13141
- Examples of aerial photo-interpretation in soil surveys for an agricultural land development project in north-east Brazil p0003 A80-15660
 A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area / Lesotho/ p0003 A80-15775
 The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java p0048 A80-15781
 Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-16565
 Multispectral aerial photography for wetland vegetation mapping p0049 A80-19542
 Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos p0023 A80-20025
 Spectral classification of tomato disease severity levels p0005 A80-20254
 Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544
 Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
 Photolineaments in the ASTP stereostrip of the western desert of Egypt p0032 N80-10548
 Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547
 Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images --- identification of folds, faults, and lineaments p0032 N80-10548
 East-West pervasive lineaments in central and southeastern Spain p0032 N80-10549
 Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blanche area, South Australia --- identification of folds, faults, and lineaments p0032 N80-10550
 Riachao Ring, Brazil: A possible meteorite crater discovered by the Apollo astronauts p0032 N80-10552
 Color of desert surfaces in the Arabian peninsula p0033 N80-10558
 Determining photograph locations over oceans p0050 N80-10561
 Interpreting ASTP photographs of the ocean and locating the area photographed, case study of the Gulf of Mexico p0036 N80-10562
 Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 N80-10567
 Observations of internal-wave surface signatures in ASTP photographs p0037 N80-10570
 Study in remote sensing for land use [AD-A071802] p0024 N80-11537
 Quantitative determination of morphological structures in sand bank regions from image structure analysis p0033 N80-12482
 Making morphological maps of sand banks from aerial photographs p0033 N80-12483
 Interpretation of water quality using remote sensing techniques p0044 N80-12493
 Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594
 Remote sensing applied to geology. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0822/1] p0034 N80-13613
 Forester's guide to aerial photo interpretation --- timber inventory p0009 N80-14425
 Manual interpretation of LANDSAT data p0013 N80-15460
 On the clustering of multidimensional pictorial data p0050 N80-15493
 Development of partitioning as an aid to spectral signature extension p0017 N80-15499
 Manual LANDSAT data analysis for crop type identification p0018 N80-15504
 A programmed labeling approach to image interpretation p0019 N80-15509
- PHOTOMAPPING**
 Digital processing of multispectral color aerial photographs of forest land p0001 A80-10171
 Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements p0027 A80-10172
 Some aspects of determining object coordinates from scanner photographs p0047 A80-10173
 Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson p0041 A80-10370
 Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876
 Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters p0001 A80-10877
 New technology for mapping: Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978 p0027 A80-11695
 Advances in digital image display and simulation from digital terrain data bases p0047 A80-11696
 Combined Skylab and high altitude aircraft photography space triangulation p0047 A80-11697
 The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications p0027 A80-11699

- Latin American experiences in utilizing satellite imagery for cartographic purposes p0027 A80-11705
Landsat imagery - A cartographic reference base p0028 A80-11706
- Chlorophyll gradient map from high-altitude ocean-color-scanner data p0035 A80-13129
- Wheat spectral reflectance - Interactions between crop configuration, sun elevation, and azimuth angle p0001 A80-13136
- Terrestrial aerial photogrammetric surveying of large open pit mines in the Rhain lignite district p0031 A80-14373
- The application of Landsat-MSS-imagery for agricultural planning in tropical rain and swamp forest zones p0002 A80-14375
- Standardization of cartographic field and aerial and space photography data for automatic map generation p0028 A80-15182
- The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest p0002 A80-15559
- Remote sensing applications in developing countries p0057 A80-15771
- Some examples of the use of satellite imagery / Landsat/ for natural resource mapping in Western Sudan p0048 A80-15772
- The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory p0048 A80-15773
- Some applications of remote sensing in agricultural resources with reference to India p0003 A80-15776
- The contribution of Landsat imagery to reconnaissance soil mapping in north-west India p0003 A80-15777
- The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 A80-15778
- The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java p0048 A80-15781
- Land use mapping in the Sahel zone using Landsat p0023 A80-15782
- An assessment of LACIE and related methodologies for conducting crop inventories p0004 A80-15783
- The use of space - International cooperation in the area of space applications --- Russian book p0057 A80-16394
- Remote-sensing studies of taiga regions --- Russian book p0053 A80-16559
- Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-16560
- Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography p0028 A80-16561
- System of landscape-statistical methods for stocktaking and mapping of forests p0004 A80-16562
- Remote identification of the spatial structure of forest phytocoenoses p0004 A80-16563
- Principals of mapping hydrological parameters from natural systems, using satellite photography p0042 A80-16564
- Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-16565
- Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography p0004 A80-16566
- Digital processing of aerial images: Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979 p0049 A80-17514
- Geometric preprocessing of sensor data used for image matching p0054 A80-17515
- Calculation of the spectral irradiance in spaceborne photography of the earth p0005 A80-20195
- American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings p0049 A80-20237
- Analysis of plant community structure and successional stage using multispectral and multitemporal aerial photography --- in Rock Creep Park, Washington, D.C. p0005 A80-20238
- Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
- The use of Landsat imagery to monitor desert encroachment in arid areas p0024 A80-20241
- Mapping of chlorophyll *a* concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data p0042 A80-20243
- Using airborne radiometry to determine atmospheric effects in Landsat data p0054 A80-20244
- Spectral vegetation relationships in a tropical rain forest p0005 A80-20249
- An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy p0028 A80-20253
- Compositing natural resource and land use information in Spearfish, South Dakota - A land capability study p0024 A80-20255
- Mapping vegetation with low cover density from Landsat data p0006 A80-20257
- Application of multitemporal photography and remote sensing data to environmental monitoring in the State of Washington p0048 A80-20265
- Cooperative methods for acquisition of aerial photography p0053 A80-20266
- Multiple-frame, full resolution Landsat mosaicking to standard map projections p0048 A80-20269
- Educator's guide for Mission to Earth: LANDSAT views the world [NASA-SP-360] p0057 N80-10537
- Apollo-Soyuz test project. Volume 2: Earth observations and photography [NASA-SP-412-VOL-2] p0049 N80-10538
- Summary of significant results p0049 N80-10539
- Evaluation of satellite images of the Levantine Rift zone p0031 N80-10542
- Analysis of Skylab and astp photographs of the Levantine (Dead Sea) fault zone p0031 N80-10543
- Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
- Photolineaments in the ASTP stereostrip of the western desert of Egypt p0032 N80-10546
- Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547
- Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images --- identification of folds, faults, and lineaments p0032 N80-10548
- Color zoning in the western desert of Egypt p0024 N80-10553
- Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556
- Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560
- Determining photograph locations over oceans p0050 N80-10561
- Interpreting ASTP photographs of the ocean and locating the area photographed, case study of the Gulf of Mexico p0036 N80-10562
- Visual observations over oceans p0036 N80-10563
- Ocean color observations --- by astronauts p0037 N80-10566
- Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 N80-10567
- South American river morphology and hydrology p0043 N80-10574
- Snow hydrology studies p0043 N80-10575
- LANDSAT project, State of Hawaii: A preliminary report [PB-296712/3] p0057 N80-10587
- Making morphological maps of sand banks from aerial photographs p0033 N80-12483
- Remote sensing applied to geology. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0822/1] p0034 N80-13613
- Remote sensing applied to urban and regional planning. A bibliography with abstracts [NTIS/PS-79/0843/7] p0025 N80-13615
- Forester's guide to aerial photo interpretation --- timber inventory p0009 N80-14425
- On the use of digital photogrammetric measurements in the compilation of topographic maps [SER-1-ORIGINAL-REPT-76] p0029 N80-14462
- Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data [NASA-TP-1553] p0021 N80-15535
- Remote sensing of agricultural resources. A bibliography with abstracts [NTIS/PS-79/0993/0] p0021 N80-15542
- PHOTOMAP**
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacacraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain [PB-297931/8] p0051 N80-15547
- PLAIN**
Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524
- Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018] p0009 N80-13597
- PLAINTON**
Monitoring of euphotic depth from aircraft p0041 A80-15056
- Remote sensing for water quality and biological measurements in coastal waters p0036 A80-19541
- Ocean color observations --- by astronauts p0037 N80-10566
- On the problem of the remote sensing of substances in water by multispectral scanning p0043 N80-12478
- PLANTS (BOTANY)**
Analysis of plant community structure and successional stage using multispectral and multitemporal aerial photography --- in Rock Creep Park, Washington, D.C. p0005 A80-20238
- Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
- Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey p0035 A80-20260
- Spectral reflectance of certain weeds p0004 A80-20754
- Impact of Great Lakes water level fluctuations on coastal wetlands [PB-296403/9] p0043 N80-10590
- Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- Use of thermal infrared and colour infrared imagery to detect crop moisture stress --- Alberta, Canada [E80-10036] p0021 N80-15530
- PLATEAU**
Use of satellite infrared data for geomorphology studies p0041 A80-15054
- Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560
- Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524
- PODS (EXTERNAL STORED)**
A light aircraft camera Pod - The Enviro-Pod p0024 A80-20251
- POLAR CAPS**
Use of satellites in polar meteorology p0035 A80-11750
- POLAR METEOROLOGY**
Use of satellites in polar meteorology p0035 A80-11750
- POLLUTION MONITORING**
Airborne semiconductor radiometers p0053 A80-14196
- Environmental monitoring systems p0023 A80-14705
- Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 A80-15265
- A light aircraft camera Pod - The Enviro-Pod p0024 A80-20251
- Spectrometer for the first Spacelab payload p0054 A80-12034
- A multispectral look at oil pollution detection monitoring and law enforcement [NASA-TM-80573] p0025 N80-12622
- Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts [NTIS/PS-79/0842/9] p0025 N80-13614
- Strategies for the surveillance of coastal waters of the Federal Republic of Germany [BMFT-FB-M-77-11] p0045 N80-13726
- Pressure Modulator Radiometer (PMR) tests [NASA-CR-159175] p0056 N80-15380
- Data base design for a worldwide multicrop information system p0020 N80-15522
- POSITION (LOCATION)**
Determining photograph locations over oceans p0050 N80-10561
- POTATOES**
The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445
- PREDICTION ANALYSIS TECHNIQUES**
Crop monitoring and prediction using satellite data p0011 N80-14455
- PROFILOMETERS**
Recording the contour of a region with an airborne laser profilograph p0028 A80-20200
- PROJECT MANAGEMENT**
LACIE quality assurance p0014 N80-15471
- PUERTO RICO**
Spectral vegetation relationships in a tropical rain forest p0005 A80-20249
- QUALITY CONTROL**
LACIE quality assurance p0014 N80-15471
- QUARTZ**
Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Golfield test areas, Nevada [E80-10035] p0034 N80-15529
- RADAR IMAGERY**
Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters p0001 A80-10877
- Inexpensive radar mapping by Ericsson Star p0047 A80-11190
- New technology for mapping: Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978 p0027 A80-11695
- Advances in digital image display and simulation from digital terrain data bases p0047 A80-11696
- Look direction modulation function of the radar backscattering coefficient of agricultural fields p0002 A80-13357

- Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467
The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 A80-15778
Digital analysis of radar imagery for vegetation detection in Nigeria p0004 A80-15780
Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar p0036 A80-15893
Crop identification with L-band radar p0005 A80-19543
Orientation problem of SLAR imagery p0049 A80-19923
The study of the ocean from space --- Russian book p0036 A80-20095
Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258
Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
- RADAR MAPS**
The practical contribution of space imagery to topographical mapping p0027 A80-11702
- RADIANCE**
Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data
[NASA-TM-80557] p0055 N80-12533
Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535
- RADIATION DETECTORS**
Development of an airborne gamma radiation system for snow surveys [EGG-1183-1679] p0044 N80-13606
- RADIATIVE HEAT TRANSFER**
Thematic mapper design description and performance prediction p0053 A80-17460
- RADIO INTERFEROMETERS**
System for real-time crustal deformation monitoring [NASA-CASE-NPO-14124-1] p0029 N80-14803
- RADIO SIGNALS**
Method for increasing the accuracy of an airborne geodetic radio rangefinder p0028 A80-15176
- RADIOMETERS**
Using airborne radiometry to determine atmospheric effects in Landsat data p0054 A80-20244
Pressure Modulator Radiometer (PMR) tests [NASA-CR-159175] p0056 N80-15380
- RAIN**
Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri [E80-10026] p0044 N80-12527
Ancillary data acquisition for LACIE p0013 N80-15462
- RAIN FORESTS**
The application of Landsat-MSS-imagery for agricultural planning in tropical rain and swamp forest zones p0002 A80-14375
The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest p0002 A80-15559
Spectral vegetation relationships in a tropical rain forest p0005 A80-20249
- RANGE FINDER**
Method for increasing the accuracy of an airborne geodetic radio rangefinder p0028 A80-15176
- RANGELANDS**
Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Alutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain [PB-297931/8] p0051 N80-15547
- REAL TIME OPERATION**
Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 A80-15265
Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431
The system and hardware design of real-time fan beam scatterometer data processors [E80-10028] p0055 N80-12530
System for real-time crustal deformation monitoring [NASA-CASE-NPO-14124-1] p0029 N80-14803
The LACIE data bases: Design considerations p0015 N80-15475
- RED TIDE**
Ocean color observations --- by astronauts p0037 N80-10566
- REFLECTANCE**
Estimate of total reflectance from the Orinoco River outflow --- from Apollo Soyuz Test Project photographs p0037 N80-10569
Observations of internal-wave surface signatures in ASTP photographs p0037 N80-10570
- REGIONAL PLANNING**
The application of Landsat-MSS-imagery for agricultural planning in tropical rain and swamp forest zones p0002 A80-14375
- The use of remote sensing for transport planning and highway engineering in developing countries p0023 A80-15774
The integration of Landsat with other natural resource data for 208 water quality planning in South Dakota p0041 A80-20261
LANDSAT project, State of Hawaii: A preliminary report [PB-298712/3] p0057 N80-10587
On measurements from aircraft --- conference, Hanover, 29-31 August 1977 [BMFT-FB-W-78-04] p0050 N80-12467
Future remote sensing tasks in regional planning p0025 N80-12484
Interpretation of IR and MSS data for town areas p0025 N80-12485
The determination of land usages for planning and cartography p0025 N80-12517
Remote sensing applied to urban and regional planning. A bibliography with abstracts [NTIS/PS-79/0843/7] p0025 N80-13615
Satellite remote sensing for agricultural advisories and planning p0011 N80-14457
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526
- REGRESSION ANALYSIS**
Development of LACIE CCEA-1 weather/wheat yield models --- regression analysis p0012 N80-15457
- RELIEF MAPS**
The practical contribution of space imagery to topographical mapping p0027 A80-11702
- REMOTE REGIONS**
Some examples of the use of satellite imagery / Landsat/ for natural resource mapping in Western Sudan p0048 A80-15772
- REMOTE SENSORS**
A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring p0003 A80-20267
Spectral reflection from agricultural and forest regions during the vegetation period p0007 N80-12513
- RESOURCES MANAGEMENT**
Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture p0001 A80-11708
Interactive analysis methods for resource mapping p0028 A80-11709
Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792
Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 A80-15265
Remote sensing applications in developing countries p0057 A80-15771
A light aircraft camera Pod - The Enviro-Pod p0024 A80-20251
Application of multidata photography and remote sensing data to environmental monitoring in the State of Washington p0048 A80-20265
Cooperative methods for acquisition of aerial photography p0053 A80-20266
An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-182434] p0057 N80-11533
Report to the Congress on coastal zone management. Transition quarter and fiscal year 1977 [PB-298537/2] p0058 N80-12722
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526
- RICE**
The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445
- RIVER BASINS**
Principals of mapping hydrological parameters from natural systems, using satellite photography p0042 A80-18664
A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data p0042 A80-20194
South American river morphology and hydrology p0043 N80-10574
Land cover classification from Landsat data: Phase 3 of a joint DOE/NASA demonstration [AD-A071723] p0024 N80-11535
Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10005] p0033 N80-12521
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523
- Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524
Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018] p0009 N80-13597
- RIVERS**
Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson p0041 A80-10370
Use of satellite infrared data for geomorphology studies p0041 A80-15054
Earth feature identification and tracking technology development p0028 A80-17403
A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data p0042 A80-20194
Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
ASTP at Barbados: Mesoscale pools of Amazon River water in the western tropical Atlantic p0037 N80-10568
Estimate of total reflectance from the Orinoco River outflow --- from Apollo Soyuz Test Project photographs p0037 N80-10569
Detection of a probable ancestral delta of the Nile River p0033 N80-10571
Suspended-sediment dispersal patterns of river deltas photographed by ASTP p0043 N80-10572
South American river morphology and hydrology p0043 N80-10574
An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-182434] p0057 N80-11533
Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520
- ROADS**
Interpretation of IR and MSS data for town areas p0025 N80-12485
- ROCKS**
Remote sensing applied to geology and mineralogy. A bibliography with abstracts [NTIS/PS-79/0844/5] p0034 N80-13612
- ROOFS**
Interpretation of IR and MSS data for town areas p0025 N80-12485
- RURAL AREAS**
New technology for mapping: Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978 p0027 A80-11695
- RURAL LAND USE**
Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268

S

- SAHARA DESERT (AFRICA)**
Land use mapping in the Sahel zone using Landsat p0023 A80-15782
- SAN ANDREAS FAULT**
Geologic analysis of ASTP photographs of parts of southern California p0031 N80-10540
- SANDS**
Color zoning in the western desert of Egypt p0024 N80-10553
Orbital observations of sand distribution in the western desert of Egypt p0024 N80-10554
Preliminary analysis of color variations of sand deposits in the western desert of Egypt p0032 N80-10555
Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560
Quantitative determination of morphological structures in sand bank regions from image structure analysis p0033 N80-12482
Making morphological maps of sand banks from aerial photographs p0033 N80-12483
- SATELLITE NETWORKS**
Constructing a network of earth resource satellites p0057 A80-17993
- SATELLITE OBSERVATION**
Proposed parameters for an automated mapping satellite /MAPSAT/ system p0027 A80-11698
The reduction and analysis of satellite magnetometer data p0054 A80-18774
- SAUDI ARABIA**
Color of desert surfaces in the Arabian peninsula p0033 N80-10558
- SCATTEROMETERS**
The system and hardware design of real-time fan beam scatterometer data processors [E80-10028] p0055 N80-12530
- SCENE ANALYSIS**
Some aspects of determining object coordinates from scanner photographs p0047 A80-10173
Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876
Landsat imagery - A cartographic reference base p0028 A80-11706

- Digital processing of aerial images: Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979 p0049 A80-17514
- Geometric preprocessing of sensor data used for image matching p0054 A80-17515
- Large Area Crop Inventory Experiment (LACIE). List spectral keys study --- Kansas [E80-10012] p0008 N80-13591
- On the clustering of multidimensional pictorial data p0050 N80-15493
- Colorimetric consideration of transparencies for a typical LACIE scene p0018 N80-15506
- Image and numerical display aids for manual interpretation p0051 N80-15508
- SEA GRASSES**
- American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings p0049 A80-20237
- Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey p0035 A80-20260
- SEA ICE**
- Inexpensive radar mapping by Ericsson Slar p0047 A80-11190
- Use of satellites in polar meteorology p0035 A80-11750
- Interim calibration report for the SMRR simulator [NASA-TM-80564] p0055 N80-12534
- Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-airdrop data buoy [AD-A074731] p0039 N80-14664
- SEA ROUGHNESS**
- The study of the ocean from space --- Russian book p0036 A80-20095
- SEA STATES**
- New developments in satellite oceanography and current measurements p0035 A80-10731
- Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467
- India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' --- microwave radiometer p0053 A80-15489
- Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar p0036 A80-15893
- Antipodal seas --- astronaut observation of ocean features p0036 N80-10564
- Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565
- A study of possible sea state information in the sample and hold gate statistics for the GEOS-3 satellite altimeter [NASA-CR-156858] p0038 N80-13753
- Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446
- SEA TRUTH**
- SEASAT: Gulf of Alaska experiment. Surface truth data inventory [PB-294616] p0038 N80-12546
- SEA WATER**
- Optical methods for investigating oceans and inland basins --- Russian book p0035 A80-10116
- Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson p0041 A80-10370
- The study of the ocean from space --- Russian book p0036 A80-20095
- Ocean color observations --- by astronauts p0037 N80-10566
- Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 N80-10567
- On the problem of the remote sensing of substances in water by multispectral scanning p0043 N80-12478
- Research into determining chemical parameters at the surface of the sea by remote sensing p0038 N80-12479
- Determination of the optical properties of the sea in the German bight p0038 N80-12516
- Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535
- SEAS**
- Antipodal seas --- astronaut observation of ocean features p0036 N80-10564
- Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- SEASAT PROGRAM**
- SEASAT: Gulf of Alaska experiment. Surface truth data inventory [PB-294616] p0038 N80-12546
- SEASAT SATELLITES**
- Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543
- SEDIMENT TRANSPORT**
- Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson p0041 A80-10370
- Remote sensing for water quality and biological measurements in coastal waters p0036 A80-19541
- Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
- Estimate of total reflectance from the Orinoco River outflow --- from Apollo Soyuz Test Project photographs p0037 N80-10569
- Suspended-sediment dispersal patterns of river deltas photographed by ASTP p0043 N80-10572
- Use of Apollo-Soyuz photographs in coastal studies p0037 N80-10573
- Making morphological maps of sand banks from aerial photographs p0033 N80-12483
- SEEDS**
- Economic evaluation: Concepts, selected studies, system costs, and a proposed program p0017 N80-15490
- SHADOWS**
- Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos p0023 A80-20025
- SHALO**
- Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 N80-10567
- SHOALS**
- Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546
- SHORELINES**
- New technology for mapping: Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978 p0027 A80-11695
- Use of Apollo-Soyuz photographs in coastal studies p0037 N80-10573
- SIBERIA**
- Remote-sensing studies of taiga regions --- Russian book p0053 A80-16559
- Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-16560
- Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography p0028 A80-16561
- Principals of mapping hydrological parameters from natural systems, using satellite photography p0042 A80-16564
- Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-16565
- Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography p0004 A80-16566
- SICILY**
- Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565
- SIDE-LOOKING RADAR**
- Inexpensive radar mapping by Ericsson Slar p0047 A80-11190
- Orientation problem of SLAR imagery p0049 A80-19923
- SIGNAL ANALYSIS**
- Method for increasing the accuracy of an airborne geodetic radio rangefinder p0028 A80-15176
- SIGNAL PROCESSING**
- The system and hardware design of real-time fan beam scatterometer data processors [E80-10028] p0055 N80-12530
- SIGNATURE ANALYSIS**
- Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876
- Remote-sensing studies of taiga regions --- Russian book p0053 A80-16559
- Analysis of the spectral reflection characteristics of natural formations in remote sensing studies p0053 A80-16568
- The reduction and analysis of satellite magnetometer data p0054 A80-18774
- Multispectral aerial photography for wetland vegetation mapping p0049 A80-19542
- On the current state of remote sensing techniques p0055 N80-12469
- Interpretation of water quality using remote sensing techniques p0044 N80-12493
- What are the advantages of multispectral classification? --- for crop identification p0007 N80-12501
- Digital processing procedure for texture analysis with remote sensing data p0050 N80-12505
- The multispectral scanner as an instrument for signature determinations p0055 N80-12515
- A multispectral look at oil pollution detection monitoring and law enforcement [NASA-TM-80573] p0025 N80-12622
- Earth observations division Earth resources data analysis capabilities [E80-10013] p0050 N80-13592
- Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593
- Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota [E80-10015] p0009 N80-13594
- Physical background of remote sensing --- multispectral reconnaissance of the Earth surface p0029 N80-14443
- Manual interpretation of LANDSAT data p0013 N80-15460
- The classification and mensuration subsystem --- wheat p0013 N80-15465
- Accuracy assessment system and operation p0014 N80-15472
- Methods for segment wheat area estimation p0017 N80-15491
- Development of partitioning as an aid to spectral signature extension p0017 N80-15499
- Manual LANDSAT data analysis for crop type identification p0018 N80-15504
- LACIE analyst interpretation keys p0018 N80-15505
- Image and numerical display aids for manual interpretation p0051 N80-15508
- A programmed labeling approach to image interpretation p0019 N80-15509
- Design, implementation, and results of LACIE field research p0020 N80-15519
- Analysis of scanner data for crop inventories --- North Dakota [E80-10040] p0021 N80-15534
- SILKWORM**
- Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography p0004 A80-16566
- SIMULATOR**
- Interim calibration report for the SMRR simulator [NASA-TM-80564] p0055 N80-12534
- SITES**
- Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1] p0039 N80-15603
- SMOKE**
- Microwave radiometric methods and the problem of forest and peat fires p0002 A80-14580
- SNOW**
- Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation --- Russian book p0041 A80-10125
- Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876
- Snow hydrology studies p0043 N80-10575
- Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520
- SNOW COVER**
- India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' --- microwave radiometer p0053 A80-15489
- Principals of mapping hydrological parameters from natural systems, using satellite photography p0042 A80-16564
- Earth feature identification and tracking technology development p0028 A80-17403
- Passive microwave studies of frozen lakes p0042 A80-20247
- Satellite snow-cover observations in Arizona p0041 A80-20264
- Snow hydrology studies p0043 N80-10575
- Remote sensing applied to hydrology. A bibliography with abstracts [NTIS/PS-79/845/2] p0043 N80-11553
- Development of an airborne gamma radiation system for snow surveys [EGG-1183-1679] p0044 N80-13606
- Snow mapping from space platforms p0045 N80-13611
- SOIL**
- Plant canopy information extraction from composite scene reflectance of row crops p0001 A80-13141
- SOIL EROSION**
- A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area /Lesotho/ p0003 A80-15775
- Land use mapping in the Sahel zone using Landsat p0023 A80-15782
- Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259
- The integration of Landsat with other natural resource data for 208 water quality planning in South Dakota p0041 A80-20261
- SOIL MAPPING**
- Measured emissivity of soils in the southeast United States p0002 A80-15057
- Examples of aerial photo-interpretation in soil surveys for an agricultural land development project in north-east Brazil p0003 A80-15560
- Some examples of the use of satellite imagery / Landsat/ for natural resource mapping in 'Western Sudan' p0048 A80-15772
- The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory p0048 A80-15773
- A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area /Lesotho/ p0003 A80-15775
- The contribution of Landsat imagery to reconnaissance soil mapping in north-west India p0003 A80-15777
- Remote-sensing studies of taiga regions --- Russian book p0053 A80-16559
- Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-16565
- Earth feature identification and tracking technology development p0028 A80-17403
- Calculation of the spectral irradiance in spaceborne photography of the earth p0005 A80-20195
- Remote sensing of Playa lakes as a source of climatic data p0042 A80-20245
- An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy p0028 A80-20253
- Compositing natural resource and land use information in Spearfish, South Dakota - A land capability study p0024 A80-20255

- Color zoning in the western desert of Egypt
p0024 N80-10553
- Orbital observations of sand distribution in the western desert of Egypt
p0024 N80-10554
- Preliminary analysis of color variations of sand deposits in the western desert of Egypt
p0032 N80-10555
- Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona
p0033 N80-10560
- Remote sensing applied to agricultural resources. Citations from the international aerospace abstracts data base
[NTIS/PS-79/0733/0] p0006 N80-10588
- Remote sensing applied to geology and mineralogy. A bibliography with abstracts
[NTIS/PS-79/0844/5] p0034 N80-13612
- The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops
p0010 N80-14445
- SOIL MOISTURE**
- Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation --- Russian book
p0041 A80-10125
- Remotely sensed land cover temperature and soil water status - A brief review
p0002 A80-15052
- A study of moisture conditions in the Pantanal of Brazil using satellite imagery
p0041 A80-15055
- India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' --- microwave radiometer
p0053 A80-15489
- Some applications of remote sensing in agricultural resources with reference to India
p0003 A80-15776
- American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978. Proceedings
p0049 A80-20237
- Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas
p0023 A80-20259
- Dual polarized long wavelength radar for discrimination of agricultural land use
p0003 A80-20268
- Remote sensing applied to hydrology. A bibliography with abstracts
[NTIS/PS-79/0845/2] p0043 N80-11553
- Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River
[E80-10004] p0044 N80-12520
- Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grandon Underwood Experimental Catchment, north west of London, U.K.
[E80-10006] p0044 N80-12522
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries
[E80-10007] p0007 N80-12523
- Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grandon Underwood and Newbury, England
[E80-10002] p0007 N80-12525
- TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] p0007 N80-12526
- Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri
[E80-10025] p0044 N80-12527
- The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
- Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America
[E80-10010] p0008 N80-13589
- Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France
[E80-10018] p0009 N80-13597
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries
[E80-10019] p0009 N80-13598
- The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing --- Buckinghamshire, England
[E80-10021] p0009 N80-13599
- Beauce TELLUS project --- France
[E80-10024] p0009 N80-13600
- Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures
[REPT-1003] p0009 N80-13616
- The application of thermal infrared remote sensing data to soil moisture and evaporation determination
p0010 N80-14447
- Satellite remote sensing in hazard monitoring and disaster evaluation
p0011 N80-14456
- Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] p0045 N80-15447
- Operation of the yield estimation subsystem
p0014 N80-15468
- The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE
p0016 N80-15482
- Application of LANDSAT digital data for monitoring drought --- South Dakota
p0016 N80-15483
- Natural sampling strategy
p0019 N80-15516
- Use of thermal infrared and colour infrared imagery to detect crop moisture stress --- Alberta, Canada
[E80-10036] p0021 N80-15530
- HCMM/soil moisture experiment --- Alberta, Canada
[E80-10037] p0021 N80-15531
- SOIL SCIENCE**
- Crop environment monitoring: The assessment of environmental phenomena using satellite remote sensing data
p0010 N80-14454
- SOILS**
- TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach
[E80-10023] p0007 N80-12526
- Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri
[E80-10025] p0044 N80-12527
- TELLUS newsletter 1 --- Beauce, France
[E80-10029] p0008 N80-12531
- SOLAR RADIATION**
- Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer
p0053 A80-17431
- SOUTH AMERICA**
- Latin American experiences in utilizing satellite imagery for cartographic purposes
p0027 A80-11705
- Remote sensing applications in developing countries
p0057 A80-15771
- The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin
p0003 A80-15778
- South American river morphology and hydrology
p0043 N80-10574
- Snow hydrology studies
p0043 N80-10575
- SOUTH DAKOTA**
- Use of satellite infrared data for geomorphology studies
p0041 A80-15054
- Compositing natural resource and land use information in Spearfish, South Dakota - A land capability study
p0024 A80-20255
- The integration of Landsat with other natural resource data for 208 water quality planning in South Dakota
p0041 A80-20261
- Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America
[E80-10010] p0008 N80-13589
- Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America
[E80-10011] p0008 N80-13590
- Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas
[E80-10016] p0009 N80-13595
- Econometric models for predicting confusion crop ratios
p0011 N80-15450
- Application of LANDSAT digital data for monitoring drought --- South Dakota
p0016 N80-15483
- SOUTHERN CALIFORNIA**
- Multiple-frame, full resolution Landsat mosaicking to standard map projections
p0048 A80-20269
- Geologic analysis of ASTP photographs of parts of southern California
p0031 N80-10540
- SOYBEANS**
- Look direction modulation function of the radar backscattering coefficient of agricultural fields
p0002 A80-13357
- Crop identification with L-band radar
p0005 A80-19543
- Obtaining timely crop area estimates using ground-gathered and LANDSAT data
[PB-300825/7] p0021 N80-15549
- SPACE PROGRAMS**
- Space research in Switzerland, 1978
p0058 N80-11995
- SPACE SHUTTLE PAYLOADS**
- Earth feature identification and tracking technology development
p0028 A80-17403
- SPACELAB PAYLOADS**
- Spectrometer for the first Spacelab payload
p0054 N80-12034
- The ESA remote sensing program: Present activities and future plans
p0058 N80-14449
- SPAIN**
- Phototelectronic analysis of southeastern Spain from ASTP photographs and LANDSAT images --- identification of folds, faults, and lineaments
p0032 N80-10548
- East-West pervasive lineaments in central and southeastern Spain
p0032 N80-10549
- Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] p0020 N80-15527
- SPATIAL DISTRIBUTION**
- The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest
p0002 A80-15559
- SPECTRAL RECONNAISSANCE**
- Spectral reflection from agricultural and forest regions during the vegetation period
p0007 N80-12513
- SPECTRAL REFLECTANCE**
- Wheat spectral reflectance - Interactions between crop configuration, sun elevation, and azimuth angle
p0001 A80-13138
- Plant canopy information extraction from composite scene reflectance of row crops
p0001 A80-13141
- Albedo of vegetated surfaces - Its variability with differing irradiances
p0002 A80-15051
- Analysis of the spectral reflection characteristics of natural formations in remote sensing studies
p0053 A80-16568
- Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer
p0053 A80-17431
- A seasonal verification of the Suits spectral reflectance model for wheat
p0005 A80-19544
- The study of the ocean from space --- Russian book
p0036 A80-20095
- Using airborne radiometry to determine atmospheric effects in Landsat data
p0054 A80-20244
- Spectral classification of tomato disease severity levels
p0005 A80-20254
- A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring
p0003 A80-20267
- Spectral reflectance of certain weeds
p0004 A80-20754
- The vegetative index number and crop identification
p0018 N80-15503
- Possible methods for distinguishing icebergs from ships by aerial remote sensing
[NASA-TM-79310] p0056 N80-15538
- SPECTRAL RESOLUTION**
- Feature selection via entropy minimization - An example using Landsat satellite data
p0048 A80-14047
- Calculation of the spectral irradiance in spaceborne photography of the earth
p0005 A80-20195
- Long wavelength radar for geological analysis in vegetated terrain
p0031 A80-20258
- Snow mapping from space platforms
p0045 N80-13611
- SPECTRAL SENSITIVITY**
- Colorimetric consideration of transparencies for a typical LACIE scene
p0018 N80-15508
- SPECTRAL SIGNATURE**
- Microwave radiometric methods and the problem of forest and peat fires
p0002 A80-14580
- SPECTRAL SIGNATURES**
- Selection of Landsat MSS data for inventories of earth resources
p0047 A80-10876
- Estimating leaf-area index of wheat with Landsat data
p0002 A80-15053
- Remote identification of the spatial structure of forest phytocoenoses
p0004 A80-18563
- Remote sensing for water quality and biological measurements in coastal waters
p0036 A80-19541
- Multispectral aerial photography for wetland vegetation mapping
p0049 A80-19542
- Spectral vegetation relationships in a tropical rain forest
p0005 A80-20249
- Processing and display techniques for multispectral satellite imagery
[AD-A072509] p0050 N80-11534
- On the problem of the remote sensing of substances in water by multispectral scanning
p0043 N80-12478
- Applicability of multispectral techniques in establishing inventories for agricultural farming and forestry
p0007 N80-12500
- On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region
p0007 N80-12512
- Spectral reflection from agricultural and forest regions during the vegetation period
p0007 N80-12513
- The multispectral scanner as an instrument for signature determinations
p0055 N80-12515
- The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
- Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data
[NASA-TM-80557] p0055 N80-12533
- A multispectral look at oil pollution detection monitoring and law enforcement
[NASA-TM-80573] p0025 N80-12622
- Large Area Crop Inventory Experiment (LACIE). List spectral keys study --- Kansas
[E80-10012] p0008 N80-13591
- Physical background of remote sensing --- multispectral reconnaissance of the Earth surface
p0029 N80-14443
- On the clustering of multidimensional pictorial data
p0050 N80-15493
- Feature extraction applied to agricultural crops as seen by LANDSAT
p0017 N80-15497
- Development of partitioning as an aid to spectral signature extension
p0017 N80-15499
- Methods of extending crop signatures from one area to another
p0017 N80-15500

- Signature extension methods in crop area estimation p0018 N80-15501
- LACIE analyst interpretation keys p0018 N80-15505
- Generation of uniform chromaticity scale imagery from LANDSAT data p0018 N80-15507
- Design, implementation, and results of LACIE field research p0020 N80-15519
- Functional definition and design of a USDA system p0020 N80-15521
- Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data [NASA-TP-1553] p0021 N80-15535
- SPECTROMETERS**
- Ocean wave spectrometer measurements in the gulf stream experiment [AD-A074369] p0039 N80-14865
- SPECTRORADIOMETERS**
- Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431
- STANDARDS**
- The National Map Accuracy Standards in the context of mapping with imagery data p0049 A80-20252
- STATISTICAL ANALYSIS**
- Feature selection via entropy minimization - An example using Landsat satellite data p0048 A80-14047
- System of landscape-statistical methods for stocktaking and mapping of forests p0004 A80-16562
- STEREOPHOTOGRAPHY**
- Fixed-base large-scale photographs for forest sampling p0005 A80-20024
- STEREOSCOPY**
- Orientation problem of SLAR imagery p0049 A80-19923
- STORM DAMAGE**
- Satellite remote sensing in hazard monitoring and disaster evaluation p0011 N80-14456
- STORMS (METEOROLOGY)**
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598
- STRAITS**
- Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis de Maumusson p0041 A80-10370
- Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565
- STRECC (BIOLOGY)**
- Application of LANDSAT digital data for monitoring drought --- South Dakota p0016 N80-15483
- Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- Use of thermal infrared and colour infrared imagery to detect crop moisture stress --- Alberta, Canada [E80-10036] p0021 N80-15530
- HCM/soil moisture experiment --- Alberta, Canada [E80-10037] p0021 N80-15531
- STRUCTURAL BASINS**
- Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography p0028 A80-16561
- Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blanche area, South Australia --- identification of folds, faults, and lineaments p0032 N80-10550
- Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559
- STRUCTURAL BASINS (GEOLOGY)**
- Remote sensing of Playa lakes as a source of climatic data p0042 A80-20245
- STRUCTURAL PROPERTIES (GEOLOGY)**
- ASTP photographs of southeastern Angola p0033 N80-10557
- STRUCTURAL PROPERTIES (GEOLOGY)**
- Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
- Photolineaments in the ASTP stereostrip of the western desert of Egypt p0032 N80-10546
- Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547
- Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images --- identification of folds, faults, and lineaments p0032 N80-10548
- East-West pervasive lineaments in central and southeastern Spain p0032 N80-10549
- Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blanche area, South Australia --- identification of folds, faults, and lineaments p0032 N80-10550
- Riachao Ring, Brazil: A possible meteorite crater discovered by the Apollo astronauts p0032 N80-10552
- Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559
- Detection of a probable ancestral delta of the Nile River p0033 N80-10571
- SUDAN**
- Some examples of the use of satellite imagery / Landsat/ for natural resource mapping in Western Sudan p0048 A80-15772
- Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556
- SURFACE PROPERTIES**
- Albedo of vegetated surfaces - Its variability with differing irradiances p0002 A80-15051
- SURFACE TEMPERATURE**
- Optical methods for investigating oceans and inland basins --- Russian book p0035 A80-10116
- Use of satellites in polar meteorology p0035 A80-11750
- Plant canopy information extraction from composite scene reflectance of row crops p0001 A80-13141
- Remotely sensed land cover temperature and soil water status - A brief review p0002 A80-15052
- Assessment of the urban heat island effect through the use of satellite data p0023 A80-15556
- Gulf stream boundary eddies off the east coast of Florida p0036 A80-16247
- Applications of HCM/soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520
- Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Catchment, north west of London, U.K. [E80-10006] p0044 N80-12522
- Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England [E80-10022] p0007 N80-12525
- TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach [E80-10023] p0007 N80-12526
- Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri [E80-10025] p0044 N80-12527
- Interim calibration report for the SMRR simulator [NASA-TM-80564] p0055 N80-12534
- Estimates of regional ET from HCM/soil moisture: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018] p0009 N80-13597
- Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598
- The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing --- Buckinghamshire, England [E80-10021] p0009 N80-13599
- Beauce TELLUS project --- France [E80-10024] p0009 N80-13600
- Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures [REPT-1003] p0009 N80-13616
- The application of thermal infrared remote sensing data to soil moisture and evaporation determination p0010 N80-14447
- Meteosat and remote sensing application p0056 N80-14448
- A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery [AD-A074186] p0039 N80-14663
- Topographical characteristics through the study of the thermal ahp hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project [E80-10020] p0045 N80-15447
- Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- Use of thermal infrared and colour infrared imagery to detect crop moisture stress --- Alberta, Canada [E80-10036] p0021 N80-15530
- Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1] p0039 N80-15603
- SURFACE WATER**
- Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792
- Space Observations for water resources: A potential to be developed p0044 N80-13609
- SWITZERLAND**
- Space research in Switzerland, 1978 p0058 N80-11995
- SYNTHETIC APERTURE RADAR**
- Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467
- SYRIA**
- Analysis of Skylab and astp photographs of the Lavantine (Dead Sea) fault zone p0031 N80-10543
- SYSTEMS ANALYSIS**
- LACIE applications evaluation system efficiency report p0015 N80-15473
- Functional definition and design of a USDA system p0020 N80-15521
- SYSTEMS ENGINEERING**
- The LACIE data bases: Design considerations p0015 N80-15475
- The application test system: Technical approach and system design p0020 N80-15523
- TECHNOLOGY ASSESSMENT**
- Snow mapping from space platforms p0045 N80-13611
- Crop environment monitoring: The remote sensing systems p0010 N80-14452
- LACIE applications evaluation system efficiency report p0015 N80-15473
- Considerations for design of future research and development interactive image analysis systems p0050 N80-15478
- The application test system: Technical approach and system design p0020 N80-15523
- TECHNOLOGY TRANSFER**
- The application test system: An approach to technology transfer --- USDA aerospace and remote sensing information requirements p0020 N80-15520
- Functional definition and design of a USDA system p0020 N80-15521
- TECHNOLOGY UTILIZATION**
- Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792
- Data base design for a worldwide multicrop information system p0020 N80-15522
- The application test system: Technical approach and system design p0020 N80-15523
- Resource modeling: A reality for program cost analysis p0020 N80-15524
- The application test system: Experiences to date and future plans p0020 N80-15525
- TECTONICS**
- Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements p0027 A80-10172
- Geodynamics from satellites [AAS PAPER 79-243] p0031 A80-16427
- Geologic analysis of ASTP photographs of parts of southern California p0031 N80-10540
- Evaluation of satellite images of the Levantine Rift zone p0031 N80-10542
- Analysis of Skylab and astp photographs of the Lavantine (Dead Sea) fault zone p0031 N80-10543
- Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544
- Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
- Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images --- identification of folds, faults, and lineaments p0032 N80-10548
- East-West pervasive lineaments in central and southeastern Spain p0032 N80-10549
- Photogeologic analysis of ASTP photographs of the Lake Torrens-Flinders Ranges-Lake Blanche area, South Australia --- identification of folds, faults, and lineaments p0032 N80-10550
- Remote sensing applied to geology and mineralogy. A bibliography with abstracts [NTIS/PS-79/0844/5] p0034 N80-13612
- TERRAIN ANALYSIS**
- Advances in digital image display and simulation from digital terrain data bases p0047 A80-11696
- Integration of LANDSAT CCT data and digital terrain data in cartographic application p0027 A80-11703
- Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture p0001 A80-11708
- Terrestrial aerial photogrammetric surveying of large open pit mines in the Rhein lignite district p0031 A80-14373
- Simple generation of one-parameter pseudoterrain surfaces p0048 A80-14952
- The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory p0048 A80-15773
- The use of remote sensing for transport planning and highway engineering in developing countries p0023 A80-15774
- The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 A80-15778
- Remote-sensing studies of taiga regions --- Russian book p0053 A80-16559
- Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-16560
- Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography p0028 A80-16561
- System of landscape-statistical methods for stocktaking and mapping of forests p0004 A80-16562
- Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-16565
- Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography p0004 A80-16566
- Analysis of the spectral reflection characteristics of natural formations in remote sensing studies p0053 A80-16568

Digital processing of aerial images; Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979 p0049 A80-17514

Geometric preprocessing of sensor data used for image matching p0054 A80-17515

Recording the contour of a region with an airborne laser profilograph p0028 A80-20200

American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings p0049 A80-20237

Using airborne radiometry to determine atmospheric effects in Landsat data p0054 A80-20244

The PDS differential rectifier - An economical approach to digital orthophotos p0054 A80-20250

An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy p0028 A80-20253

Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258

Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544

Volcanic landforms and astroblemes p0032 N80-10551

Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556

ASTP photographs of southeastern Angola p0033 N80-10557

Remote sensing applied to geology and mineralogy. A bibliography with abstracts [NTIS/PS-79/0844/5] p0034 N80-13612

TERRESTRIAL RADIATION

Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation --- Russian book p0041 A80-10125

TEXAS

Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240

Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524

Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America p0008 N80-13589

Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America [E80-10010] p0008 N80-13589

Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas [E80-10016] p0009 N80-13595

Texas applications system verification and transfer remote sensing information subsystem: Functional design [E80-10017] p0050 N80-13596

TEXTURED

Digital processing procedure for texture analysis with remote sensing data p0050 N80-12505

THERMAL MAPPING

Application of multidata photography and remote sensing data to environmental monitoring in the State of Washington p0048 A80-20265

THEMATIC MAPPING

Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876

Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters: p0001 A80-10877

Inexpensive radar mapping by Ericsson Slar p0047 A80-11190

New technology for mapping: Proceedings of the International Symposium, Ottawa, Canada, October 2-8, 1978 p0027 A80-11695

The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications p0027 A80-11699

Latin American experiences in utilizing satellite imagery for cartographic purposes p0027 A80-11705

Landsat imagery - A cartographic reference base p0028 A80-11706

Interactive analysis methods for resource mapping p0028 A80-11709

Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792

The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest p0002 A80-15559

Some applications of remote sensing in agricultural resources with reference to India p0003 A80-15776

Problems of remote sensing in the tropics - An appraisal of the Nigerian situation with regard to forest resources p0004 A80-15779

Remote-sensing studies of taiga regions --- Russian book p0053 A80-16559

Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-16560

Thematic mapper design description and performance prediction p0053 A80-17480

Multispectral Resource Sampler - An experimental satellite sensor for the mid-1980s p0053 A80-17462

A suggested method for delimiting urbanized areas using digital Landsat data p0024 A80-20246

A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248

The National Map Accuracy Standards in the context of mapping with imagery data p0049 A80-20252

Satellite snow-cover observations in Arizona p0041 A80-20264

A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring p0003 A80-20267

Interpretation of IR and MSS data for town areas p0025 N80-12485

Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524

Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- Colorado and Washington [E80-10009] p0008 N80-13588

Snow mapping from space platforms p0045 N80-13611

The mapping of important farmland using remote sensor and socio-economic variables --- Ontario County, New York p0009 N80-14424

Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia [E80-10031] p0026 N80-15526

THERMAL EMISSION

Measured emissivity of soils in the southeast United States p0002 A80-15057

THERMAL MAPPING

Remotely sensed land cover temperature and soil water status - A brief review p0002 A80-15052

Use of satellite infrared data for geomorphology studies p0041 A80-15054

Assessment of the urban heat island effect through the use of satellite data p0023 A80-15556

Remote sensing methods applied to the solution of the forest fire problem p0004 A80-16567

American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978, Proceedings p0049 A80-20237

On the current state of remote sensing techniques p0055 N80-12469

HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution [E80-10002] p0044 A80-12518

Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520

Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona [E80-10005] p0033 N80-12521

Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Catchment, north west of London, U.K. [E80-10006] p0044 N80-12522

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523

Joint flight experiment UK/1977, Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England [E80-10022] p0007 N80-12525

TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach p0007 N80-12526

Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri [E80-10025] p0044 N80-12527

TELLUS newsletter 1 --- Beauce, France [E80-10029] p0008 N80-12531

Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018] p0009 N80-13597

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598

The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing --- Buckinghamshire, England [E80-10021] p0009 N80-13599

Beauce TELLUS project --- France [E80-10024] p0009 N80-13600

The application of thermal infrared remote sensing data to soil moisture and evaporation determination p0010 N80-14447

A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery [AD-A074186] p0039 N80-14863

Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project [E80-10020] p0045 N80-15447

Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527

Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission [E80-10033] p0034 N80-15528

Geologic application of thermal inertia imaging using HCMM data --- Cuprite, Elko, and Goldfield test areas, Nevada [E80-10035] p0034 N80-15529

Use of thermal infrared and colour infrared imagery to detect crop moisture stress --- Alberta, Canada [E80-10036] p0021 N80-15530

HCMM/soil moisture experiment --- Alberta, Canada [E80-10037] p0021 N80-15531

THERMAL POLLUTION

Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts [NTIS/PS-79/0842/9] p0025 N80-13614

THUNDERSTORMS

Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project [E80-10020] p0045 N80-15447

TIDAL WAVES

The structure and variability of shelf sea fronts as observed by an undulating CTD system --- Conductivity and Temperature Detector p0035 A80-20938

TIDES

Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520

TIDAL IDENTIFICATION

Digital processing of multispectral color aerial photographs of forest land p0001 A80-10171

Remote identification of the spatial structure of forest phytocoenoses p0004 A80-16563

Texture analysis as a recognition parameter for different types of forests p0006 N80-12498

TIDAL INVENTORY

Digital processing of multispectral color aerial photographs of forest land p0001 A80-10171

Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters p0001 A80-10877

The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest p0002 A80-15559

The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 A80-15778

Problems of remote sensing in the tropics - An appraisal of the Nigerian situation with regard to forest resources p0004 A80-15779

Digital analysis of radar imagery for vegetation detection in Nigeria p0004 A80-15780

System of landscape-statistical methods for stocktaking and mapping of forests p0004 A80-16562

Fixed-base large-scale photographs for forest sampling p0005 A80-20024

A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248

Application of multidata photography and remote sensing data to environmental monitoring in the State of Washington p0048 A80-20265

An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-162434] p0057 N80-11533

Land cover classification from Landsat data: Phase 3 of a joint DOE/NASA demonstration [AD-A071723] p0024 N80-11535

Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach [VT-LU-15] p0054 N80-11547

Applicability of multispectral techniques in establishing inventories for agricultural farming and forestry p0007 N80-12500

Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- Colorado and Washington [E80-10009] p0008 N80-13588

Forester's guide to aerial photo interpretation --- timber inventory p0009 N80-14425

TIRAS SATELLITES

Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543

TOPOGRAPHY

Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements p0027 A80-10172

Some aspects of determining object coordinates from scanner photographs p0047 A80-10173

New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978 p0027 A80-11695

Proposed parameters for an automated mapping satellite /MAPSAT/ system p0027 A80-11698

The practical contribution of space imagery to topographical mapping p0027 A80-11702

Integration of LANDSAT CCT data and digital terrain data in cartographic application p0027 A80-11703

Landsat imagery - A cartographic reference base p0028 A80-11706

Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture p0001 A80-11708

Use of satellite infrared data for geomorphology studies p0041 A80-15054

The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory p0048 A80-15773

Remote-sensing studies of taiga regions --- Russian book p0053 A80-16559

Structure of taiga landscapes and its study by remote sensing techniques p0028 A80-16560

Principles of studying mountainous forest landscapes in the Baikal Lake basin, using aerial and satellite photography p0028 A80-16561

System of landscape-statistical methods for stocktaking and mapping of forests p0004 A80-16562

Recording the contour of a region with an airborne laser profilograph p0028 A80-20200

Summary of significant results p0049 N80-10539

Geologic analysis of ASTP photographs of parts of southern California p0031 N80-10540

Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544

Photolineaments in the ASTP stereostrip of the western desert of Egypt p0032 N80-10546

Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547

Volcanic landforms and astroblemes p0032 N80-10551

ASTP photographs of southeastern Angola p0033 N80-10557

Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559

South American river morphology and hydrology p0043 N80-10574

Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data [NASA-TM-80557] p0055 N80-12533

Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- Colorado and Washington [E80-10009] p0008 N80-13588

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598

On the use of digital photogrammetric measurements in the compilation of topographic maps [SER-1-ORIGINAL-REPT-76] p0029 N80-14462

Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project [E80-10020] p0045 N80-15447

TOWED BODIES

The structure and variability of shelf sea fronts as observed by an undulating CTD system --- Conductivity and Temperature Detector p0035 A80-20938

TRACKING (POSITION)

Long-term tracking of arctic icebergs [AD-A072473] p0037 N80-10583

TRACKING NETWORKS

A review of NASA international programs [NASA-TM-80845] p0058 N80-14971

TRANSPARENCE

Colorimetric consideration of transparencies for a typical LACIE scene p0018 N80-15506

TREES (PLANTS)

Digital processing of multispectral color aerial photographs of forest land p0001 A80-10171

Remotely sensed land cover temperature and soil water status - A brief review p0002 A80-15052

Remote identification of the spatial structure of forest phytocoenoses p0004 A80-16563

Crop identification with L-band radar p0005 A80-19543

Fixed-base large-scale photographs for forest sampling p0005 A80-20024

Texture analysis as a recognition parameter for different types of forests p0006 N80-12498

Phenology as a factor in the determination of different forms in vegetation by remote sensing p0007 N80-12499

Forest resource information system, phase 3 [E80-10026] p0007 N80-12528

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598

Forester's guide to aerial photo interpretation --- timber inventory p0009 N80-14425

TRIANGULATION

Combined Skylab and high altitude aircraft photography space triangulation p0047 A80-11697

TROPICAL REGIONS

Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters p0001 A80-10877

The application of Landsat-MSS-imagery for agricultural planning in tropical rain and swamp forest zones p0002 A80-14375

The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest p0002 A80-15559

Problems of remote sensing in the tropics - An appraisal of the Nigerian situation with regard to forest resources p0004 A80-15779

Digital analysis of radar imagery for vegetation detection in Nigeria p0004 A80-15780

The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java p0048 A80-15781

Spectral vegetation relationships in a tropical rain forest p0005 A80-20249

ASTP at Barbados: Mesoscale pools of Amazon River water in the western tropical Atlantic p0037 N80-10568

TROPOSPHERE

Pressure Modulator Radiometer (PMR) tests [NASA-CR-159175] p0056 N80-15380

TURKEY

Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544

U

U.S.S.R.

An assessment of LACIE and related methodologies for conducting crop inventories p0004 A80-15783

Lodging of grain crops and its detection by aerial photography p0006 N80-10994

Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030] p0011 N80-15448

USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467

The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482

LACIE area, yield, and production estimate characteristics: U.S.S.R. p0016 N80-15485

A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511

U.S.S.R. SPACE PROGRAM

The use of space - International cooperation in the area of space applications --- Russian book p0057 A80-16394

Constructing a network of earth resource satellites p0057 A80-17993

The study of the ocean from space --- Russian book p0038 A80-20095

UNDERWATER RESOURCES

SEASAT demonstration experiments with the offshore oil, gas and mining industries p0038 N80-11532

[NASA-CR-162423]

International Decade of Ocean Exploration, volume 7 --- information on oceanography programs dealing with marine environments [NOAA-S/T-78-211-VOL-7] p0039 N80-15772

UNITED KINGDOM

Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar p0038 A80-15893

Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Catchment, north west of London, U.K. [E80-10006] p0044 N80-12522

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- Italy, France, Germany, England, Wales and the Benelux Countries [E80-10007] p0007 N80-12523

Joint flight experiment UK/1977. Report no. 1: Planning and execution --- soil moisture and evapotranspiration in Grendon Underwood and Newbury, England [E80-10022] p0007 N80-12525

Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest --- France, Italy, Germany, The United Kingdom, and the Benelux Countries [E80-10019] p0009 N80-13598

UNITED STATES OF AMERICA

Use of satellite infrared data for geomorphology studies p0041 A80-15054

Assessment of the urban heat island effect through the use of satellite data p0023 A80-15556

A light aircraft camera Pod - The Enviro-Pod p0024 A80-20251

The National Map Accuracy Standards in the context of mapping with imagery data p0049 A80-20252

Use of Apollo-Soyuz photographs in coastal studies p0037 N80-10573

Snow hydrology studies p0043 N80-10575

Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520

Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030] p0011 N80-15448

LACIE large area acreage estimation --- United States of America p0012 N80-15453

Accuracy assessment: The statistical approach to performance evaluation in LACIE --- Great Plains corridor, United States p0013 N80-15459

USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467

The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482

LACIE area, yield, and production estimate characteristics: U.S. Great Plains p0016 N80-15484

Accuracy and performance of LACIE area estimates --- wheat yield in the U.S. Great Plains States p0016 N80-15487

A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511

UPPER ATMOSPHERE

Geophysics, astronomy and space, no. 450 [JPRS-73946] p0033 N80-11527

URBAN DEVELOPMENT

Future remote sensing tasks in regional planning p0025 N80-12484

Interpretation of IR and MSS data for town areas p0025 N80-12485

URBAN PLANNING

New technology for mapping; Proceedings of the International Symposium, Ottawa, Canada, October 2-6, 1978 p0027 A80-11695

Land use mapping in the Sahel zone using Landsat p0023 A80-15782

Educator's guide for Mission to Earth: LANDSAT views the world [NASA-SP-360] p0057 N80-10537

Remote sensing applied to urban and regional planning. A bibliography with abstracts [NTIS/PS-79/0843/7] p0025 N80-13615

URBAN RESEARCH

A suggested method for delimiting urbanized areas using digital Landsat data p0024 A80-20248

Compositing natural resource and land use information in Spearfish, South Dakota - A land capability study p0024 A80-20255

URBAN TRANSPORTATION

Remote sensing applied to urban and regional planning. A bibliography with abstracts [NTIS/PS-79/0843/7] p0025 N80-13615

UTAH

Passive microwave studies of frozen lakes p0042 A80-20247

Mapping vegetation with low cover density from Landsat data p0006 A80-20257

V

VAPOR PRESSURE

Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018] p0009 N80-13597

VEGETATION

Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters p0001 A80-10877

Plant canopy information extraction from composite scene reflectance of row crops p0001 A80-13141

Computer graphic feature analysis and selection --- for viewing parallelepipeds in 3-d space p0047 A80-13358

Albedo of vegetated surfaces - Its variability with differing irradiances p0002 A80-15051

Some examples of the use of satellite imagery /Landsat/ for natural resource mapping in Western Sudan p0048 A80-15772

Digital analysis of radar imagery for vegetation detection in Nigeria p0004 A80-15780

Remote identification of the spatial structure of forest phytocoenoses p0004 A80-16563

Earth feature identification and tracking technology development p0028 A80-17403

Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431

Multispectral aerial photography for wetland vegetation mapping p0049 A80-19542

Crop identification with L-band radar p0005 A80-19543

American Society of Photogrammetry, Fall Technical Meeting, Albuquerque, N. Mex., October 15-20, 1978. Proceedings p0049 A80-20237

Spectral vegetation relationships in a tropical rain forest p0005 A80-20249

W

An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy p0028 A80-20253

Mapping vegetation with low cover density from Landsat data p0006 A80-20257

Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258

Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey p0035 A80-20260

A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring p0003 A80-20267

Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268

Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556

Remote sensing applied to agricultural resources. Citations from the international aerospace abstracts data base [NTIS/PS-79/0733/0] p0006 N80-10588

Impact of Great Lakes water level fluctuations on coastal wetlands [PB-296403/9] p0043 N80-10590

Land cover classification from Landsat data: Phase 3 of a joint DOE/NASA demonstration [AD-A071723] p0024 N80-11535

Interpretation of IR and MSS data for town areas p0025 N80-12485

Phenology as a factor in the determination of different forms in vegetation by remote sensing p0007 N80-12499

On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region p0007 N80-12512

Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri [E80-10025] p0044 N80-12527

Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589

Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site --- Rhone Valley area, Avignon, France [E80-10018] p0009 N80-13597

Beauce TELLUS project --- France [E80-10024] p0009 N80-13600

Crop monitoring and prediction using satellite data p0011 N80-14455

The vegetative index number and crop identification p0018 N80-15503

Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data [NASA-TP-1553] p0021 N80-15535

Remote sensing of agricultural resources. A bibliography with abstracts [NTIS/PS-79/0993/0] p0021 N80-15542

VEGETATION GROWTH

Remotely sensed land cover temperature and soil water status - A brief review p0002 A80-15052

Land use mapping in the Sahel zone using Landsat p0023 A80-15782

Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259

A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring p0003 A80-20267

Classification of agricultural land with the aid of remote sensing methods p0006 N80-12495

Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor --- Southwest Texas [E80-10008] p0025 N80-12524

TELLUS newsletter 1 --- Beauce, France [E80-10029] p0008 N80-12531

Forester's guide to aerial photo interpretation --- timber inventory p0009 N80-14425

VENEZUELA

Estimate of total reflectance from the Orinoco River outflow --- from Apollo Soyuz Test Project photographs p0037 N80-10569

VERMONT

Multispectral aerial photography for wetland vegetation mapping p0049 A80-19542

VERY LONG BASE INTERFEROMETRY

System for real-time crustal deformation monitoring [NASA-CASE-NPO-14124-1] p0029 N80-14603

VIRGINIA

Using airborne radiometry to determine atmospheric effects in Landsat data p0054 A80-20244

Land cover classification from Landsat data: Phase 3 of a joint DOE/NASA demonstration [AD-A071723] p0024 N80-11535

VISUAL OBSERVATION

Visual observations over oceans p0036 N80-10563

Ocean color observations --- by astronauts p0037 N80-10566

VOLCANOES

Volcanic landforms and astrombles p0032 N80-10551

WASHINGTON

Application of multidata photography and remote sensing data to environmental monitoring in the State of Washington p0048 A80-20265

Cooperative methods for acquisition of aerial photography p0053 A80-20266

Study in remote sensing for land use [AD-A071802] p0024 N80-11537

Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types --- Colorado and Washington [E80-10009] p0008 N80-13588

Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America [E80-10010] p0008 N80-13589

WATER

Monitoring of euphotic depth from aircraft p0041 A80-15056

WATER COLOR

Optical methods for investigating oceans and inland basins --- Russian book p0035 A80-10116

New developments in satellite oceanography and current measurements p0035 A80-10731

Chlorophyll gradient map from high-altitude ocean-color-scanner data p0035 A80-13129

A study of moisture conditions in the Pantanal of Brazil using satellite imagery p0041 A80-15055

Remote sensing for water quality and biological measurements in coastal waters p0036 A80-19541

The study of the ocean from space --- Russian book p0036 A80-20095

Ocean color observations --- by astronauts p0037 N80-10566

Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 A80-10567

ASTP at Barbados: Mesoscale pools of Amazon River water in the western tropical Atlantic p0037 N80-10568

Estimate of total reflectance from the Orinoco River outflow --- from Apollo Soyuz Test Project photographs p0037 N80-10569

On the problem of the remote sensing of substances in water by multispectral scanning p0043 N80-12478

Research into determining chemical parameters at the surface of the sea by remote sensing p0038 N80-12479

Determination of the optical properties of the sea in the German bight p0038 N80-12516

Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535

WATER CURRENTS

Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson p0041 A80-10370

Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar p0036 A80-15893

Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520

WATER DEPTH

Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546

WATER MANAGEMENT

Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data p0042 A80-20243

Remote sensing applied to hydrology. A bibliography with abstracts [NTIS/PS-79/0845/2] p0043 N80-11553

WATER POLLUTION

Optical methods for investigating oceans and inland basins --- Russian book p0035 A80-10116

Research into determining chemical parameters at the surface of the sea by remote sensing p0038 N80-12479

HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution [E80-10002] p0044 N80-12518

Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts [NTIS/PS-79/0842/9] p0025 N80-13614

Strategies for the surveillance of coastal waters of the Federal Republic of Germany [BMFT-FB-M-77-11] p0045 N80-13726

WATER QUALITY

Environmental monitoring systems p0023 A80-14705

Monitoring of euphotic depth from aircraft p0041 A80-15056

Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 A80-15265

Remote sensing for water quality and biological measurements in coastal waters p0036 A80-19541

Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data p0042 A80-20243

The integration of Landsat with other natural resource data for 208 water quality planning in South Dakota p0041 A80-20261

On the problem of the remote sensing of substances in water by multispectral scanning p0043 N80-12478

Interpretation of water quality using remote sensing techniques p0044 N80-12493

WATER RESOURCES

Earth feature identification and tracking technology development p0028 A80-17403

Remote sensing of Playa lakes as a source of climatic data p0042 A80-20245

Application of multidata photography and remote sensing data to environmental monitoring in the State of Washington p0048 A80-20265

LANDSAT project. State of Hawaii: A preliminary report [PB-296712/3] p0057 N80-10587

An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-162434] p0057 N80-11533

Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach [VT-LU-15] p0054 N80-11547

Remote sensing applied to hydrology. A bibliography with abstracts [NTIS/PS-79/0845/2] p0043 N80-11553

Space Observations for water resources: A potential to be developed p0044 N80-13609

SPOT, French preoperational remote sensing satellite system p0056 N80-13610

Operating scenario for a Hydrographic Airborne Laser Sounder (HALS) [AD-A073872] p0038 N80-14390

Heat Capacity Mapping Mission (HCMM) [E80-10039] p0045 N80-15533

WATER RUNOFF

A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data p0042 A80-20194

WATER TEMPERATURE

Optical methods for investigating oceans and inland basins --- Russian book p0035 A80-10116

New developments in satellite oceanography and current measurements p0035 A80-10731

Gulf stream boundary eddies off the east coast of Florida p0036 A80-16247

Remote sensing for water quality and biological measurements in coastal waters p0036 A80-19541

The structure and variability of shelf sea fronts as observed by an undulating CTD system --- Conductivity and Temperature Detector p0035 A80-20938

Applications of HCMM data to soil moisture snow and estuarine current studies --- soil moisture in Minnesota and water circulation in the Delaware Bay and Potomac River [E80-10004] p0044 N80-12520

A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery [AD-A074186] p0039 N80-14663

Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543

Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1] p0039 N80-15603

WATER WAVES

Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467

The study of the ocean from space --- Russian book p0036 A80-20095

Observations of internal-wave surface signatures in ASTP photographs p0037 N80-10570

Ocean wave spectrometer measurements in the gulf stream experiment [AD-A074369] p0039 N80-14665

WATERWEDS

Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 A80-15265

Satellite snow-cover observations in Arizona p0041 A80-20264

Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data --- Grendon Underwood Experimental Catchment, north west of London, U.K. [E80-10006] p0044 N80-12522

Remote estimation of surface moisture over a watershed --- Goodwater Creek Watershed, Missouri [E80-10025] p0044 N80-12527

U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed [PB-297442/6] p0044 N80-12547

WATERWAYS

Interpretation of water quality using remote sensing techniques p0044 N80-12493

WEATHER

Crop environment monitoring: The assessment of environmental phenomena using satellite remote sensing data p0010 N80-14454

WEATHER FORECASTING

Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project
[E80-10020] p0045 N80-15447

WEIGHTING FUNCTIONS

Weighted aggregation p0020 N80-15518

WETLANDS

Multispectral aerial photography for wetland vegetation mapping p0049 A80-19542
Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
Impact of Great Lakes water level fluctuations on coastal wetlands p0043 N80-10590
[PB-296403/9]
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 --- Pennsylvania, Delaware, Maryland, Virginia, and the District of Columbia p0026 N80-15526
[E80-10031]
Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data p0021 N80-15535
[NASA-TP-1553]

WHEAT

Wheat spectral reflectance - Interactions between crop configuration, sun elevation, and azimuth angle p0001 A80-13136
Look direction modulation function of the radar backscattering coefficient of agricultural fields p0002 A80-13357
Estimating leaf-area index of wheat with Landsat data p0002 A80-15053
An assessment of LACIE and related methodologies for conducting crop inventories p0004 A80-15783
A seasonal verification of the Suits spectral reflectance model for wheat p0005 A80-19544
Lodging of grain crops and its detection by aerial photography p0006 N80-10994
A study of the tolerance block approach to special stratification --- winter wheat in Kansas p0008 N80-12529
[E80-10027]
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America p0008 N80-13589
[E80-10010]
Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America p0008 N80-13590
[E80-10011]
Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota p0008 N80-13593
[E80-10014]
Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization --- North Dakota, Oklahoma, Montana, Colorado, and Minnesota p0009 N80-13594
[E80-10015]
Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains --- Colorado, Oklahoma, South Dakota, Minnesota, Montana, North Dakota, Kansas, Nebraska, Texas p0009 N80-13595
[E80-10016]
The agro-ecological zones project --- agroclimatic and land suitability assessment for various crops p0010 N80-14445
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium p0011 N80-15448
[E80-10030]
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449
Econometric models for predicting confusion crop ratios p0011 N80-15450
LACIE sampling design p0011 N80-15451
LACIE large area acreage estimation --- United States of America p0012 N80-15453
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts --- wheat p0012 N80-15454
Classification and mensuration of LACIE segments p0012 N80-15455
Development of LACIE CCEA-1 weather/wheat yield models --- regression analysis p0012 N80-15457
Growth stage estimation --- crop calendars p0012 N80-15458
Accuracy assessment: The statistical approach to performance evaluation in LACIE --- Great Plains corridor, United States p0013 N80-15459
Ancillary data acquisition for LACIE p0013 N80-15462
The classification and mensuration subsystem --- wheat p0013 N80-15465
Concepts leading to the IMAGE-100 hybrid interactive system p0014 N80-15466
USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467
Accuracy assessment system and operation p0014 N80-15472

The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482

LACIE area, yield, and production estimate characteristics: U.S. Great Plains p0016 N80-15484
LACIE area, yield, and production estimate characteristics: U.S.S.R. p0016 N80-15485
LACIE area, yield, and production estimate characteristics: Canada p0016 N80-15486
Accuracy and performance of LACIE area estimates --- wheat yield in the U.S. Great Plains States p0016 N80-15487
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
Accuracy and performance of LACIE crop development models p0016 N80-15489
Economic evaluation: Concepts, selected studies, system costs, and a proposed program p0017 N80-15490
Methods for segment wheat area estimation p0017 N80-15491
Development of partitioning as an aid to spectral signature extension p0017 N80-15499
The vegetative index number and crop identification p0018 N80-15503
LACIE analyst interpretation keys p0018 N80-15505
Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510
A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511
The law of the minimum and an application to wheat yield estimation p0019 N80-15512
CCEA second-generation wheat yield model for hard red wheat in North Dakota p0019 N80-15513
Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514
New developments in sampling and aggregation for remotely sensed surveys p0019 N80-15515
Natural sampling strategy p0019 N80-15516
Multiyear estimates for the LACIE sampling plans p0019 N80-15517
The application test system: An approach to technology transfer --- USDA aerospace and remote sensing information requirements p0020 N80-15520
Functional definition and design of a USDA system p0020 N80-15521
Analysis of scanner data for crop inventories --- North Dakota p0021 N80-15534
[E80-10040]
WIND (METEOROLOGY)
Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar p0036 A80-15893
WIND EROSION
Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259
WIND VELOCITY
Beauce TELLUS project --- France p0009 N80-13600
[E80-10024]
WISCONSIN
A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248
WYOMING
Geologic application of thermal-inertia mapping from satellite --- Powder River Basin, Wyoming and Cabeza Prieta, Arizona p0033 N80-12521
[E80-10005]

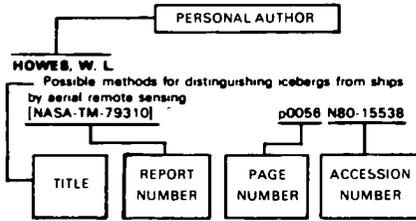
Y

YIELD
Natural sampling strategy p0019 N80-15516
YEMEN
Color of desert surfaces in the Arabian peninsula p0033 N80-10558
YIELD
Some applications of remote sensing in agricultural resources with reference to India p0003 A80-15776
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites --- Great Plains Corridor, North America p0008 N80-13589
[E80-10010]
Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model --- Wheat growth in the Great Plains Corridor, North America p0008 N80-13590
[E80-10011]
Overview of agrometeorology --- influence of meteorological parameters on crop growth p0009 N80-14441
Remote sensing applied to agriculture p0010 N80-14446
Agroclimatological methods involving remote sensing techniques p0010 N80-14451
Crop monitoring and prediction using satellite data p0011 N80-14455
Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium p0011 N80-15448
[E80-10030]

Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449
Econometric models for predicting confusion crop ratios p0011 N80-15450
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts --- wheat p0012 N80-15454
Development of LACIE CCEA-1 weather/wheat yield models --- regression analysis p0012 N80-15457
The classification and mensuration subsystem --- wheat p0013 N80-15465
Operation of the yield estimation subsystem p0014 N80-15468
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports p0014 N80-15469
LACIE area, yield, and production estimate characteristics: U.S. Great Plains p0016 N80-15484
LACIE area, yield, and production estimate characteristics: U.S.S.R. p0016 N80-15485
LACIE area, yield, and production estimate characteristics: Canada p0016 N80-15486
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510
A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511
The law of the minimum and an application to wheat yield estimation p0019 N80-15512
CCEA second-generation wheat yield model for hard red wheat in North Dakota p0019 N80-15513
New developments in sampling and aggregation for remotely sensed surveys p0019 N80-15515
Multiyear estimates for the LACIE sampling plans p0019 N80-15517
Weighted aggregation p0020 N80-15518

PERSONAL AUTHOR INDEX

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

- AARONSON, A. C.**
The application test system: An approach to technology transfer p0020 N80-15520
- ABBOTTS, L. F.**
The acquisition, storage, and dissemination of LANDSAT and other LACIE support data p0013 N80-15464
- ABDEL-RAHMAN, M. A.**
Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
East-West pervasive lineaments in central and southeastern Spain p0032 N80-10549
Detection of a probable ancestral delta of the Nile River p0033 N80-10571
- ABOTTEEN, K. M.**
Classification and mensuration of LACIE segments p0012 N80-15455
The classification and mensuration subsystem p0013 N80-15465
- ABOTTEEN, R. A.**
Generation of uniform chromaticity scale imagery from LANDSAT data p0018 N80-15507
Image and numerical display aids for manual interpretation p0051 N80-15508
A programmed labeling approach to image interpretation p0019 N80-15509
- ABRAMS, L. K.**
Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544
- ACKERMAN, M.**
Spectrometer for the first Spacelab payload p0054 N80-12034
- AHLERS, C. W.**
Accuracy assessment system and operation p0014 N80-15472
- ALBERTZ, J.**
On measurements from aircraft [BMFT-FB-W-78-04] p0050 N80-12467
- ALEXANDER, R. H.**
Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 [E80-10031] p0026 N80-15526
- ALI, M. E. O.**
Combined Skylab and high altitude aircraft photography space triangulation p0047 A80-11697
- ALLAN, J. A.**
The contribution of Landsat imagery to reconnaissance soil mapping in north-west India p0003 A80-15777
- ALLEN, C. M.**
The structure and variability of shelf sea fronts as observed by an undulating CTD system p0035 A80-20938
- ALLEN, G. P.**
Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson p0041 A80-10370
- ALLISON, L. J.**
A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data p0042 A80-20194
- ANDERSON, J. O.**
Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-airdrop data buoy [AD-A074731] p0039 N80-14664
- ANDERSON, R. R.**
Analysis of plant community structure and successional stage using multispectral and multirate aerial photography p0005 A80-20238
- ANONSEN, W. H.**
Acquisition and preprocessing of LANDSAT data p0013 N80-15461
- APEL, J. R.**
Observations of internal-wave surface signatures in ASTP photographs p0037 N80-10570
- ARAUJO, D. P. H.**
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- ARCONI, S. A.**
Detection of arctic water supplies with geophysical techniques [AD-A074157] p0043 N80-11538
- ASHBURN, P.**
USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467
The vegetative index number and crop identification p0018 N80-15503
The application test system: Experiences to date and future plans p0020 N80-15525
- ASKEW, A. J.**
Space Observations for water resources: A potential to be developed p0044 N80-13609
- ATKINSON, L. P.**
Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535
- AVERY, T. E.**
Forester's guide to aerial photo interpretation p0009 N80-14425

B

- BADHWAR, G.**
Accuracy assessment system and operation p0014 N80-15472
- BAGWELL, D. J.**
Remote sensing of sea-state and surface winds in the Irish and Celtic seas using MF radar p0036 A80-15893
- BAIER, W.**
Crop weather models: Concepts and applications p0010 N80-14450
- BAIR, G. L.**
Simple generation of one-parameter pseudoterrain surfaces p0048 A80-14952
- BAKER, J. R.**
Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514
- BAKER, V. R.**
South American river morphology and hydrology p0043 N80-10574
- BALASUBRAMANIAN, S.**
India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' p0053 A80-15489
- BALON, J. E.**
SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-182423] p0038 N80-11532
- BANYARD, S. G.**
Radar interpretation based on photo-truth keys - A practical training exercise for tropical foresters p0001 A80-10877
- BARDINET, C.**
Land use mapping in the Sahel zone using Landsat p0023 A80-15782
- BARE, J. E.**
Look direction modulation function of the radar backscattering coefficient of agricultural fields p0002 A80-13357
- Crop identification with L-band radar** p0005 A80-19543
- BARGEL, B.**
Digital processing procedure for texture analysis with remote sensing data p0050 N80-12505
- BARLOW, C. A.**
Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
- BARNES, J. C.**
Snow hydrology studies p0043 N80-10575
- BARNETT, T. L.**
Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510
- BARON, J. G.**
LACIE analyst interpretation keys p0018 N80-15505
- BARNETT, E. C.**
Satellite Remote Sensing: Applications in Agrometeorology and Agrometeorology [ESA-SP-1020] p0009 N80-14440
Crop environment monitoring: The remote sensing systems p0010 N80-14452
Crop environment monitoring: The assessment of environmental phenomena using satellite remote sensing data p0010 N80-14454
Crop monitoring and prediction using satellite data p0011 N80-14455
Satellite remote sensing in hazard monitoring and disaster evaluation p0011 N80-14456
Satellite remote sensing for agricultural advisories and planning p0011 N80-14457
- BABU, J. P.**
Natural sampling strategy p0019 N80-15516
- BATLIVALA, P. P.**
Crop identification with L-band radar p0005 A80-19543
- BAUER, M. E.**
Design, implementation, and results of LACIE field research p0020 N80-15519
- BEAUMONT, T. E.**
The use of remote sensing for transport planning and highway engineering in developing countries p0023 A80-15774
- BEGG, J. E.**
Remotely sensed land cover temperature and soil water status - A brief review p0002 A80-15052
- BEKEN, A.**
Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544
- BELCHER, R. C.**
Analysis of Skylab and astp photographs of the Levantine (Dead Sea) fault zone p0031 N80-10543
- BELOW, A. I.**
Method for increasing the accuracy of an airborne geodetic radio rangefinder p0028 A80-15176
- BENDER, M. J.**
Accuracy assessment system and operation p0014 N80-15472
- BENSON, J. L.**
The application test system: Technical approach and system design p0020 N80-15523
- BENTON, A. R., JR.**
Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
- BERNALDEZ, F. G.**
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- BERRY, J. E.**
Geometric preprocessing of sensor data used for image matching p0054 A80-17515
- BESSION, J.**
Spectrometer for the first Spacelab payload p0054 N80-12034
- BEY, P.**
Ocean wave spectrometer measurements in the gulf stream experiment [AD-A074369] p0039 N80-14665
- BJJVELD, J. H.**
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach [E80-10023] p0007 N80-12526
- BIZZELL, R. M.**
Classification and mensuration of LACIE segments p0012 N80-15455
The classification and mensuration subsystem p0013 N80-15465

- BLAINE, L. R.**
Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535
- BLYTH, K.**
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach [E80-10023] p0007 N80-12526
- BOATWRIGHT, G. O.**
Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510
- BOATWRIGHT, S. M.**
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports p0014 N80-15469
- BOBOLEVA, E. E.**
Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-16565
- BODINE, J. H.**
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446
- BONNER, J.**
U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed [PB-297442/6] p0044 N80-12547
US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain [PB-297931/8] p0051 N80-15547
- BORGASSER, M.**
Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258
Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
- BORMAN, K. L.**
A study of possible sea state information in the sample and hold gate statistics for the GEOS-3 satellite altimeter [NASA-CR-156858] p0038 N80-13753
- BORODIN, L. F.**
Microwave radiometric methods and the problem of forest and peat fires p0002 A80-14580
- BORSTAD, G.**
ASTP at Barbados: Mesoscale pools of Amazon River water in the western tropical Atlantic p0037 N80-10568
- BOWLEY, C. J.**
Snow hydrology studies p0043 N80-10575
- BRANDENBERGER, A. J.**
Combined Skylab and high altitude aircraft photography space triangulation p0047 A80-11697
- BRASCHLER, C. B.**
Econometric models for predicting confusion crop ratios p0011 N80-15450
- BREED, C. S.**
Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560
- BREED, W. J.**
Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560
- BRERA, A. M.**
The use of Landsat imagery to monitor desert encroachment in arid areas p0024 A80-20241
- BROWN, L. E.**
Acquisition and preprocessing of LANDSAT data p0013 N80-15461
- BROWN, M. L. JR.**
Texas applications system verification and transfer remote sensing information subsystem: Functional design [E80-10017] p0050 N80-13596
- BRUCE, W. D.**
Landsat imagery - A cartographic reference base p0028 A80-11706
- BRYANT, J. D.**
On the clustering of multidimensional pictorial data p0050 N80-15493
- BUCK, B. M.**
Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-airdrop data buoy [AD-A074731] p0039 N80-14664
- BUDANOV, V. Y.**
Lodging of grain crops and its detection by aerial photography p0006 N80-10994
- BUELOW, K.**
USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467
The application test system: An approach to technology transfer p0020 N80-15520
- BURKE, S. P.**
Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-airdrop data buoy [AD-A074731] p0039 N80-14664
- BUSHNELL, M.**
Gulf stream boundary eddies off the east coast of Florida p0036 A80-16247
Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1] p0039 N80-15603
- BUTERA, M. K.**
Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data [NASA-TP-1553] p0021 N80-15535
- BYRNE, G.**
A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data p0042 A80-20194
- BYRNE, G. F.**
Remotely sensed land cover temperature and soil water status - A brief review p0002 A80-15052
- BYRNES, H. J.**
Operating scenario for a Hydrographic Airborne Laser Sounder (HALS) [AD-A073872] p0038 N80-14390

C

- CALLA, O. P. N.**
India's first remotely-sensed satellite data from 'BHASKARA' using 'SAMIR' p0053 A80-15489
- CAPONIGRO, P.**
Topographical characteristics through the study of the thermal and hydrological disuniformity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project [E80-10020] p0045 N80-15447
- CARLSON, G. E.**
Simple generation of one-parameter pseudoterrain surfaces p0048 A80-14952
- CARSON, R. M.**
The structure and variability of shelf sea fronts as observed by an undulating CTD system p0035 A80-20938
- CASTAING, P.**
Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis de Maumusson p0041 A80-10370
- CATE, R. B.**
The law of the minimum and an application to wheat yield estimation p0019 N80-15512
- CATOE, C. E.**
A multispectral look at oil pollution detection monitoring and law enforcement [NASA-TM-80573] p0025 N80-12622
- CAVALIERI, D.**
Interim calibration report for the SMMR simulator [NASA-TM-80564] p0055 N80-12534
- CHANCE, J. E.**
A seasonal verification of the Suits spectral reflectance model for wheat p0005 A80-19544
- CHANG, A. T. C.**
Passive microwave studies of frozen lakes p0042 A80-20247
- CHAPELLE, E. W.**
Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431
- CHAPMAN, M. E.**
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446
- CHEFFIN, R. E.**
Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model [E80-10011] p0008 N80-13590
- CHEN, D. T.**
Ocean wave spectrometer measurements in the gulf stream experiment [AD-A074369] p0039 N80-14665
- CHEKASHIN, V. P.**
Remote identification of the spatial structure of forest phytocoenoses p0004 A80-16563
- CHHIKARA, R. S.**
Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains [E80-10016] p0009 N80-13595
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449
LACIE sampling design p0011 N80-15451
LACIE large area acreage estimation p0012 N80-15453
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts p0012 N80-15454
Accuracy assessment: The statistical approach to performance evaluation in LACIE p0013 N80-15459
- CIBUZAR, A.**
Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data p0042 A80-20243
- CICONE, R.**
Analysis of scanner data for crop inventories [E80-10040] p0021 N80-15534
- CIHLAR, J.**
Use of thermal infrared and colour infrared imagery to detect crop moisture stress [E80-10036] p0021 N80-15530
HCMM/soil moisture experiment [E80-10037] p0021 N80-15531
- CLAASSEN, J. P.**
The system and hardware design of real-time fan beam scatterometer data processors [E80-10028] p0055 N80-12530
- CLARK, B. V.**
The system and hardware design of real-time fan beam scatterometer data processors [E80-10028] p0055 N80-12530
- CLARK, J. E.**
Econometric models for predicting confusion crop ratios p0011 N80-15450
- CLARK, N. F.**
Use of thermal infrared and colour infrared imagery to detect crop moisture stress [E80-10036] p0021 N80-15530
- CLAYDON, J. C.**
Development of partitioning as an aid to spectral signature extension p0017 N80-15499
- CLUNTON, N. J.**
Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization [E80-10015] p0009 N80-13594
- COLLINS, W. G.**
Remote sensing applications in developing countries p0057 A80-15771
- COLVOCORESSES, A. P.**
Proposed parameters for an automated mapping satellite /MAPSAT/ system p0027 A80-11698
- CONTE, D.**
LACIE area, yield, and production estimate characteristics: Canada p0016 N80-15488
- COSMI, F. M.**
Pressure Modulator Radiometer (PMR) tests [NASA-CR-159175] p0056 N80-15380
- COTTRELL, D. A.**
The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications p0027 A80-11699
- CRAIG, M.**
Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549
- CREA, W. E.**
Growth stage estimation p0012 N80-15458
Accuracy and performance of LACIE crop development models p0016 N80-15489
- CRISMAN, B. W.**
Gulf stream boundary eddies off the east coast of Florida p0036 A80-16247
Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1] p0039 N80-15603
- CRIST, E.**
Analysis of scanner data for crop inventories [E80-10040] p0021 N80-15534

D

- DANA, R. W.**
Using airborne radiometry to determine atmospheric effects in Landsat data p0054 A80-20244
- DARCH, J. P.**
A study of moisture conditions in the Pantanal of Brazil using satellite imagery p0041 A80-15056
- DARIO, E. R.**
Functional definition and design of a USDA system p0020 N80-15521
- DAUPHIN, V. M.**
LACIE status and tracking p0014 N80-15470
- DAVID, F. C.**
The application test system: An approach to technology transfer p0020 N80-15520
- DECELL, H. P., JR.**
Linear feature selection with applications p0051 N80-15496
- DEERING, D. W.**
Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor [E80-10008] p0025 N80-12524
- DEJACE, J.**
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data [E80-10006] p0044 N80-12522
- DELANEY, A. J.**
Detection of arctic water supplies with geophysical techniques [AD-A072157] p0043 N80-11538
- DEMPSEY, D. J.**
A study of possible sea state information in the sample and hold gate statistics for the GEOS-3 satellite altimeter [NASA-CR-156858] p0038 N80-13753
- DENNIS, T. S.**
Large Area Crop Inventory Experiment (LACIE). List spectral keys study [E80-10012] p0008 N80-13591
- DEVRIES, M.**
Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259

- DEY, B.**
Some applications of remote sensing in agricultural resources with reference to India p0003 N80-15776
- DICKINSON, G. L.**
Functional definition and design of a USDA system p0020 N80-15521
- DIETZ, R. S.**
Volcanic landforms and astroblemes p0032 N80-10551
- DIETZE, H.**
Interpretation of water quality using remote sensing techniques p0044 N80-12493
- DISPERATI, A. A.**
The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin p0003 N80-15778
- DMITRIEV, A. V.**
Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation p0041 N80-10125
- DOEFEL, H. J.**
Phenology as a factor in the determination of different forms in vegetation by remote sensing p0007 N80-12499
- DOERFFER, R.**
On the problem of the remote sensing of substances in water by multispectral scanning p0043 N80-12478
- DONKER, N. H. W.**
The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java p0048 N80-15781
- DOWNES, J. M.**
Data base design for a worldwide multicrop information system p0020 N80-15522
- DRIGGERS, W. G.**
Data base design for a worldwide multicrop information system p0020 N80-15522
- DUNIN, F. X.**
Remotely sensed land cover temperature and soil water status - A brief review p0002 N80-15052
- DUPREY, B. B.**
Man-machine interfaces in LACIE/ERIPS p0015 N80-15476
- DZHANSEITOV, K. K.**
Remote identification of the spatial structure of forest phytocoenoses p0004 N80-16563
- E**
- EAGLESON, K. W.**
Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 N80-15265
- EBERT, J. I.**
Remote sensing of Playa lakes as a source of climatic data p0042 N80-20245
- EGOROVA, O. I.**
Some aspects of determining object coordinates from scanner photographs p0047 N80-10173
- EISGRUBER, L. M.**
Econometric models for predicting confusion crop ratios p0011 N80-15450
- EKENGREN, B.**
Inexpensive radar mapping by Ericsson Star p0047 N80-11190
- EL-AHSHRY, M. T.**
Use of Apollo-Soyuz photographs in coastal studies p0037 N80-10573
- EL-BAZ, F.**
Apollo-Soyuz test project. Volume 2: Earth observations and photography [NASA-SP-412-VOL-2] p0049 N80-10538
Summary of significant results p0049 N80-10539
Photolineaments in the ASTP stereostrip of the western desert of Egypt p0032 N80-10546
Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547
Color zoning in the western desert of Egypt p0024 N80-10553
Orbital observations of sand distribution in the western desert of Egypt p0024 N80-10554
Preliminary analysis of color variations of sand deposits in the western desert of Egypt p0032 N80-10555
Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556
Color of desert surfaces in the Arabian peninsula p0033 N80-10558
Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559
Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 N80-10567
Estimate of total reflectance from the Orinoco River outflow p0037 N80-10569
Detection of a probable ancestral delta of the Nile River p0033 N80-10571
- EL-ETR, H. A.**
Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
Photolineaments in the ASTP stereostrip of the western desert of Egypt p0032 N80-10546
- Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547
Color zoning in the western desert of Egypt p0024 N80-10553
- ELGIN, J. H., JR.**
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
- ELLEFSEN, R.**
A suggested method for delimiting urbanized areas using digital Landsat data p0024 N80-20246
- ELMAN, R. I.**
Digital processing of multispectral color aerial photographs of forest land p0001 N80-10171
- ENABNIT, D. B.**
Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546
- EPPLER, W. G.**
Accuracy assessment system and operation p0014 N80-15472
On evaluating clustering procedures for use in classification p0017 N80-15494
- ERICKSON, J. D.**
Methods for segment wheat area estimation p0017 N80-15491
- EVANS, S. M.**
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports p0014 N80-15469
Functional definition and design of a USDA system p0020 N80-15521
- EVERETTE, J. M.**
LACIE status and tracking p0014 N80-15470
- F**
- FAHY, D. P.**
Advances in digital image display and simulation from digital terrain data bases p0047 N80-11696
- FALLS, A. M.**
Texas applications system verification and transfer remote sensing information subsystem: Functional design [E80-10017] p0050 N80-13596
- FAINTICH, M. B.**
Advances in digital image display and simulation from digital terrain data bases p0047 N80-11696
- FEDCHENKO, P. P.**
Spectral reflectance of certain weeds p0004 N80-20754
- FEDOROV, K. N.**
The study of the ocean from space p0036 N80-20095
- FEIVISON, A. H.**
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449
LACIE sampling design p0011 N80-15451
LACIE large area acreage estimation p0012 N80-15453
Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts p0012 N80-15454
Accuracy assessment: The statistical approach to performance evaluation in LACIE p0013 N80-15459
Estimating crop proportions from remotely sensed data p0017 N80-15492
New developments in sampling and aggregation for remotely sensed surveys p0019 N80-15515
Weighted aggregation p0020 N80-15518
- FEYERHERM, A. M.**
A universal model for estimating wheat yields [CONTRIB-78-288-A] p0019 N80-15511
- FISCHER, W.**
On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region p0007 N80-12512
- FLEMING, E. A.**
Landsat imagery - A cartographic reference base p0028 N80-11708
- FLEMING, P. M.**
Remotely sensed land cover temperature and soil water status - A brief review p0002 N80-15052
- FLOWERS, F. L.**
A look at computer system selection criteria p0015 N80-15480
- FOOSE, R. M.**
Evaluation of satellite images of the Levantine Rift zone p0031 N80-10542
- FOREMAN, R. N.**
Land cover classification from Landsat data: Phase 3 of a joint DOE/NASA demonstration [AD-A071723] p0024 N80-11535
- FOSTER, J. L.**
Passive microwave studies of frozen lakes p0042 N80-20247
- FOUTS, L. D.**
Resource modeling: A reality for program cost analysis p0020 N80-15524
- FRANKE, C.**
Making morphological maps of sand banks from aerial photographs p0033 N80-12483
- FRAYSE, G.**
Agroclimatological methods involving remote sensing techniques p0010 N80-14451
- FRERE, M.**
Overview of agrometeorology p0009 N80-14441
- FRIDMAN, SH. D.**
Fundamentals of remote-sensing methods of measuring snow water equivalent and soil moisture from terrestrial gamma radiation p0041 N80-10125
- FRIMOUT, D.**
Spectrometer for the first Spacelab payload p0054 N80-12034
- FRITZSCHE, A. E.**
Development of an airborne gamma radiation system for snow surveys [EGG-1183-1679] p0044 N80-13606
- G**
- GALAZI, G. I.**
Optical methods for investigating oceans and inland basins p0035 N80-10116
- GIENAPP, H.**
Determination of the optical properties of the sea in the German bight p0038 N80-12516
- GIFFORD, A. W.**
Orbital observations of sand distribution in the western desert of Egypt p0024 N80-10554
- GIRARD, A.**
Spectrometer for the first Spacelab payload p0054 N80-12034
- GIULI, R. T.**
Summary of significant results p0049 N80-10539
- GLOERSEN, P.**
Interim calibration report for the SMMR simulator [NASA-TM-80564] p0055 N80-12534
- GOETZ, L. K.**
Analysis of Skylab and astp photographs of the Levantine (Dead Sea) fault zone p0031 N80-10543
- GOLDOBINA, L. S.**
Method for increasing the accuracy of an airborne geodetic radio rangefinder p0028 N80-15176
- GOODMAN, L. R.**
Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546
- GOSSARD, D. W.**
Use of digital terrain modeling to support resource planning in the Forest Service, U.S. Department of Agriculture p0001 N80-11708
- GREBOWSKY, G. J.**
LACIE registration processing p0012 N80-15456
- GREGG, T. W. D.**
Application of multitemperature photography and remote sensing data to environmental monitoring in the State of Washington p0048 N80-20265
Cooperative methods for acquisition of aerial photography p0053 N80-20266
- GREGOR, P. J.**
Cost and performance characteristics of data system configurations for processing remotely sensed data p0015 N80-15481
- GUENTHER, G. C.**
Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546
- GURNEY, R. J.**
TELLUS: A combined surface temperature, soil moisture and evaporation/mapping approach [E80-10023] p0007 N80-12526
The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing [E80-10021] p0009 N80-13599
- GUSEMAN, L. F., JR.**
Linear feature selection with applications p0051 N80-15496
- GUTSCHEWSKI, G. L.**
LACIE quality assurance p0014 N80-15471
- H**
- HALL, D. K.**
Passive microwave studies of frozen lakes p0042 N80-20247
- HALL, E. L.**
Digital processing of aerial images: Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979 p0049 N80-17514
- HALL, J. A.**
Array technology as applied to future earth resources sensors p0054 N80-17463
- HALLUM, C. R.**
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449
LACIE sampling design p0011 N80-15451
Natural sampling strategy p0019 N80-15516
- HAMMOND, D. L.**
Ocean wave spectrometer measurements in the gulf stream experiment [AD-A074369] p0039 N80-14665
- HANSEN, H. L.**
USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467
The application test system: Experiences to date and future plans p0020 N80-15525

- HANSMEYER, L.**
Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data p0042 A80-20243
- HANUSCHAK, G.**
Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549
- HARLAN, J. C.**
Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor [E80-10008] p0025 N80-12524
Design, implementation, and results of LACIE field research p0020 N80-15519
- HARMUTH, H. F.**
Concept development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature [AD-A074439] p0051 N80-15540
- HARNEY, E. D.**
Thematic mapper design description and performance prediction p0053 A80-17460
- HARRISS, R. C.**
Remote sensing for water quality and biological measurements in coastal waters p0036 A80-19541
- HART, W. D.**
Chlorophyll gradient map from high-altitude ocean-color-scanner data p0035 A80-13129
Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535
- HARTLEY, H. O.**
Multiyear estimates for the LACIE sampling plans p0019 N80-15517
- HATCH, R. E.**
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports p0014 N80-15489
- HAY, C. M.**
Manual interpretation of LANDSAT data p0013 N80-15460
Development of partitioning as an aid to spectral signature extension p0017 N80-15499
Manual LANDSAT data analysis for crop type identification p0018 N80-15504
- HEFT, R. E.**
Cooperative methods for acquisition of aerial photography p0053 A80-20266
- HEILMAN, J. L.**
HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution [E80-10002] p0044 N80-12518
- HELBIG, H.**
Aerial photography of agricultural farming land p0006 N80-12496
- HERRMANN, R.**
Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 A80-15265
- HEYDORN, R. P.**
Classification and mensuration of LACIE segments p0012 N80-15455
Methods for segment wheat area estimation p0017 N80-15491
An evaluation of procedure 1 p0018 N80-15502
- HICKMAN, J. R.**
LACIE area, yield, and production estimate characteristics: U.S.S.R. p0016 N80-15485
Data base design for a worldwide multicrop information system p0020 N80-15522
- HILDEBRANDT, G.**
Interpretation of water quality using remote sensing techniques p0044 N80-12493
- HILDEBRANDT, G.**
Texture analysis as a recognition parameter for different types of forests p0006 N80-12498
- HILL, J. D.**
Operation of the yield estimation subsystem p0014 N80-15468
The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482
- HILWIG, F. W.**
Selection of Landsat MSS data for inventories of earth resources p0047 A80-10876
- HIRT, F. H.**
Interpretation of IR and MSS data for town areas p0025 N80-12485
- HOFFER, R. M.**
A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248
Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types [E80-10009] p0008 N80-13588
- HOLBEN, B. N.**
Spectral vegetation relationships in a tropical rain forest p0005 A80-20249
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
- Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data [NASA-TM-80557] p0055 N80-12533
- HOLMES, G.**
Analysis of scanner data for crop inventories [E80-10040] p0021 N80-15534
- HOLZ, R. K.**
South American river morphology and hydrology p0043 N80-10574
- HOPKINS, T. S.**
Ocean color observations p0037 N80-10566
- HORN, T. N.**
Acquisition and preprocessing of LANDSAT data p0013 N80-15461
- HORRALL, K. B.**
Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images p0032 N80-10548
- HORTON, J.**
The PDS differential rectifier - An economical approach to digital orthophotos p0054 A80-20250
- HOUDART, M.**
Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson p0041 A80-10370
- HOUSTON, A. G.**
Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449
Accuracy assessment: The statistical approach to performance evaluation in LACIE p0013 N80-15459
Accuracy assessment system and operation p0014 N80-15472
LACIE area, yield, and production estimate characteristics: Canada p0016 N80-15486
Accuracy and performance of LACIE area estimates p0016 N80-15487
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
- HOWARD, G. E., JR.**
A light aircraft camera Pod - The Enviro-Pod p0024 A80-20251
- HOWARD, J. A.**
Overview of remote sensing for agrilclimatology and agrometeorology p0010 N80-14442
Remote sensing applied to agriculture p0010 N80-14446
- HOWES, W. L.**
Possible methods for distinguishing icebergs from ships by aerial remote sensing [NASA-TM-79310] p0056 N80-15538
- HOWLAND, W. G.**
Multispectral aerial photography for wetland vegetation mapping p0049 A80-19542
- HSU, E. M.**
Accuracy assessment system and operation p0014 N80-15472
Accuracy and performance of LACIE area estimates p0016 N80-15487
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
- HSU, E. N.**
Accuracy assessment: The statistical approach to performance evaluation in LACIE p0013 N80-15459
- HSU, S.-Y.**
The National Map Accuracy Standards in the context of mapping with imagery data p0049 A80-20252
- HUANG, N. E.**
New developments in satellite oceanography and current measurements p0035 A80-10731
- HUNDEMANN, A. S.**
Remote sensing applied to geology and mineralogy. A bibliography with abstracts [NTIS/PS-79/0844/5] p0034 N80-13612
Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts [NTIS/PS-79/0842/9] p0025 N80-13614
Remote sensing applied to urban and regional planning. A bibliography with abstracts [NTIS/PS-79/0843/7] p0025 N80-13615
Remote sensing of agricultural resources. A bibliography with abstracts [NTIS/PS-79/0993/0] p0021 N80-15542
- HUNDERMAN, A. S.**
Remote sensing applied to hydrology. A bibliography with abstracts [NTIS/PS-79/0845/2] p0043 N80-11553
- HURST, R. L.**
Resource modeling: A reality for program cost analysis p0020 N80-15524
- HUYGEN, J.**
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data [E80-10006] p0044 N80-12522
- I**
- ISO, S. B.**
Wheat spectral reflectance - Interactions between crop configuration, sun elevation, and azimuth angle p0001 A80-13136
- Plant canopy information extraction from composite scene reflectance of row crops p0001 A80-13141
- ISAEV, A. S.**
Remote-sensing studies of taiga regions p0053 A80-16559
Analysis of the landscape-ecological correlation of Siberian silkworm infestation areas, using aerial and satellite photography p0004 A80-16566
Analysis of the spectral reflection characteristics of natural formations in remote sensing studies p0053 A80-16568
- ITTEN, K. I.**
Snow mapping from space platforms p0045 N80-13611
- J**
- JAKKOLA, S.**
Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach [VT-LU-15] p0054 N80-11547
- JACKSON, R. D.**
Weight spectral reflectance - Interactions between crop configuration, sun elevation, and azimuth angle p0001 A80-13136
Plant canopy information extraction from composite scene reflectance of row crops p0001 A80-13141
Heat Capacity Mapping Mission (HCMM) [E80-10039] p0045 N80-15533
- JAWORSKI, E.**
Impact of Great Lakes water level fluctuations on coastal wetlands [PB-296403/9] p0043 N80-10590
- JEAN, B. R.**
The system and hardware design of real-time fan beam scatterometer data processors [E80-10028] p0055 N80-12530
- JEFFRESS, C. H.**
LACIE status and tracking p0014 N80-15470
- JENSEN, J. R.**
Computer graphic feature analysis and selection p0047 A80-13358
- JOHNSON, C. L.**
LACIE/ERIPS software system summary p0015 N80-15477
- JOHNSON, F.**
Generation of uniform chromaticity scale imagery from LANDSAT data p0018 N80-15507
- JOHNSON, R. W.**
Remote sensing for water quality and biological measurements in coastal waters p0036 A80-19541
- JORDAN, L. E., III**
Landsat applications in Georgia - A successful example of technology transfer between NASA and state government p0057 A80-14792
- JUDAY, R. D.**
Colorimetric consideration of transparencies for a typical LACIE scene p0018 N80-15506
Generation of uniform chromaticity scale imagery from LANDSAT data p0018 N80-15507
- JUSTICE, C.**
Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data [NASA-TM-80557] p0055 N80-12533
- JUSTICE, C. O.**
An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy p0028 A80-20253
- K**
- KADRO, A.**
Spectral reflection from agricultural and forest regions during the vegetation period p0007 N80-12513
- KAHLE, A. B.**
Geologic application of thermal inertia imaging using HCMM data [E80-10035] p0034 N80-15529
- KAHLE, H.**
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446
- KALASHNIKOV, E. N.**
System of landscape-statistical methods for stocktaking and mapping of forests p0004 A80-18562
- KANEMASU, E. T.**
Estimating leaf-area index of wheat with Landsat data p0002 A80-15053
- KARPENKO, V. D.**
Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-16565
- KASSAM, A. H.**
The agro-ecological zones project p0010 N80-14445
- KAULA, W. M.**
Geodynamics from satellites [AAS PAPER 79-243] p0031 A80-16427
- KAUTH, R. J.**
Feature extraction applied to agricultural crops as seen by LANDSAT p0017 N80-15497
Signature extension methods in crop area estimation p0018 N80-15501

- Analysis of scanner data for crop inventories
[E80-10040] p0021 N80-15534
- KEECH, M. A.**
The value of using SLAR, satellite imagery and aerial photography for a forest survey in the Amazon basin
p0003 A80-15778
- KEMPER, B.**
Examples of aerial photo-interpretation in soil surveys for an agricultural land development project in north-east Brazil
p0003 A80-15560
- KHAPIN, IU. B.**
Airborne semiconductor radiometers
p0053 A80-14196
- KHLEBOPROS, R. G.**
Analysis of the spectral reflection characteristics of natural formations in remote sensing studies
p0053 A80-16568
- KHRUSTALEV, M. M.**
Constructing a network of earth resource satellites
p0057 A80-17993
- KILPELAE, E.**
Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach
[VTT-LU-15] p0054 N80-11547
- KIM, H. H.**
Chlorophyll gradient map from high-altitude ocean-color-scanner data
p0035 A80-13129
Ocean chlorophyll studies from a U-2 aircraft platform
[NASA-TM-80574] p0038 N80-12535
- KING, W. J.**
Gulf stream boundary eddies off the east coast of Florida
p0036 A80-16247
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data
[ORO-5444-1] p0039 N80-15603
- KINSLER, M. C.**
Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota
[E80-10014] p0008 N80-13593
- KIRIEEV, D. M.**
Structure of taiga landscapes and its study by remote sensing techniques
p0028 A80-16560
- KLUEGEL, R.**
Mapping of chlorophyll a concentrations and Secchi Disc depth of lakes within region 5 using Landsat digital data
p0042 A80-20243
- KOCIN, P. J.**
Remote estimation of surface moisture over a watershed
[E80-10025] p0044 N80-12527
- KOHL, M.**
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data
[E80-10006] p0044 N80-12522
- KOMSTANTINOV, V. S.**
Constructing a network of earth resource satellites
p0057 A80-17993
- KONDRATEV, K. IA.**
Spectral reflectance of certain weeds
p0004 A80-20754
- KONECNY, G.**
On the current state of remote sensing techniques
p0055 N80-12469
- KORSUNOV, V. M.**
Mapping the soil cover of taiga landscapes by remote sensing techniques
p0004 A80-16565
- KOSCHE, H.**
Strategies for the surveillance of coastal waters of the Federal Republic of Germany
[BMFT-FB-M-77-11] p0045 N80-13726
- KOVAL, A. D.**
The use of space - International cooperation in the area of space applications
p0057 A80-16394
- KRAMER, R. J.**
Analysis of plant community structure and successional stage using multispectral and multirate aerial photography
p0005 A80-20238
- KREFT, A. E.**
Pressure Modulator Radiometer (PMR) tests
[NASA-CR-159175] p0056 N80-15380
- KRIEBEL, K. T.**
Albedo of vegetated surfaces - Its variability with differing irradiances
p0002 A80-15051
- KROPATZSCH, W.**
Concept for the automatic registration of satellite images with a digital map data base
p0027 A80-11701
- KRYLOV, IU. V.**
Calculation of the spectral irradiance in spaceborne photography of the earth
p0005 A80-20195
- KUITTINEN, R.**
Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach
[VTT-LU-15] p0054 N80-11547
- KULIASOV, A. G.**
Recording the contour of a region with an airborne laser profilograph
p0028 A80-20200
- KUZMICHIEV, V. V.**
Remote identification of the spatial structure of forest phytocoenoses
p0004 A80-16563
- L**
- LABRANDERO, D. J. L.**
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] p0020 N80-15527
- LAIRD, J. C.**
Ocean color observations
p0037 N80-10566
- LAMBECK, P. F.**
Feature extraction applied to agricultural crops as seen by LANDSAT
p0017 N80-15497
- LANGBEIN, J. O.**
Crustal deformation in central California: Multi-wavelength geodetic observations and interpretations
p0029 N80-14605
- LANGERAAR, W. D.**
Physical background of remote sensing
p0029 N80-14443
- LANSING, J. C. JR.**
Thematic mapper design description and performance prediction
p0053 A80-17460
- LARIN-ALABI, F. B.**
Problems of remote sensing in the tropics - An appraisal of the Nigerian situation with regard to forest resources
p0004 A80-15779
- LATHROP, L. D.**
Spectral classification of tomato disease severity levels
p0005 A80-20254
- LAWRANCE, C. J.**
The natural regions of Ethiopia compiled from Landsat imagery, as a basis for an engineering materials inventory
p0048 A80-15773
- LEATHERDALE, J. D.**
The practical contribution of space imagery to topographical mapping
p0027 A80-11702
- LEBEDEV, A. A.**
Constructing a network of earth resource satellites
p0057 A80-17993
- LEBEDEV, A. V.**
Principals of mapping hydrological parameters from natural systems, using satellite photography
p0042 A80-16564
- LEBERL, F.**
Concept for the automatic registration of satellite images with a digital map data base
p0027 A80-11701
- LEDOVSKIKH, V. IA.**
Remote identification of the spatial structure of forest phytocoenoses
p0004 A80-16563
- LEDUC, S. K.**
Development of LACIE CCEA-1 weather/wheat yield models
p0012 N80-15457
CCEA second-generation wheat yield model for hard red wheat in North Dakota
p0019 N80-15513
- LEE, W. JR.**
An evaluation of procedure 1
p0018 N80-15502
- LEMASTER, E. W.**
A seasonal verification of the Suits spectral reflectance model for wheat
p0005 A80-19544
- LENHART, K. G.**
Meteosat and remote sensing application
p0056 N80-14448
- LENNINGTON, R. K.**
CLASSY: An adaptive maximum likelihood clustering algorithm
p0051 N80-15495
- LISZCZ, C. J.**
LACIE area sampling frame and sample selection
p0012 N80-15452
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports
p0014 N80-15469
- LOPEZDESAGREDO, F.**
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain
[E80-10032] p0020 N80-15527
- LOVELAND, T.**
Compositing natural resource and land use information in Spearfish, South Dakota - A land capability study
p0024 A80-20255
The integration of Landsat with other natural resource data for 208 water quality planning in South Dakota
p0041 A80-20261
- LOVFALD, L. O.**
LACIE area, yield, and production estimate characteristics: Canada
p0016 N80-15486
- LUEBBE, R.**
Obtaining timely crop area estimates using ground-gathered and LANDSAT data
[PB-300825/7] p0021 N80-15549
- LYON, J. C.**
Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks
p0015 N80-15479
- LYON, R. J. P.**
Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission
[E80-10033] p0034 N80-15528
- M**
- MACDONALD, H. C.**
Long wavelength radar for geological analysis in vegetated terrain
p0031 A80-20258
Dual polarized long wavelength radar for discrimination of agricultural land use
p0003 A80-20268
- MACDORAN, P. F.**
System for real-time crustal deformation monitoring
[NASA-CASE-NPO-14124-1] p0029 N80-14603
- MACKIN, T. F.**
Concepts leading to the IMAGE-100 hybrid interactive system
p0014 N80-15466
- MAHER, K. M.**
An economic analysis of five selected LANDSAT assisted information systems in Oregon
[NASA-CR-162434] p0057 N80-11533
- MAHR, D.**
Interpretation of water quality using remote sensing techniques
p0044 N80-12493
- MAIA, J. C.**
The Brazilian Landsat program - Automated and manual mapping and future plans for cartographic applications
p0027 A80-11699
- MAIER, D. C.**
Long-term tracking of arctic icebergs
[AD-A072473] p0037 N80-10583
- MAKHANYA, E. M.**
A photo-interpretation study of erosion hazard in the Thaba Bosiu rural development area /Lesotho/
p0003 A80-15775
- MALILA, W. A.**
Design, implementation, and results of LACIE field research
p0020 N80-15519
Analysis of scanner data for crop inventories
[E80-10040] p0021 N80-15534
- MANSFIELD, P. J.**
Impact of Great Lakes water level fluctuations on coastal wetlands
[PB-296403/9] p0043 N80-10590
- MARACCI, G.**
Monitoring of euphotic depth from aircraft
p0041 A80-15056
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data
[E80-10006] p0044 N80-12522
- MARASIN, L. E.**
Recording the contour of a region with an airborne laser profilograph
p0028 A80-20200
- MARELLI, L.**
The Earthnet programme
p0056 N80-14444
- MARESCA, T. J.**
Pressure Modulator Radiometer (PMR) tests
[NASA-CR-159175] p0056 N80-15380
- MARQUIS, D. L.**
LACIE area, yield, and production estimate characteristics: U.S. Great Plains
p0016 N80-15484
- MARSH, S. E.**
Geologic application of thermal inertia imaging using HCMM data
[E80-10035] p0034 N80-15529
- MARTIN, M. V.**
Texas applications system verification and transfer remote sensing information subsystem: Functional design
[E80-10017] p0050 N80-13596
- MASUMY, S. A.**
Texture analysis as a recognition parameter for different types of forests
p0006 N80-12498
- MATSON, M.**
Applications of HCMM data to soil moisture snow and estuarine current studies
[E80-10004] p0044 N80-12520
- MAUL, G. A.**
Determining photograph locations over oceans
p0050 N80-10561
Interpreting ASTP photographs of the ocean and locating the area photographed, case study of the Gulf of Mexico
p0036 N80-10562
Survey of satellite sensors and data with application to OTEC resource and operations requirements
[PB-300297/9] p0039 N80-15543
- MAXWELL, T. A.**
Preliminary analysis of color variations of sand deposits in the western desert of Egypt
p0032 N80-10555
Suspended-sediment dispersal patterns of river deltas photographed by ASTP
p0043 N80-10572
- MAY, G. A.**
USDA analyst review of the LACIE IMAGE-100 hybrid system test
p0014 N80-15467
The application test system: Experiences to date and future plans
p0020 N80-15525
- MAZHUGH, I. N.**
Recording the contour of a region with an airborne laser profilograph
p0028 A80-20200
- MCCALLUM, W. E.**
The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports
p0014 N80-15469
- MCCANN, D. H.**
Array technology as applied to future earth resources sensors
p0054 A80-17463
- MCCLEIN, C. R.**
Chlorophyll gradient map from high-altitude ocean-color-scanner data
p0035 A80-13129

- Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535
- MCCLELLAND, D. R.**
The application test system: Technical approach and system design p0020 N80-15523
- MCCOLLOUGH, M. D., JR.**
Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 A80-15265
- MCCOY, R. M.**
Mapping vegetation with low cover density from Landsat data p0006 A80-20257
- MCCRARY, D. G.**
Operation of the yield estimation subsystem p0014 N80-15468
- MCEWEN, M. C.**
Design, implementation, and results of LACIE field research p0020 N80-15519
- MCFADEEN, D.**
Analysis of plant community structure and successional stage using multispectral and multivariate aerial photography p0005 A80-20238
- MCGINNIS, D. F.**
Applications of HCMM data to soil moisture snow and estuarine current studies [E80-10004] p0044 N80-12520
- MCGINNIS, D. F., JR.**
Use of satellite infrared data for geomorphology studies p0041 A80-15054
- MCHONE, J. F.**
Volcanic landforms and astroblemes p0032 N80-10551
Riachao Ring, Brazil: A possible meteorite crater discovered by the Apollo astronauts p0032 N80-10552
- MCKENZIE, R. C.**
Use of thermal infrared and colour infrared imagery to detect crop moisture stress [E80-10036] p0021 N80-15530
- MCCLAFFERTY, S.**
Determining photograph locations over oceans p0050 N80-10561
- MCCLEAN, J. T.**
A multispectral look at oil pollution detection monitoring and law enforcement [NASA-TM-80573] p0025 N80-12622
- MCURTREY, J. E., III**
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
- MCNUIT, S. L.**
SEASAT: Gulf of Alaska experiment. Surface truth data inventory [PB-294616] p0038 N80-12546
- MEGER, J.**
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data [E80-10006] p0044 N80-12522
- MEIJERINK, A. H. J.**
The ITC approach to digital processing applied to land use mapping in the Himalayas and Central Java p0048 A80-15781
- MELTON, D. C., JR.**
Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544
Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images p0032 N80-10548
- MIKHAILOV, V. I.**
Combined application of cartographic and aerial-photographic techniques for the investigation of present tectonic movements p0027 A80-10172
- MILLER, S. M.**
Geologic application of thermal-inertia mapping from satellite [E80-10005] p0033 N80-12521
- MINTER, T. C.**
Methods of extending crop signatures from one area to another p0017 N80-15500
- MIRALLES, D. J. M.**
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- MIRONOV, A. S.**
Microwave radiometric methods and the problem of forest and peat fires p0002 A80-14580
- MISRA, P. N.**
An evaluation of procedure 1 p0018 N80-15502
- MITCHELL, R. D.**
A study of possible sea state information in the sample and hold gate statistics for the GEOS-3 satellite altimeter [NASA-CR-156858] p0038 N80-13753
- MOIGN, Y.**
Remote sensing study of seaward dispersion of estuary waters in the Gironde inlet and the Pertuis of Maumusson p0041 A80-10370
- MONGET, J.-M.**
Land use mapping in the Sahel zone using Landsat p0023 A80-15782
- MOORE, D. G.**
Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259
- HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution [E80-10002] p0044 N80-12518
- MORGAN, E. L.**
Automated biomonitoring applications to remote water quality stations and satellite data retrieval - New developments in achieving real-time biosensing for watershed management [ASME PAPER 79-ENAS-41] p0041 A80-15265
- MORITZ, T. E.**
On evaluating clustering procedures for use in classification p0017 N80-15494
- MOURAD, A. G.**
SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-162423] p0038 N80-11532
- MOUSTAFA, A. R.**
Photofinances in the ASTP stereostrip of the western desert of Egypt p0032 N80-10546
- MROCYNSKI, R. P.**
A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248
Forest resource information system, phase 3 [E80-10026] p0007 N80-12528
- MUEHLBERGER, W. R.**
Analysis of Skylab and astp photographs of the Levantine (Dead Sea) fault zone p0031 N80-10543
- MUEKSCHE, W.**
The application of Landsat-MSS-imagery for agricultural planning in tropical rain and swamp forest zones p0002 A80-14375
- MURAI, S.**
Integration of LANDSAT CCT data and digital terrain data in cartographic application p0027 A80-11703
- MYERS, V. I.**
Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259

N

- NARKEVICH, V. I.**
Recording the contour of a region with an airborne laser profilograph p0028 A80-20200
- NELSON, R. M.**
The acquisition, storage, and dissemination of LANDSAT and other LACIE support data p0013 N80-15464
- NEMEC, J.**
Space Observations for water resources: A potential to be developed p0044 N80-13609
- NESTOR, D. A.**
A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery [AD-A074186] p0039 N80-14663
- NEUBAUER, H. G.**
On the use of digital photogrammetric measurements in the compilation of topographic maps [SER-1-ORIGINAL-REPT-76] p0029 N80-14462
- NEWTON, R. W.**
The system and hardware design of real-time fan beam scatterometer data processors p0055 N80-12530
- NICHOLS, J. D.**
Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593
- NIEMZ, K.**
The determination of land usages for planning and cartography p0025 N80-12517
- NOVOGRUDSKII, B. V.**
The study of the ocean from space p0036 A80-20095
- NOYER, S. C.**
A comparison of Landsat and forest survey estimates of forest cover p0005 A80-20248
- NUNEZDELASCUEVAS, R.**
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527

O

- ODELL, E. L. G.**
Pressure Modulator Radiometer (PMR) tests [NASA-CR-159175] p0056 N80-15380
- OFFIELD, T. W.**
Geologic application of thermal-inertia mapping from satellite [E80-10005] p0033 N80-12521
- OGROSKY, C. E.**
Aerial photographic methods for the detection of submerged vegetation in coastal New Jersey p0035 A80-20260
- OKAMOTO, A.**
Orientation problem of SLAR imagery p0049 A80-19923
- ONA, A. L.**
Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593
- OSTERHOUDT, F. H.**
Economic evaluation: Concepts, selected studies, system costs, and a proposed program p0017 N80-15490
- OZGA, M.**
Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549

P

- PACKARD, R. L.**
The application test system: An approach to technology transfer p0020 N80-15520
Data base design for a worldwide multicrop information system p0020 N80-15522
- PALEY, H. N.**
Geologic application of thermal inertia imaging using HCMM data [E80-10035] p0034 N80-15529
- PALMER, W. F.**
LACIE analyst interpretation keys p0018 N80-15505
- PANCOAST, F. O.**
Pressure Modulator Radiometer (PMR) tests [NASA-CR-159175] p0056 N80-15380
- PARRILLA, D. A.**
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- PARRY, D. E.**
Some examples of the use of satellite imagery / Landsat / for natural resource mapping in Western Sudan p0048 A80-15772
- PARRY, E. P.**
Environmental monitoring systems p0023 A80-14705
- PATTERSON, R. L.**
Ancillary data acquisition for LACIE p0013 N80-15462
- PAULSEN, G. M.**
A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511
- PAYNE, R. W.**
LACIE analyst interpretation keys p0018 N80-15505
- PENNYPACKER, S. P.**
Spectral classification of tomato disease severity levels p0005 A80-20254
- PENTEADO-ORELLANA, M. M.**
South American river morphology and hydrology p0043 N80-10574
- PENTLAND, A. P.**
Feature extraction applied to agricultural crops as seen by LANDSAT p0017 N80-15497
- PERLADO, D. J. P.**
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- PERUZZI, D.**
A suggested method for delimiting urbanized areas using digital Landsat data p0024 A80-20246
- PETRAKOVSKII, I. A.**
Analysis of the spectral reflection characteristics of natural formations in remote sensing studies p0053 A80-18568
- PHINNEY, D. E.**
Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites [E80-10010] p0008 N80-13589
Growth stage estimation p0012 N80-15458
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510
The law of the minimum and an application to wheat yield estimation p0019 N80-15512
Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514
- PICON, D. J. L.**
Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527
- PINTER, P. J., JR.**
Wheat spectral reflectance - Interactions between crop configuration, sun elevation, and azimuth angle p0001 A80-13136
Plant canopy information extraction from composite scene reflectance of row crops p0001 A80-13141
- PITTS, D. E.**
Accuracy assessment system and operation p0014 N80-15472
Accuracy and performance of LACIE area estimates p0016 N80-15487
- PLESHIKOV, F. I.**
Mapping the soil cover of taiga landscapes by remote sensing techniques p0004 A80-16565
- PLEVIN, J.**
The ESA remote sensing program: Present activities and future plans p0058 N80-14449
- POGGI, A.**
Use of satellites in polar meteorology p0035 A80-11750

- POISSON, M.**
Land use mapping in the Sahel zone using Landsat
p0023 A80-15782
- POLLOCK, R. B.**
Estimating leaf-area index of wheat with Landsat data
p0002 A80-15053
- PONT, W.**
Analysis of scanner data for crop inventories
[E80-10040] p0021 N80-15534
- POOLE, E. W.**
A look at computer system selection criteria
p0015 N80-15480
- POPOV, I. V.**
Recording the contour of a region with an airborne laser
profilograph p0028 A80-20200
- PORE, M. D.**
Large Area Crop Inventory Experiment (LACIE). List
spectral keys study p0008 N80-13591
[E80-10012]
On evaluating clustering procedures for use in
classification p0017 N80-15494
Generation of uniform chromaticity scale imagery from
LANDSAT data p0018 N80-15507
A programmed labeling approach to image
interpretation p0019 N80-15509
- POTAPOV, A. N.**
Digital processing of multispectral color aerial
photographs of forest land p0001 A80-10171
- POTTER, J. F.**
Accuracy and performance of LACIE area estimates
p0016 N80-15487
- POWELL, R. E.**
Geologic analysis of ASTP photographs of parts of
southern California p0031 N80-10540
- PRELAT, A. E.**
Geological and geothermal data use investigations for
application explorer mission-A, heat capacity mapping
mission p0034 N80-15528
[E80-10033]
- PRICE, J. C.**
Assessment of the urban heat island effect through the
use of satellite data p0023 A80-15556
- PRITCHARD, J. A.**
Use of satellite infrared data for geomorphology studies
p0041 A80-15054
- PROCTOR, M. H.**
Econometric models for predicting confusion crop
ratios p0011 N80-15450
- PROCTOR, P. D.**
Analysis and synthesis of space imagery of the
southeastern-Turkey/northwestern-Iran mobile belt
p0031 N80-10544
Phototectonic analysis of southeastern Spain from ASTP
photographs and LANDSAT images p0032 N80-10548
Photogeologic analysis of ASTP photographs of the Lake
Torrens-Flinders Ranges-Lake Blanche area, South
Australia p0032 N80-10550
- PRYKE, I.**
The ESA remote sensing program: Present activities
and future plans p0058 N80-14449
- PRYSLAK, M.**
Determining photograph locations over oceans
p0050 N80-10561
- PURNELL, R. F.**
The application test system: Technical approach and
system design p0020 N80-15523
- Q**
- QUIREIN, J. A.**
An assessment of LACIE and related methodologies for
conducting crop inventories p0004 A80-15783
Classification and mensuration of LACIE segments
p0012 N80-15455
- R**
- RACETTE, G. W.**
Pressure Modulator Radiometer (PMR) tests
[NASA-CR-159175] p0056 N80-15380
- RADER, M. L.**
Accuracy assessment system and operation
p0014 N80-15472
Cartography: LACIE's spatial processor
p0015 N80-15474
- RADO, B. G.**
Landsat applications in Georgia - A successful example
of technology transfer between NASA and state
government p0057 A80-14792
- RAJU, G.**
India's first remotely-sensed satellite data from
'BHASKARA' using 'SAMIR' p0053 A80-15489
- RANA, S. S.**
India's first remotely-sensed satellite data from
'BHASKARA' using 'SAMIR' p0053 A80-15489
- RANGO, A.**
Passive microwave studies of frozen lakes
p0042 A80-20247
- RAPNAEL, C. N.**
Impact of Great Lakes water level fluctuations on coastal
wetlands [PB-296403/9] p0043 N80-10590
- RASIN, A. M.**
Method for increasing the accuracy of an airborne
geodetic radio rangefinder p0028 A80-15176
- RASSBACH, M. E.**
CLASSY: An adaptive maximum likelihood clustering
algorithm p0051 N80-15495
- RAVET, F. W.**
The application test system: An approach to technology
transfer p0020 N80-15520
- REGAN, R. D.**
The reduction and analysis of satellite magnetometer
data p0054 A80-18774
- REGINATO, R. J.**
Wheat spectral reflectance - Interactions between crop
configuration, sun elevation, and azimuth angle
p0001 A80-13136
- Plant canopy information extraction from composite
scene reflectance of row crops p0001 A80-13141
- REGISTER, D. T.**
On evaluating clustering procedures for use in
classification p0017 N80-15494
- REICHENBACH, K.**
Terrestrial aerial photogrammetric surveying of large open
pit mines in the Rhein lignite district p0031 A80-14373
- REICHERT, P. G.**
Applicability of multiscanning techniques in establishing
inventories for agricultural farming and forestry
p0007 N80-12500
- The multispectral scanner as an instrument for signature
determinations p0055 N80-12515
- REINIGER, P.**
Mapping thermal inertia, soil moisture and evaporation
from aircraft day and night thermal data
[E80-10006] p0044 N80-12522
Joint flight experiment UK/1977. Report no. 1: Planning
and execution p0007 N80-12525
[E80-10022]
TELLUS: A combined surface temperature, soil moisture
and evaporation mapping approach p0007 N80-12526
[E80-10023]
TELLUS newsletter 1 p0008 N80-12531
[E80-10029]
- RIAPOLOV, V. IA.**
Analysis of the landscape-ecological correlation of
Siberian silkworm infestation areas, using aerial and satellite
photography p0004 A80-16566
- RICHARDSON, W.**
A study of the tolerance block approach to special
stratification p0008 N80-12529
[E80-10027]
Feature extraction applied to agricultural crops as seen
by LANDSAT p0017 N80-15497
Signature extension methods in crop area estimation
p0018 N80-15501
- RICHTSCHEID, P.**
Classification of agricultural land with the aid of remote
sensing methods p0006 N80-12495
- RIPPLE, B.**
Compositing natural resource and land use information
in Spearfish, South Dakota - A land capability study
p0024 A80-20255
The integration of Landsat with other natural resource
data for 208 water quality planning in South Dakota
p0041 A80-20261
- ROBE, R. G.**
Long-term tracking of arctic icebergs
[AD-A072473] p0037 N80-10583
- ROBERTS, J. L.**
The mapping of important farmland using remote sensor
and socio-economic variables p0009 N80-14424
- ROBINSON, A. C.**
SEASAT demonstration experiments with the offshore
oil, gas and mining industries [NASA-CR-162423] p0038 N80-11532
- ROESE, J. A.**
Processing and display techniques for multispectral
satellite imagery [AD-A072509] p0050 N80-11534
- ROGERS, J. L.**
Operation of the yield estimation subsystem
p0014 N80-15468
- ROSEMA, A.**
TELLUS: A combined surface temperature, soil moisture
and evaporation mapping approach [E80-10023] p0007 N80-12526
- ROSEMA, I. A.**
The application of thermal infrared remote sensing data
to soil moisture and evaporation determination
p0010 N80-14447
- ROSINI, E.**
Topographical characteristics through the study of the
thermal and hydrological disuniformity of the soil from the
mesoscale. An application to local forecasting of ambient
temperature from the TELLUS project [E80-10020] p0045 N80-15447
- ROSSO, R.**
The SPOT remote sensing satellite - Assessment of the
geometric quality of the images p0047 A80-11704
- RUBSTOV, N. I.**
Principles of studying mountainous forest landscapes in
the Baikal Lake basin, using aerial and satellite
photography p0028 A80-16561
- RUTECKI, D. J.**
Pressure Modulator Radiometer (PMR) tests
[NASA-CR-159175] p0056 N80-15380
- SAKAMOTO, C. M.**
Development of LACIE CCEA-1 weather/wheat yield
models p0012 N80-15457
- SANDHAM, W. A.**
Remote sensing of sea-state and surface winds in the
Irish and Celtic seas using MF radar p0036 A80-15893
- SCHLESINGER, J.**
Compositing natural resource and land use information
in Spearfish, South Dakota - A land capability study
p0024 A80-20255
The integration of Landsat with other natural resource
data for 208 water quality planning in South Dakota
p0041 A80-20261
- SCHMIDT, D.**
Research into determining chemical parameters at the
surface of the sea by remote sensing p0038 N80-12479
- SCHMUGGE, T. J.**
A hydrological analysis of east Australian floods using
Nimbus-5 electrically scanning radiometer data
p0042 A80-20194
- SCHNEIDER, K. H.**
Feasibility of using remote sensing for determining
nutritional requirements, diseases and pest infestations in
agricultural crops p0006 N80-12497
- SCHNEIDER, S. R.**
Use of satellite infrared data for geomorphology studies
p0041 A80-15054
- SCHNETZLER, C. C.**
Multispectral Resource Sampler - An experimental
satellite sensor for the mid-1980s p0053 A80-17462
- SCHROEDER, M.**
On measurements from aircraft
[BMFT-FB-WV-78-04] p0050 N80-12467
Aims and tasks of the aircraft test program
p0055 N80-12468
- SCHULTINK, G.**
The application of remote sensing techniques for the
enforcement of the Michigan Sand Dune Management and
Protection Act p0023 A80-20263
- SCHUMANN, H. H.**
Satellite snow-cover observations in Arizona
p0041 A80-20264
- SCOTT, R. B.**
Application of multidata photography and remote sensing
data to environmental monitoring in the State of
Washington p0048 A80-20285
Cooperative methods for acquisition of aerial
photography p0053 A80-20286
- SCRIBOT, A. A.**
SPOT, French preoperational remote sensing satellite
system p0056 N80-13610
- SEELEY, M. W.**
Prediction of wheat phenological development: A
state-of-the-art review p0019 N80-15514
- SEGUIN, B.**
Estimates of regional ET from HCMM data: Summary
of 1977 experiment and final arrangement for 1978 in
southeastern France test site [E80-10018] p0009 N80-13597
- SELLMAN, B.**
Feature selection via entropy minimization - An example
using Landsat satellite data p0048 A80-14047
- SELLMANN, P. V.**
Detection of arctic water supplies with geophysical
techniques [AD-A072157] p0043 N80-11538
- SEMIN, A. G.**
Airborne semiconductor radiometers
p0053 A80-14196
- SHAHROKHI, F.**
The use of Landsat imagery to monitor desert
encroachment in arid areas p0024 A80-20241
- SHARAPOV, A. N.**
Airborne semiconductor radiometers
p0053 A80-14196
- SHEARMAN, E. D. R.**
Remote sensing of sea-state and surface winds in the
Irish and Celtic seas using MF radar p0036 A80-15893
- SHIFRIN, K. S.**
Optical methods for investigating oceans and inland
basins p0035 A80-10116
The study of the ocean from space p0036 A80-20095
- SHINN, R. D.**
Study in remote sensing for land use
[AD-A071802] p0024 N80-11537
- SHIRIAEV, E. E.**
Standardization of cartographic field and aerial and space
photography data for automatic map generation
p0028 A80-15182
- SICKLER, R.**
Photogeologic analysis of ASTP photographs of the Lake
Torrens-Flinders Ranges-Lake Blanche area, South
Australia p0032 N80-10550
- SIGLER, G. B.**
Advances in digital image display and simulation from
digital terrain data bases p0047 A80-11696
- SIGMAN, R.**
Obtaining timely crop area estimates using
ground-gathered and LANDSAT data
[PB-300825/7] p0021 N80-15549
- SILVER, L. T.**
Geologic analysis of ASTP photographs of parts of
southern California p0031 N80-10540

- SIMPSON, J. H.**
The structure and variability of shelf sea fronts as observed by an undulating CTD system p0035 A80-20938
- SIVERTSON, W. E., JR.**
Earth feature identification and tracking technology development p0028 A80-17403
- SKEA, W.**
Ocean color observations p0037 N80-10566
- SKLIAROV, V. E.**
The study of the ocean from space p0036 A80-20095
- SLANEY, V. R.**
Landsat imagery - A cartographic reference base p0028 A80-11706
- SLEZAK, M. H.**
Preliminary analysis of color variations of sand deposits in the western desert of Egypt
Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556
- SMALLWOOD, M. D.**
Snow hydrology studies p0043 N80-10575
- SMART, R. T.**
An evaluation of procedure 1 p0018 N80-15502
- SNELL, W. W.**
Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
- SOER, G. J. R.**
Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures [REPT-1003] p0009 N80-13616
- SOKOLOV, S. A.**
Recording the contour of a region with an airborne laser profilograph p0028 A80-20200
- SOLODUKHIN, V. I.**
Recording the contour of a region with an airborne laser profilograph p0028 A80-20200
- SOLOMON, S.**
An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-162434] p0057 N80-11533
- SORENSEN, B. M.**
Monitoring of euphotic depth from aircraft p0041 A80-15056
- SPENCER, R. D.**
Fixed-base large-scale photographs for forest sampling p0005 A80-20024
- SPIERS, B. E.**
Ancillary data acquisition for LACIE p0013 N80-15462
- SPITZER, J. F.**
Cost and performance characteristics of data system configurations for processing remotely sensed data p0015 N80-15481
- STANLEY, D. J.**
Digital analysis of radar imagery for vegetation detection in Nigeria
Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565
- STANLEY, W. I.**
A look at computer system selection criteria p0015 N80-15480
- STAPLES, J. E.**
Latin American experiences in utilizing satellite imagery for cartographic purposes p0027 A80-11705
- STEINER, D.**
Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos p0023 A80-20025
- STEVENSON, R. E.**
Antipodal seas p0036 N80-10564
- STOCK, P.**
Interpretation of IR and MSS data for town areas p0025 N80-12485
- STORY, A. S.**
Texas applications system verification and transfer remote sensing information subsystem: Functional design [E80-10017] p0050 N80-13596
- STRELTSOV, V. A.**
Constructing a network of earth resource satellites p0057 A80-17993
- STROME, W. M.**
Landsat imagery - A cartographic reference base p0028 A80-11706
- STROMMEN, N. D.**
Development of LACIE CCEA-1 weather/wheat yield models p0012 N80-15457
- STROUD, R. O.**
The system and hardware design of real-time fan beam scatterometer data processors [E80-10028] p0055 N80-12530
- STRUEBING, K.**
Research into determining chemical parameters at the surface of the sea by remote sensing p0038 N80-12479
- STUFF, R. G.**
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
Accuracy and performance of LACIE crop development models p0016 N80-15489
Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510
Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514
- SULESTER, J. M.**
Concepts leading to the IMAGE-100 hybrid interactive system p0014 N80-15466
- SUMNER, C. A.**
Classification and mensuration of LACIE segments p0012 N80-15455
- SUTTON, S. M., JR.**
South American river morphology and hydrology p0043 N80-10574
- SWIFT, C. T.**
Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467
- SWIFT, R. N.**
Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546
- T**
- TALVITIE, J.**
Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach [VTT-LU-15] p0054 N80-11547
- TALWANI, M.**
Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446
- TARBET, J. D.**
The application test system: Technical approach and system design p0020 N80-15523
- TASSONE, G.**
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data [E80-10006] p0044 N80-12522
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach [E80-10023] p0007 N80-12526
- TATEISHI, R.**
Integration of LANDSAT CCT data and digital terrain data in cartographic application p0027 A80-11703
- TAYLOR, S. E.**
Measured emissivity of soils in the southeast United States p0002 A80-15057
- TERRY, R. D.**
Visual observations over oceans p0036 N80-10563
- THOMAS, G. S.**
Feature extraction applied to agricultural crops as seen by LANDSAT p0017 N80-15497
- THOMAS, R. W.**
Development of partitioning as an aid to spectral signature extension p0017 N80-15499
- THOMAS, R. W. L.**
Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546
- THOMPSON, D. F.**
Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images p0032 N80-10548
- THOMPSON, D. R.**
The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482
Application of LANDSAT digital data for monitoring drought p0016 N80-15483
- THOMPSON, L. L.**
Multispectral Resource Sampler - An experimental satellite sensor for the mid-1980s p0053 A80-17462
- TINDAL, M. A.**
Educator's guide for Mission to Earth: LANDSAT views the world [NASA-SP-360] p0057 N80-10537
- TISDALL, T.**
Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 N80-10567
- TURIN, IJ. A.**
The use of space - International cooperation in the area of space applications p0057 A80-16394
- TOKERUD, R. E.**
An assessment of LACIE and related methodologies for conducting crop inventories p0004 A80-15783
- TOLMAN, D. N.**
Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258
Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
- TRAGNI, F.**
Earth observations division Earth resources data analysis capabilities [E80-10013] p0050 N80-13592
- TRENCHARD, M. H.**
Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0016 N80-15488
The law of the minimum and an application to wheat yield estimation p0019 N80-15512
Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514
- TRICHEL, M. C.**
Methods for segment wheat area estimation p0017 N80-15491
- TRINDL, E.**
What are the advantages of multispectral classification? p0007 N80-12501
- TUCKER, C. J.**
A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring p0003 A80-20267
The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532
- TUCKER, C. T.**
Spectral vegetation relationships in a tropical rain forest p0005 A80-20249
- TURNER, A. K.**
Interactive analysis methods for resource mapping p0028 A80-11709
- TURNER, H.**
Digital image processing techniques to extract metric data on buildings from shadows on simulated air photos p0023 A80-20025
- U**
- ULABY, F. T.**
Look direction modulation function of the radar backscattering coefficient of agricultural fields p0002 A80-13357
Crop identification with L-band radar p0005 A80-19543
- UMBERGER, D. E.**
Econometric models for predicting confusion crop ratios p0011 N80-15450
Development of LACIE CCEA-1 weather/wheat yield models p0012 N80-15457
- V**
- VALENDIK, E. N.**
Microwave radiometric methods and the problem of forest and peat fires p0002 A80-14580
Remote sensing methods applied to the solution of the forest fire problem p0004 A80-16567
- VAN GENDEREN, J. L.**
Remote sensing applications in developing countries p0057 A80-15771
- VELA, R. R.**
Accuracy assessment system and operation p0014 N80-15472
Cartography: LACIE's spatial processor p0015 N80-15474
- VERSTEEGH, P. J. D.**
The effects of plot size and plot spacing on the precision of line plot sampling in a tropical rain forest p0002 A80-15559
- VONHESLER, A.**
Future remote sensing tasks in regional planning p0025 N80-12484
- VUKOVICH, F. M.**
Gulf stream boundary eddies off the east coast of Florida p0036 A80-16247
Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543
Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [ORO-5444-1] p0039 N80-15603
- W**
- WAHL, M.**
The Geoscientific Airborne Remote Sensing Program [BMFT-FB-W-78-31] p0055 N80-13608
- WAITE, W. P.**
Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258
Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
- WAITS, G. H.**
LACIE data-handling techniques p0013 N80-15463
- WARNER, D. M.**
Apollo-Soyuz test project. Volume 2: Earth observations and photography [NASA-SP-412-VOL-2] p0049 N80-10538
Summary of significant results p0049 N80-10539
Orbital observations of sand distribution in the western desert of Egypt p0024 N80-10554
ASTP photographs of southeastern Angola p0033 N80-10557
Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559
- WATSON, K.**
Geologic application of thermal-inertia mapping from satellite [E80-10005] p0033 N80-12521
- WEHMANEN, O. A.**
Application of LANDSAT digital data for monitoring drought p0018 N80-15483
- WEIBLATT, E. A.**
Texas applications system verification and transfer remote sensing information subsystem: Functional design [E80-10017] p0050 N80-13596

PERSONAL AUTHOR INDEX

ZWEIBAUM, F. M.

- WELLS, W. T.**
A study of possible sea state information in the sample and hold gate statistics for the GEOS-3 satellite altimeter [NASA-CR-156858] p0038 N80-13753
- WESTBERRY, L. E.**
The LACIE data bases: Design considerations p0015 N80-15475
- WESTERLUND, F. V.**
Study in remote sensing for land use [AD-A071802] p0024 N80-11537
- WHEELER, S. G.**
An evaluation of procedure 1 p0018 N80-15502
- WHITE, T. T.**
LACIE applications evaluation system efficiency report p0015 N80-15473
- WHITE, W. P.**
Accuracy assessment system and operation p0014 N80-15472
- WHITEHEAD, V. S.**
Growth stage estimation p0012 N80-15458
Accuracy and performance of LACIE crop development models p0016 N80-15489
Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510
- WIECZOREK, U.**
Quantitative determination of morphological structures in sand bank regions from image structure analysis p0033 N80-12482
- WIEGAND, C. L.**
A seasonal verification of the Suits spectral reflectance model for wheat p0005 A80-19544
- WIENER, T. F.**
Digital processing of aerial images: Proceedings of the Seminar, Huntsville, Ala., May 22-24, 1979 p0049 A80-17514
- WIESNET, D. R.**
Applications of HCMM data to soil moisture snow and estuarine current studies [E80-10004] p0044 N80-12520
- WILKERSON, J. C.**
SEASAT: Gulf of Alaska experiment. Surface truth data inventory [PB-294616] p0038 N80-12546
- WILKINSON, T. B.**
Considerations for design of future research and development interactive image analysis systems p0050 N80-15478
- WILLIAMSON, B. B.**
Impact of Great Lakes water level fluctuations on coastal wetlands [PB-296403/9] p0043 N80-10590
- WILSON, L. R.**
Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467
- WILSON, R. G.**
Earth feature identification and tracking technology development p0028 A80-17403
- WISE, T. D.**
Thematic mapper design description and performance prediction p0053 A80-17460
- WITT, R. G.**
Mapping vegetation with low cover density from Landsat data p0006 A80-20257
- WOOLLEY, S. K.**
Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model [E80-10011] p0008 N80-13590
Accuracy and performance of LACIE crop development models p0016 N80-15489
- WORCESTER, B.**
Remote sensing for monitoring resources for development and conservation of desert and semi-desert areas p0023 A80-20259

Y

- YAGER, W. C.**
Pressure Modulator Radiometer (PMR) tests [NASA-CR-159175] p0056 N80-15380
- YAO, S. S.**
On evaluating clustering procedures for use in classification p0017 N80-15494
- YENTSCH, C. S.**
Ocean color observations p0037 N80-10566
Estimate of total reflectance from the Orinoco River outflow p0037 N80-10569
- YODER, J. A.**
Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535
- YOO, J. K.**
Geometric preprocessing of sensor data used for image matching p0054 A80-17515

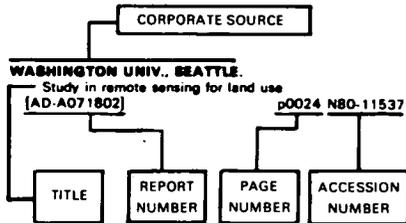
Z

- ZANDONELLA, A.**
Feature selection via entropy minimization - An example using Landsat satellite data p0048 A80-14047

- ZHIRIN, V. M.**
Digital processing of multispectral color aerial photographs of forest land p0001 A80-10171
- ZHUKOV, A. IA.**
Recording the contour of a region with an airborne laser profilograph p0028 A80-20200
- ZOBRIET, A. L.**
Multiple-frame, full resolution Landsat mosaicking to standard map projections p0048 A80-20269
- ZOLLARS, G. F.**
Remote sensing applied to agricultural resources. Citations from the international aerospace abstracts data base [NTIS/PS-79/0733/0] p0006 N80-10588
Remote sensing applied to geology. Citations from the International Aerospace Abstracts data base [NTIS/PS-79/0822/1] p0034 N80-13613
- ZWEIBAUM, F. M.**
Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431

CORPORATE SOURCE INDEX

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

- AIN SHAMS UNIV., CAIRO (EGYPT).**
Structural pattern of the northern part of the eastern desert of Egypt p0031 N80-10545
Photolineaments in the ASTP stereostrip of the western desert of Egypt p0032 N80-10546
Utilization of ASTP photographs in the study of small structures in Abu Rawash and Wadi el Natrun, Egypt p0032 N80-10547
East-West pervasive lineaments in central and southeastern Spain p0032 N80-10549
Detection of a probable ancestral delta of the Nile River p0033 N80-10571
- AMHERST COLL., MASS.**
Evaluation of satellite images of the Levantine Rift zone p0031 N80-10542
- ARIZONA STATE UNIV., TEMPE.**
Volcanic landforms and astrobloemes p0032 N80-10551
- ARKANSAS UNIV., FAYETTEVILLE.**
Long wavelength radar for geological analysis in vegetated terrain p0031 A80-20258
Dual polarized long wavelength radar for discrimination of agricultural land use p0003 A80-20268
- ARMY COLD REGIONS RESEARCH AND ENGINEERING LAB., HANOVER, N. H.**
Detection of arctic water supplies with geophysical techniques [AD-A072157] p0043 N80-11538
- ARMY ENGINEER TOPOGRAPHIC LABS., FORT BELVOIR, VA.**
Land cover classification from Landsat data: Phase 3 of a joint DOE/NASA demonstration [AD-A071723] p0024 N80-11535

B

- BADISCHE ANILIN- UND SODA-FABRIK A.G., LANDWIRTSCHAFTLICHE, GIESSEN (WEST GERMANY).**
Feasibility of using remote sensing for determining nutritional requirements, diseases and pest infestations in agricultural crops p0006 N80-12497
- BARNES ENGINEERING CO., STAMFORD, CONN.**
Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431
- BATTELLE COLUMBUS LABS., OHIO.**
SEASAT demonstration experiments with the offshore oil, gas and mining industries [NASA-CR-162423] p0038 N80-11532
An economic analysis of five selected LANDSAT assisted information systems in Oregon [NASA-CR-162434] p0057 N80-11533
- BIGELOW LAB. FOR OCEAN SCIENCES, WEST BOOTHBAY HARBOR, MAINE.**
Ocean color observations p0037 N80-10566

- Estimate of total reflectance from the Orinoco River outflow p0037 N80-10569
- BRISTOL UNIV. (ENGLAND).**
Crop environment monitoring: The remote sensing systems p0010 N80-14452
Crop environment monitoring: The assessment of environmental phenomena using satellite remote sensing data p0010 N80-14454
Crop monitoring and prediction using satellite data p0011 N80-14455
Satellite remote sensing in hazard monitoring and disaster evaluation p0011 N80-14456
Satellite remote sensing for agricultural advisories and planning p0011 N80-14457

C

- CALIFORNIA INST. OF TECH., PASADENA.**
Geologic analysis of ASTP photographs of parts of southern California p0031 N80-10540
- CALIFORNIA UNIV., LOS ANGELES.**
Geodynamics from satellites [AAS PAPER 79-243] p0031 A80-16427
- CALIFORNIA UNIV. AT BERKELEY.**
Manual interpretation of LANDSAT data p0013 N80-15460
Development of partitioning as an aid to spectral signature extension p0017 N80-15499
Manual LANDSAT data analysis for crop type identification p0018 N80-15504
- CANADA CENTRE FOR REMOTE SENSING, OTTAWA (ONTARIO).**
Use of thermal infrared and colour infrared imagery to detect crop moisture stress [E80-10038] p0021 N80-15530
HCMM/soil moisture experiment [E80-10037] p0021 N80-15531
- CATHOLIC UNIV. OF AMERICA, WASHINGTON, D. C.**
Manual development of automated image analysis. Automated contour recognition and classification in aerial photography by means of angles and curvature [AD-A074439] p0051 N80-15540
- CENTRE NATIONAL D'ETUDES SPATIALES, PARIS (FRANCE).**
SPOT, French preoperational remote sensing satellite system p0056 N80-13610
- CENTRE NATIONAL D'ETUDES SPATIALES, TOULOUSE (FRANCE).**
French space programs p0058 N80-14165
- COAST GUARD RESEARCH AND DEVELOPMENT CENTER, GROTON, CONN.**
Long-term tracking of arctic icebergs [AD-A072473] p0037 N80-10583
- COMITE NATIONAL FRANCAIS DE RECHERCHES DANS L'ESPACE, PARIS.**
French space programs p0058 N80-14165
- COMMISSION OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY).**
Mapping thermal inertia, soil moisture and evaporation from aircraft day and night thermal data [E80-10006] p0044 N80-12522
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest [E80-10007] p0007 N80-12523
Joint flight experiment UK/1977. Report no. 1: Planning and execution [E80-10022] p0007 N80-12525
TELLUS: A combined surface temperature, soil moisture and evaporation mapping approach [E80-10023] p0007 N80-12526
TELLUS newsletter 1 [E80-10029] p0008 N80-12531
Soil moisture and heat budget evaluation in selected European zones of agricultural and environmental interest [E80-10019] p0009 N80-13598
Beauce TELLUS project [E80-10024] p0009 N80-13600
- COMMITTEE ON SCIENCE AND TECHNOLOGY (U. S. HOUSE).**
Earth resources data and information service [GPO-49-530] p0057 N80-11530
- COMMITTEE ON SPACE RESEARCH (COSPAR), BERNE (SWITZERLAND).**
Space research in Switzerland, 1978 p0058 N80-11995

- COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, CANBERRA (AUSTRALIA).**
A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data p0042 A80-20194

D

- DEPARTMENT OF AGRICULTURE, COLUMBIA, MD.**
Econometric models for predicting confusion crop ratios p0011 N80-15450
- DEPARTMENT OF AGRICULTURE, HOUSTON, TEX.**
USDA analyst review of the LACIE IMAGE-100 hybrid system test p0014 N80-15467
LACIE area, yield, and production estimate characteristics: U.S.S.R. p0016 N80-15485
The vegetative index number and crop identification p0018 N80-15503
Functional definition and design of a USDA system p0020 N80-15521
Data base design for a worldwide multicrop information system p0020 N80-15522
Resource modeling: A reality for program cost analysis p0020 N80-15524
The application test system: Experiences to date and future plans p0020 N80-15525
- DEPARTMENT OF AGRICULTURE, PHOENIX, ARIZ.**
Heat Capacity Mapping Mission (HCMM) [E80-10039] p0045 N80-15533
- DEPARTMENT OF AGRICULTURE, WASHINGTON, D.C.**
Economic evaluation: Concepts, selected studies, system costs, and a proposed program p0017 N80-15490
- DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, COLOGNE (WEST GERMANY).**
The Geoscientific Airborne Remote Sensing Program [BMFT-FB-W-78-31] p0055 N80-13608
- DEUTSCHE FORSCHUNGS- UND VERSUCHSANSTALT FUER LUFT- UND RAUMFAHRT, OBERPFAPFENHOFEN (WEST GERMANY).**
On measurements from aircraft [BMFT-FB-W-78-04] p0050 N80-12467
Aims and tasks of the aircraft test program p0055 N80-12468
Aerial photography of agricultural farming land p0006 N80-12496
What are the advantages of multispectral classification? p0007 N80-12501
- DEUTSCHES HYDROGRAPHISCHES INSTITUT, HAMBURG (WEST GERMANY).**
Research into determining chemical parameters at the surface of the sea by remote sensing p0038 N80-12479
Determination of the optical properties of the sea in the German bight p0038 N80-12516
- DORNIER-WERKE G.M.B.H., FRIEDRICHSHAFEN (WEST GERMANY).**
Strategies for the surveillance of coastal waters of the Federal Republic of Germany [BMFT-FB-M-77-11] p0045 N80-13726

E

- ECONOMICS, STATISTICS AND COOPERATIVES SERVICE, WASHINGTON, D. C.**
Obtaining timely crop area estimates using ground-gathered and LANDSAT data [PB-300825/7] p0021 N80-15549
- EDGERTON, GERMESHAUSEN AND GRIER, INC., LAS VEGAS, NEV.**
Development of an airborne gamma radiation system for snow surveys [EGG-1183-1679] p0044 N80-13606
- EG AND G WASHINGTON ANALYTICAL SERVICES CENTER, RIVERDALE, MD.**
A study of possible sea state information in the sample and hold gate statistics for the GEOS-3 satellite altimeter [NASA-CR-156858] p0038 N80-13753
- ENVIRONMENTAL ANALYSIS AND REMOTE SENSING, DELFT (NETHERLANDS).**
The application of thermal infrared remote sensing data to soil moisture and evaporation determination p0010 N80-14447

ENVIRONMENTAL DATA AND INFORMATION SERVICE, WASHINGTON, D. C.

Development of LACIE CCEA-1 weather/wheat yield models p0012 N80-15457
 International Decade of Ocean Exploration, volume 7 [NOAA-S/T-78-211-VOL-7] p0039 N80-15772

ENVIRONMENTAL DEFENSE FUND, INC., DENVER, COLO.

Use of Apollo-Soyuz photographs in coastal studies p0037 N80-10573

ENVIRONMENTAL RESEARCH AND TECHNOLOGY, INC., CONCORD, MASS.

Snow hydrology studies p0043 N80-10575

ENVIRONMENTAL RESEARCH INST. OF MICHIGAN, ANN ARBOR.

A study of the tolerance block approach to special stratification [E80-10027] p0008 N80-12529
 Feature extraction applied to agricultural crops as seen by LANDSAT p0017 N80-15497
 Signature extension methods in crop area estimation p0018 N80-15501

Analysis of scanner data for crop inventories [E80-10040] p0021 N80-15534

EUROPEAN SPACE AGENCY, PARIS (FRANCE).

Satellite Remote Sensing: Applications in Agrometeorology and Agrometeorology [ESA-SP-1020] p0009 N80-14440

The Earthnet programme p0056 N80-14444
 The ESA remote sensing program: Present activities and future plans p0058 N80-14449

EUROPEAN SPACE OPERATIONS CENTER, DARMSTADT (WEST GERMANY).

Meteosat and remote sensing application p0056 N80-14448

F**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS, ROME (ITALY).**

Overview of agrometeorology p0009 N80-14441
 Overview of remote sensing for agrometeorology and agrometeorology p0010 N80-14442

Physical background of remote sensing p0029 N80-14443

The agro-ecological zones project p0010 N80-14445

Remote sensing applied to agriculture p0010 N80-14446

FORD AEROSPACE AND COMMUNICATIONS CORP., HOUSTON, TEX.

The application test system: Technical approach and system design p0020 N80-15523

FORESTER SERVICE, WASHINGTON, D. C.

Forester's guide to aerial photo interpretation p0009 N80-14425

FORSCHUNGSGRUPPE FUER INFORMATIONSPERARBEITUNG UND MUSTERKENNUNG, KARLSRUHE (WEST GERMANY).

Digital processing procedure for texture analysis with remote sensing data p0050 N80-12505

Freiburg Univ. (West Germany).

Interpretation of water quality using remote sensing techniques p0044 N80-12493

Texture analysis as a recognition parameter for different types of forests p0006 N80-12498

Phenology as a factor in the determination of different forms in vegetation by remote sensing p0007 N80-12499

Applicability of multisensing techniques in establishing inventories for agricultural farming and forestry p0007 N80-12500

Spectral reflection from agricultural and forest regions during the vegetation period p0007 N80-12513

The multispectral scanner as an instrument for signature determinations p0055 N80-12515

G**GENERAL ELECTRIC CO., PHILADELPHIA, PA.**

Pressure Modulator Radiometer (PMR) tests [NASA-CR-159175] p0058 N80-13580

GEOLOGICAL SURVEY, DENVER, COLO.

Geologic application of thermal-inertia mapping from satellite [E80-10005] p0033 N80-12521

GEOLOGICAL SURVEY, FLAGSTAFF, ARIZ.

Dunes and other windforms of central Australia, and a comparison with linear dunes on the Moenkopi Plateau, Arizona p0033 N80-10560

GEOLOGICAL SURVEY, RESTON, VA.

U. S. geological survey sources of photographs and images of biosphere reserves taken from spacecraft and aircraft: Beaver Creek watershed [PB-297442/6] p0044 N80-12547

Central atlantic regional ecological test site: A prototype regional environmental information system, volume 1 [E80-10031] p0026 N80-15526

US Geological Survey sources of photographs and images of biosphere reserves taken from Spacecraft and Aircraft Aleutian Islands National Wildlife Range. Project 8: Conservation of natural areas and of the genetic material they contain [PB-297931/8] p0051 N80-15547

H**HAMBURG UNIV. (WEST GERMANY).**

On the problem of the remote sensing of substances in water by multispectral scanning p0043 N80-12478

HAWAII AD HOC COMMITTEE ON REMOTE SENSING, HONOLULU.

LANDSAT project, State of Hawaii: A preliminary report [PB-296712/3] p0057 N80-10587

HOUSTON UNIV., TEX.

Linear feature selection with applications p0051 N80-15496

HUGHES AIRCRAFT CO., EL SEGUNDO, CALIF.

Thematic mapper design description and performance prediction p0053 N80-17460

I**IBM FEDERAL SYSTEMS DIV., HOUSTON, TEXAS.**

The LACIE data bases: Design considerations p0015 N80-15475

Man-machine interfaces in LACIE/ERIPS p0015 N80-15476

LACIE/ERIPS software system summary p0015 N80-15477

A look at computer system selection criteria p0015 N80-15480

ILLINOIS UNIV. AT URBANA-CHAMPAIGN.

Riachao Ring, Brazil: A possible meteorite crater discovered by the Apollo astronauts p0032 N80-10552

INSTITUT FUER ANGEWANDTE GEOAEBIE, FRANKFURT AM MAIN (WEST GERMANY).

On the use of digital photogrammetric measurements in the compilation of topographic maps [SER-1-ORIGINAL-REPT-78] p0029 N80-14462

INSTITUT FUER ANGEWANDTE GEOAEBIE, SINGLINGEN (WEST GERMANY).

The determination of land usages for planning and cartography p0025 N80-12517

INSTITUT FUER PHYSIKALISCHE WELTRAUMFORSCHUNG, FREIBURG (WEST GERMANY).

On the significance of spectral signatures of vegetation covered surfaces in the 400-1100 nanometer region p0007 N80-12512

INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE, PARIS (FRANCE).

Estimates of regional ET from HCMM data: Summary of 1977 experiment and final arrangement for 1978 in southeastern France test site [E80-10018] p0009 N80-13597

INSTITUUT VOOR CULTURTECHNIE EN WATERHUISHOUDING, WAGENINGEN (NETHERLANDS).

Estimation of regional evapotranspiration and soil moisture conditions using remotely sensed crop surface temperatures [REPT-1003] p0009 N80-13616

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).

The estimation of soil moisture content and actual evapotranspiration using thermal infra-red remote sensing [E80-10021] p0009 N80-13599

INSTITUTO GEOGRAFICO NACIONAL, MADRID (SPAIN).

Thermal mapping, geothermal source location, natural effluents and plant stress in the Mediterranean coast of Spain [E80-10032] p0020 N80-15527

J**JET PROPULSION LAB., CALIFORNIA INST. OF TECH., PASADENA.**

Multiple-frame, full resolution Landsat mosaicking to standard map projections p0048 N80-20269

System for real-time crustal deformation monitoring [NASA-CASE-NPO-14124-1] p0029 N80-14803

Geologic application of thermal inertia imaging using HCMM data [E80-10035] p0034 N80-15529

JOINT PUBLICATIONS RESEARCH SERVICE, ARLINGTON, VA.

Lodging of grain crops and its detection by aerial photography p0006 N80-10994

Geophysics, astronomy and space, no. 450 [JPRS-73946] p0033 N80-11527

JOINT RESEARCH CENTRE OF THE EUROPEAN COMMUNITIES, ISPRA (ITALY).

Agroclimatomological methods involving remote sensing techniques p0010 N80-14451

K**KANSAS STATE UNIV., MANHATTAN.**

A universal model for estimating wheat yields [CONTRIB-78-268-A] p0019 N80-15511

L**LAMONT-DOHERTY GEOLOGICAL INST., PALISADES, N. Y.**

Shape of the ocean surface and implications for the Earth's interior: GEOS-3 results [NASA-CR-156859] p0029 N80-15446

LAND RESOURCE RESEARCH INST., OTTAWA (ONTARIO).

Crop weather models: Concepts and applications p0010 N80-14450

LANDESKULTURAMT HESSEN, WIESSBADEN (WEST GERMANY).

Classification of agricultural land with the aid of remote sensing methods p0008 N80-12495

LOCKHEED ELECTRONICS CO., HOUSTON, TEX.

An assessment of LACIE and related methodologies for conducting crop inventories p0004 N80-15783

Large Area Crop Inventory Experiment (LACIE). Experiment plan for evaluation of LANDSAT agronomic variables using wheat intensive test sites [E80-10010] p0008 N80-13589

Large Area Crop Inventory Experiment (LACIE). Evaluation of the LACIE transition year crop calendar model [E80-10011] p0008 N80-13590

Large Area Crop Inventory Experiment (LACIE). List spectral keys study [E80-10012] p0008 N80-13591

Earth observations division Earth resources data analysis capabilities [E80-10013] p0050 N80-13592

Large Area Crop Inventory Experiment (LACIE). Phase 3 direct wheat study of North Dakota [E80-10014] p0008 N80-13593

Large Area Crop Inventory Experiment (LACIE). Phase 3 labeling error characterization [E80-10015] p0009 N80-13594

Large Area Crop Inventory Experiment (LACIE). A revised screening procedure for LACIE phase 3 data in the US Great Plains [E80-10016] p0009 N80-13595

Texas applications system verification and transfer remote sensing information subsystem: Functional design [E80-10017] p0050 N80-13596

LACIE area sampling frame and sample selection p0012 N80-15452

LACIE data-handling techniques p0013 N80-15463

The acquisition, storage, and dissemination of LANDSAT and other LACIE support data p0013 N80-15464

Cartography: LACIE's spatial processor p0015 N80-15474

Considerations for design of future research and development interactive image analysis systems p0050 N80-15478

On evaluating clustering procedures for use in classification CLASSY: An adaptive maximum likelihood clustering algorithm p0051 N80-15495

Methods of extending crop signatures from one area to another p0017 N80-15500

LACIE analyst interpretation keys p0018 N80-15505

Image and numerical display aids for manual interpretation p0051 N80-15508

A programmed labeling approach to image interpretation p0019 N80-15509

The law of the minimum and an application to wheat yield estimation p0019 N80-15512

M**McGILL UNIV., MONTREAL (QUEBEC).**

ASTP at Barbados: Mesoscale pools of Amazon River water in the western tropical Atlantic p0037 N80-10568

MINISTERO DELL'AGRICOLTURA E DELLE FORESTE, ROME (ITALY).

Topographical characteristics through the study of the thermal and hydrological discontinuity of the soil from the mesoscale. An application to local forecasting of ambient temperature from the TELLUS project [E80-10020] p0045 N80-15447

MISSOURI UNIV. AT ROLLA.

Analysis and synthesis of space imagery of the southeastern-Turkey/northwestern-Iran mobile belt p0031 N80-10544

Phototectonic analysis of southeastern Spain from ASTP photographs and LANDSAT images p0032 N80-10548

Photogeologic analysis of ASTP photographs of the Lake Torrens-Fiinders Ranges-Lake Blanche area, South Australia p0032 N80-10550

MITRE CORP., HOUSTON, TEX.

Cost and performance characteristics of data system configurations for processing remotely sensed data p0015 N80-15481

N

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WASHINGTON, D. C.

A review of NASA international programs
[NASA-TM-80845] p0058 N80-14971

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, EARTH RESOURCES LABS., BAY ST. LOUIS, MISS.

Demonstration of wetland vegetation mapping in Florida from computer-processed satellite and aircraft multispectral scanner data
[NASA-TP-1553] p0021 N80-15535

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, GODDARD SPACE FLIGHT CENTER, GREENBELT, MD.

Chlorophyll gradient map from high-altitude ocean-color-scanner data p0035 A80-13129

Assessment of the urban heat island effect through the use of satellite data p0023 A80-15556

Making real-time sun reflectance measurements with a microprocessor-based spectroradiometer p0053 A80-17431

Multispectral Resource Sampler - An experimental satellite sensor for the mid-1980s p0053 A80-17462

A hydrological analysis of east Australian floods using Nimbus-5 electrically scanning radiometer data p0042 A80-20194

Passive microwave studies of frozen lakes p0042 A80-20247

Spectral vegetation relationships in a tropical rain forest p0005 A80-20249

An examination of the relationships between selected ground properties and Landsat MSS data in an area of complex terrain in southern Italy p0028 A80-20253

A comparison between the first four thematic mapper reflective bands and other satellite sensor systems for vegetational monitoring p0003 A80-20267

Educator's guide for Mission to Earth: LANDSAT views the world p0057 N80-10537

The relationship of red and photographic infrared spectral data to grain yield variation within a winter wheat field [NASA-TM-80328] p0008 N80-12532

Examination of Lambertian and non-Lambertian models for simulating the topographic effect on remotely sensed data p0055 N80-12533

Interim calibration report for the SMMR simulator [NASA-TM-80564] p0055 N80-12534

Ocean chlorophyll studies from a U-2 aircraft platform [NASA-TM-80574] p0038 N80-12535

A multispectral look at oil pollution detection monitoring and law enforcement p0025 N80-12822

LACIE registration processing p0012 N80-15456

Acquisition and preprocessing of LANDSAT data p0013 N80-15461

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, LYNDON B. JOHNSON SPACE CENTER, HOUSTON, TEX.

Apollo-Soyuz test project, Volume 2: Earth observations and photography p0049 N80-10538

Summary of significant results p0049 N80-10539

Visual observations over oceans p0036 N80-10563

Proceedings of Technical Sessions, volumes 1 and 2: The LACIE Symposium [E80-10030] p0011 N80-15448

Sampling, aggregation, and variance estimation for area, yield, and production in LACIE p0011 N80-15449

LACIE sampling design p0011 N80-15451

LACIE large area acreage estimation p0012 N80-15453

Large area aggregation and mean-squared prediction error estimation for LACIE yield and production forecasts p0012 N80-15454

Classification and mensuration of LACIE segments p0012 N80-15455

Growth stage estimation p0012 N80-15458

Accuracy assessment: The statistical approach to performance evaluation in LACIE p0013 N80-15459

Ancillary data acquisition for LACIE p0013 N80-15462

The classification and mensuration subsystem p0013 N80-15465

Concepts leading to the IMAGE-100 hybrid interactive system p0014 N80-15466

The crop assessment subsystem: System implementation and approaches used for the generation of crop production reports p0014 N80-15469

LACIE status and tracking p0014 N80-15470

LACIE quality assurance p0014 N80-15471

Accuracy assessment system and operation p0014 N80-15472

LACIE applications evaluation system efficiency report p0015 N80-15473

Very high speed processing: Applicability of peripheral devices to pixel-dependent tasks p0015 N80-15479

The LACIE crop years: An assessment of the crop conditions experienced in the three years of LACIE p0016 N80-15482

Application of LANDSAT digital data for monitoring drought p0016 N80-15483

LACIE area, yield, and production estimate characteristics: U.S. Great Plains p0018 N80-15484

LACIE area, yield, and production estimate characteristics: Canada p0018 N80-15486

Accuracy and performance of LACIE area estimates p0018 N80-15487

Accuracy and performance of LACIE yield estimates in major wheat producing regions of the world p0018 N80-15488

Accuracy and performance of LACIE crop development models p0016 N80-15489

Methods for segment wheat area estimation p0017 N80-15491

Estimating crop proportions from remotely sensed data p0017 N80-15492

An evaluation of procedure 1 p0018 N80-15502

Colorimetric consideration of transparencies for a typical LACIE scene p0018 N80-15506

Generation of uniform chromaticity scale imagery from LANDSAT data p0018 N80-15507

Status of yield estimation technology: A review of second-generation model development and evaluation p0019 N80-15510

Prediction of wheat phenological development: A state-of-the-art review p0019 N80-15514

New developments in sampling and aggregation for remotely sensed surveys p0019 N80-15515

Natural sampling strategy p0019 N80-15516

Weighted aggregation p0020 N80-15518

Design, implementation, and results of LACIE field research p0020 N80-15519

The application test system: An approach to technology transfer p0020 N80-15520

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, LANGLEY RESEARCH CENTER, LANGLEY STATION, VA.

Synthetic aperture radar imaging of moving ocean waves p0035 A80-14467

Earth feature identification and tracking technology development p0028 A80-17403

Remote sensing for water quality and biological measurements in coastal waters p0038 A80-19541

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, LEWIS RESEARCH CENTER, CLEVELAND, OHIO.

Possible methods for distinguishing icebergs from ships by aerial remote sensing p0056 N80-15538

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, PASADENA OFFICE, CALIF.

System for real-time crustal deformation monitoring [NASA-CASE-NPO-14124-1] p0029 N80-14603

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, WALLOPS STATION, WALLOPS ISLAND, VA.

New developments in satellite oceanography and current measurements p0035 A80-10731

NATIONAL OCEAN SURVEY, ROCKVILLE, MD.

Technical papers on airborne laser hydrography [PB-299321/0] p0045 N80-15546

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, COLUMBIA, MO.

CCEA second-generation wheat yield model for hard red wheat in North Dakota p0019 N80-15513

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, HOUSTON, TEX.

Operation of the yield estimation subsystem p0014 N80-15468

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, MIAMI, FLA.

Survey of satellite sensors and data with application to OTEC resource and operations requirements [PB-300297/9] p0039 N80-15543

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SEATTLE, WASH.

Observations of internal-wave surface signatures in ASTP photographs p0037 N80-10570

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, WASHINGTON, D. C.

Interpreting ASTP photographs of the ocean and locating the area photographed, case study of the Gulf of Mexico p0036 N80-10562

Applications of HCMM data to soil moisture snow and estuarine current studies [E80-10004] p0044 N80-12520

SEASAT: Gulf of Alaska experiment. Surface truth data inventory [PB-294616] p0038 N80-12546

Report to the Congress on coastal zone management. Transition quarter and fiscal year 1977 [PB-298537/2] p0058 N80-12722

NATIONAL TECHNICAL INFORMATION SERVICE, SPRINGFIELD, VA.

Remote sensing applied to hydrology. A bibliography with abstracts [NTIS/PS-79/0845/2] p0043 N80-11553

Remote sensing applied to geology and mineralogy. A bibliography with abstracts [NTIS/PS-79/0844/5] p0034 N80-13612

Remote sensing applied to environmental pollution detection and management. A bibliography with abstracts [NTIS/PS-79/0842/9] p0025 N80-13614

Remote sensing applied to urban and regional planning. A bibliography with abstracts [NTIS/PS-79/0843/7] p0025 N80-13615

Remote sensing of agricultural resources. A bibliography with abstracts [NTIS/PS-79/0993/0] p0021 N80-15542

NAVAL OCEAN RESEARCH AND DEVELOPMENT ACTIVITY, BAY ST. LOUIS, MISS.

Operating scenario for a Hydrographic Airborne Laser Sounder (HALS) [AD-A073872] p0038 N80-14390

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CALIF.

Processing and display techniques for multispectral satellite imagery [AD-A072509] p0050 N80-11534

NAVAL POSTGRADUATE SCHOOL, MONTEREY, CALIF.

A study of the relationship between oceanic chemical mesoscale and sea surface thermal structure as detected by satellite infrared imagery [AD-A074186] p0039 N80-14663

NAVAL RESEARCH LAB., WASHINGTON, D. C.

Ocean wave spectrometer measurements in the gulf stream experiment [AD-A074389] p0039 N80-14665

NEW MEXICO UNIV., ALBUQUERQUE.

Remote sensing applied to agricultural resources. Citations from the international aerospace abstracts data base [NTIS/PS-79/0733/0] p0006 N80-10588

Remote sensing applied to geology. Citations from the international Aerospace Abstracts data base [NTIS/PS-79/0822/1] p0034 N80-13613

O

OFFICE NATIONAL D'ETUDES ET DE RECHERCHES AEROSPATIALES, PARIS (FRANCE).

Spectrometer for the first Spacelab payload p0054 N80-12034

P

PAN AMERICAN UNIV., EDINBURG, TEX.

A seasonal verification of the Suits spectral reflectance model for wheat p0005 A80-19544

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.

Remote estimation of surface moisture over a watershed [E80-10025] p0044 N80-12527

POLAR RESEARCH LAB., INC., SANTA BARBARA, CALIF.

Arctic Research in Environmental Acoustics (AREA). Technical report no. 8: Arctic lead-airdrop data buoy [AD-A074731] p0039 N80-14664

PURDUE UNIV., LAFAYETTE, IND.

Forest resource information system, phase 3 [E80-10026] p0007 N80-12528

Digital processing of LANDSAT MSS and topographic data to improve capabilities for computerized mapping of forest cover types [E80-10009] p0008 N80-13588

R

REGIONALE PLANUNGSGEMEINSCHAFT UTERMAIN, FRANKFURT (WEST GERMANY).

Future remote sensing tasks in regional planning p0025 N80-12484

RESEARCH TRIANGLE INST., RESEARCH TRIANGLE PARK, N. C.

Sea-surface temperature variability analysis of potential OTEC sites utilizing satellite data [OR0-5444-1] p0039 N80-15603

Ruhr PLANNING AUTHORITY, ESSEN (WEST GERMANY).

Interpretation of IR and MSS data for town areas p0025 N80-12485

S

SANTA BARBARA RESEARCH CENTER, GOLETA, CALIF.

Thematic mapper design description and performance prediction p0053 A80-17460

SCIENCE SYSTEMS AND APPLICATIONS, INC., LANHAM, MD.

Chlorophyll gradient map from high-altitude ocean-color-scanner data p0035 A80-13129

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CALIF.

Antipodal seas p0036 N80-10564

SMITHSONIAN INSTITUTION, WASHINGTON, D. C.

Orbital observations of sand distribution in the western desert of Egypt p0024 N80-10553

Preliminary analysis of color variations of sand deposits in the western desert of Egypt p0032 N80-10555

- Temporal changes as depicted on orbital photographs of arid regions in North Africa p0029 N80-10556
 ASTP photographs of southeastern Angola p0033 N80-10557
 Color of desert surfaces in the Arabian peninsula p0033 N80-10558
 Monte Desert of San Juan, Argentina, as photographed by ASTP p0033 N80-10559
 Determining photograph locations over oceans p0050 N80-10561
 Maltese Front and Strait of Sicily ocean pattern analysis p0037 N80-10565
 Analysis of water color as seen in orbital and aerial photographs of Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts p0042 N80-10567
 Suspended-sediment dispersal patterns of river deltas photographed by ASTP p0043 N80-10572
- SOUTH DAKOTA STATE UNIV., BROOKINGS.**
 HCMM energy budget data as a model input for assessing regions of high potential groundwater pollution [E80-10002] p0044 N80-12518
- STANFORD UNIV., CALIF.**
 Geological and geothermal data use investigations for application explorer mission-A, heat capacity mapping mission [E80-10033] p0034 N80-15528
- STATE UNIV. OF NEW YORK COLL. OF ENVIRONMENTAL SCIENCE AND FORESTRY, SYRACUSE.**
 The mapping of important farmland using remote sensor and socio-economic variables p0009 N80-14424

T

- TECHNICAL RESEARCH CENTRE OF FINLAND, ESPOO.**
 Automated earth resources surveys using satellite and aircraft scanner data: A Finnish approach [VTT-LU-15] p0054 N80-11547
- TECHNISCHE HOCHSCHULE, DARMSTADT (WEST GERMANY).**
 On measurements from aircraft [BMFT-FB-W-78-04] p0050 N80-12467
- TECHNISCHE UNIVERSITAET, HANOVER (WEST GERMANY).**
 On the current state of remote sensing techniques p0055 N80-12469
- TECHNISCHE UNIVERSITAET, MUNICH (WEST GERMANY).**
 Quantitative determination of morphological structures in sand bank regions from image structure analysis p0033 N80-12482
 Making morphological maps of sand banks from aerial photographs p0033 N80-12483
- TEXAS A&M UNIV., COLLEGE STATION.**
 Monitoring of deltaic wetland processes with seasonal aerial photography p0042 A80-20240
 Applied regional monitoring of the vernal advancement and retrogradation (green wave effect) of natural vegetation in the Great Plains corridor [E80-10008] p0025 N80-12524
 The system and hardware design of real-time fan beam scatterometer data processors [E80-10028] p0055 N80-12530
 On the clustering of multidimensional pictorial data p0050 N80-15493
 Multiyear estimates for the LACIE sampling plans p0019 N80-15517
- TEXAS UNIV. AT AUSTIN.**
 Analysis of Skylab and astp photographs of the Levantine (Dead Sea) fault zone p0031 N80-10543
 South American river morphology and hydrology p0043 N80-10574

U

- UNIVERSITY OF EASTERN MICHIGAN, YPSILANTI.**
 Impact of Great Lakes water level fluctuations on coastal wetlands [PB-296403/9] p0043 N80-10590

W

- WASHINGTON UNIV., SEATTLE.**
 Study in remote sensing for land use [AD-A071802] p0024 N80-11537
 Crustal deformation in central California: Multi-wavelength geodetic observations and interpretations p0029 N80-14605
- WORLD METEOROLOGICAL ORGANIZATION, GENEVA (SWITZERLAND).**
 Space Observations for water resources: A potential to be developed p0044 N80-13609

Z

- ZURICH UNIV. (SWITZERLAND).**
 Snow mapping from space platforms p0045 N80-13611

CONTRACT NUMBER INDEX

Typical Contract Number Index Listing



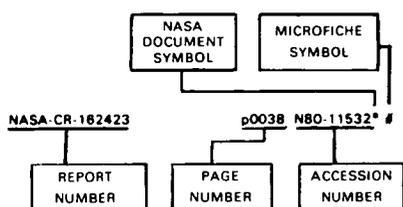
Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession 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.

| | | |
|------------------------|-------|-----------|
| | p0009 | N80-13594 |
| | p0009 | N80-13595 |
| | p0050 | N80-13596 |
| NGL-44-001-001 | p0042 | A80-20240 |
| NRC A-7501 | p0023 | A80-20025 |
| NSF SOC-75-02253 | p0042 | A80-20245 |
| NSG-5263 | p0031 | A80-16427 |
| NSG-9033 | p0005 | A80-19544 |
| N00014-79-C-0042 | p0039 | N80-14864 |
| PROJ. CARETS | p0026 | N80-15526 |
| PROJ. TELLUS | p0044 | N80-12522 |
| | p0007 | N80-12525 |
| | p0007 | N80-12526 |
| | p0008 | N80-12531 |
| | p0009 | N80-13598 |
| | p0009 | N80-13599 |
| | p0039 | N80-14865 |
| | p0039 | N80-14865 |
| RR0310343 | p0021 | N80-15535 |
| WF52553000 | | |
| 177-52-83-13 | | |

| | | |
|--------------------------------|-------|-----------|
| AF PROJ. 2103 | p0024 | N80-11537 |
| BMFT-WE-0175 | p0050 | N80-12467 |
| | p0055 | N80-13808 |
| DA PROJ. 4A7-62730-AT-42 | p0043 | N80-11538 |
| DA-ERO-78-G044 | p0027 | A80-11701 |
| DAAK40-77-C-0107 | p0054 | A80-17515 |
| DAAK70-78-C-0147 | p0051 | N80-15540 |
| DI-14-0001-7163 | p0043 | N80-10590 |
| E(11-1)-2538 | p0037 | N80-10566 |
| | p0037 | N80-10569 |
| EF-77-C-05-05444 | p0036 | A80-18247 |
| EG-77-C-05-5444 | p0039 | N80-15603 |
| EY-76-C-08-1183 | p0044 | N80-13606 |
| F08635-77-C-0278 | p0024 | N80-11537 |
| JPL-954940 | p0031 | A80-20258 |
| | p0003 | A80-20268 |
| JPL-955048 | p0031 | A80-20258 |
| | p0003 | A80-20268 |
| NASA ORDER S-40255-B | p0045 | N80-15533 |
| NASA ORDER S-54053-A | p0054 | A80-20244 |
| NASA ORDER S-70243-AG | p0026 | N80-15526 |
| NASW-2800 | p0038 | N80-11532 |
| | p0057 | N80-11533 |
| NAS1-15044 | p0056 | N80-15380 |
| NAS5-20796 | p0025 | N80-12524 |
| NAS5-22948 | p0037 | N80-10566 |
| | p0037 | N80-10569 |
| NAS5-24200 | p0053 | A80-17480 |
| NAS5-24206 | p0044 | N80-12518 |
| NAS5-24232 | p0034 | N80-15528 |
| NAS6-2497 | p0038 | N80-13753 |
| NAS6-2519 | p0029 | N80-15446 |
| NAS7-100 | p0048 | A80-20269 |
| | p0034 | N80-15529 |
| NAS9-13831 | p0049 | N80-10538 |
| NAS9-14282 | p0019 | N80-15511 |
| NAS9-14533 | p0019 | N80-15511 |
| NAS9-14565 | p0017 | N80-15499 |
| NAS9-14689 | p0050 | N80-15493 |
| | p0051 | N80-15496 |
| NAS9-15000 | p0051 | N80-15496 |
| NAS9-15200 | p0004 | A80-15783 |
| | p0017 | N80-15494 |
| | p0051 | N80-15495 |
| NAS9-15311 | p0055 | N80-12530 |
| NAS9-15325 | p0007 | N80-12528 |
| NAS9-15476 | p0008 | N80-12529 |
| | p0021 | N80-15534 |
| NAS9-15508 | p0008 | N80-13588 |
| NAS9-15800 | p0008 | N80-13589 |
| | p0008 | N80-13590 |
| | p0008 | N80-13591 |
| | p0050 | N80-13592 |
| | p0008 | N80-13593 |

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.

AD-A071723 p0024 N80-11535 #
 AD-A071802 p0024 N80-11537 #
 AD-A072157 p0043 N80-11538 #
 AD-A072473 p0037 N80-10583 #
 AD-A072509 p0050 N80-11534 #
 AD-A073872 p0038 N80-14390 #
 AD-A074186 p0039 N80-14863 #
 AD-A074369 p0039 N80-14865 #
 AD-A074439 p0051 N80-15540 #
 AD-A074731 p0039 N80-14864 #
 AD-E000321 p0039 N80-14865 #
 AFESC/ESL-TR-79-15 p0024 N80-11537 #
 ASME PAPER 79-ENAS-41 p0041 A80-15285 #
 BCL-OA-TFR-79-5 p0057 N80-11533* #
 BCL-OA-TFR-79-6 p0038 N80-11532* #
 BMFT-FB-M-77-11 p0045 N80-13726 #
 BMFT-FB-W-78-04 p0050 N80-12487 #
 BMFT-FB-W-78-31 p0055 N80-13808 #
 CGR/DC-8/79 p0037 N80-10583 #
 CONF-790495-1 p0044 N80-13806 #
 CONTRIB-78-268-A p0019 N80-15511* #
 CRREL-79-15 p0043 N80-11538 #
 E-266 p0056 N80-15538* #
 EGG-1183-1679 p0044 N80-13806 #
 ERIM-132400-25-R p0008 N80-12529* #
 ERIM-132400-28-P p0021 N80-15534* #
 ESA-SP-1020 p0009 N80-14440 #
 ETL-0175 p0024 N80-11535 #
 ETL-0194 p0051 N80-15540 #
 E80-10002 p0044 N80-12518* #
 E80-10004 p0044 N80-12520* #
 E80-10005 p0033 N80-12521* #
 E80-10006 p0044 N80-12522* #
 E80-10007 p0007 N80-12523* #
 E80-10008 p0025 N80-12524* #
 E80-10009 p0008 N80-13588* #
 E80-10010 p0008 N80-13589* #
 E80-10011 p0008 N80-13590* #
 E80-10012 p0008 N80-13591* #
 E80-10013 p0050 N80-13592* #
 E80-10014 p0008 N80-13593* #
 E80-10015 p0009 N80-13594* #
 E80-10018 p0009 N80-13595* #

E80-10017 p0050 N80-13596* #
 E80-10018 p0009 N80-13597* #
 E80-10019 p0009 N80-13598* #
 E80-10020 p0045 N80-15447* #
 E80-10021 p0009 N80-13599* #
 E80-10022 p0007 N80-12525* #
 E80-10023 p0007 N80-12526* #
 E80-10024 p0009 N80-13600* #
 E80-10025 p0044 N80-12527* #
 E80-10026 p0007 N80-12528* #
 E80-10027 p0008 N80-12529* #
 E80-10028 p0055 N80-12530* #
 E80-10029 p0008 N80-12531* #
 E80-10030 p0011 N80-15448* #
 E80-10031 p0026 N80-15526* #
 E80-10032 p0020 N80-15527* #
 E80-10033 p0034 N80-15528* #
 E80-10035 p0034 N80-15529* #
 E80-10036 p0021 N80-15530* #
 E80-10037 p0021 N80-15531* #
 E80-10039 p0045 N80-15533* #
 E80-10040 p0021 N80-15534* #
 GPO-49-530 p0057 N80-11530 #
 ISBN-951-38-0723-1 p0054 N80-11547 #
 ISSN-0379-6566 p0009 N80-14440 #
 JPRS-73946 p0033 N80-11527 #
 JSC-14744 p0008 N80-13593* #
 JSC-14745 p0009 N80-13594* #
 JSC-14785 p0050 N80-13596* #
 JSC-14852 p0009 N80-13595* #
 JSC-15042 p0008 N80-13591* #
 JSC-16015-VOL-1 p0011 N80-15448* #
 JSC-16015-VOL-2 p0011 N80-15448* #
 JSC-16019 p0008 N80-13590* #
 JSC-16020 p0008 N80-13589* #
 JSC-16030-REV-D p0050 N80-13592* #
 LARS-063079 p0007 N80-12528* #
 LARS-071579 p0008 N80-13588* #
 LEC-3949-REV-D p0050 N80-13592* #
 LEC-12723 p0009 N80-13595* #
 LEC-12980 p0008 N80-13593* #
 LEC-13012 p0009 N80-13594* #
 LEC-13258 p0050 N80-13596* #
 LEC-13456 p0008 N80-13591* #
 LEC-13482 p0008 N80-13590* #
 LEC-13632 p0008 N80-13589* #
 NASA-CASE-NPO-14124-1 p0029 N80-14603* #
 NASA-CR-156858 p0038 N80-13753* #
 NASA-CR-156859 p0029 N80-15446* #
 NASA-CR-159175 p0056 N80-15380* #
 NASA-CR-160312 p0008 N80-13588* #
 NASA-CR-160313 p0009 N80-13595* #
 NASA-CR-160314 p0008 N80-13590* #
 NASA-CR-160315 p0008 N80-13589* #
 NASA-CR-160338 p0008 N80-13591* #
 NASA-CR-160339 p0050 N80-13592* #
 NASA-CR-160340 p0008 N80-13593* #
 NASA-CR-160341 p0009 N80-13594* #
 NASA-CR-160342 p0050 N80-13596* #
 NASA-CR-160346 p0007 N80-12528* #
 NASA-CR-160350 p0055 N80-12530* #
 NASA-CR-160351 p0008 N80-12529* #
 NASA-CR-160362 p0021 N80-15534* #
 NASA-CR-162368 p0044 N80-12527* #
 NASA-CR-162379 p0044 N80-12518* #
 NASA-CR-162381 p0044 N80-12520* #
 NASA-CR-162382 p0033 N80-12521* #
 NASA-CR-162383 p0044 N80-12522* #
 NASA-CR-162384 p0007 N80-12523* #
 NASA-CR-162385 p0025 N80-12524* #
 NASA-CR-162390 p0009 N80-13597* #
 NASA-CR-162391 p0009 N80-13598* #
 NASA-CR-162392 p0045 N80-15447* #
 NASA-CR-162393 p0009 N80-13599* #
 NASA-CR-162394 p0007 N80-12525* #
 NASA-CR-162395 p0007 N80-12526* #
 NASA-CR-162396 p0009 N80-13600* #
 NASA-CR-162397 p0008 N80-12531* #

NASA-CR-162423 p0038 N80-11532* #
 NASA-CR-162434 p0057 N80-11533* #
 NASA-CR-162442 p0028 N80-15526* #
 NASA-CR-162443 p0020 N80-15527* #
 NASA-CR-162444 p0034 N80-15528* #
 NASA-CR-162446 p0034 N80-15529* #
 NASA-CR-162447 p0021 N80-15530* #
 NASA-CR-162448 p0021 N80-15531* #
 NASA-CR-162450 p0045 N80-15533* #
 NASA-SP-380 p0057 N80-10537* #
 NASA-SP-412-VOL-2 p0049 N80-10538* #
 NASA-TM-79310 p0056 N80-15538* #
 NASA-TM-80328 p0008 N80-12532* #
 NASA-TM-80557 p0055 N80-12533* #
 NASA-TM-80564 p0055 N80-12534* #
 NASA-TM-80573 p0025 N80-12622* #
 NASA-TM-80574 p0038 N80-12535* #
 NASA-TM-80811 p0011 N80-15448* #
 NASA-TM-80845 p0058 N80-14971* #
 NASA-TP-1553 p0021 N80-15535* #
 NOAA-S/T-78-211-VOL-7 p0039 N80-15772 #
 NOAA-TM-ERL-AOML-37 p0039 N80-15543 #
 NOAA-TM-NOS-25 p0045 N80-15546 #
 NOAA-79031609 p0038 N80-12546 #
 NOAA-79050811 p0057 N80-10587 #
 NOAA-79061803 p0058 N80-12722 #
 NOAA-79072309 p0045 N80-15546 #
 NOAA-79081002 p0039 N80-15543 #
 NORDA-TN-34 p0038 N80-14390 #
 NOSCR/TR-439 p0050 N80-11534 #
 NRL-MR-4070 p0039 N80-14665 #
 NTIS/PS-75/068 p0021 N80-15542 #
 NTIS/PS-75/668 p0021 N80-15542 #
 NTIS/PS-76/0714 p0021 N80-15542 #
 NTIS/PS-77/0674 p0025 N80-13814 #
 NTIS/PS-77/0675 p0025 N80-13815 #
 NTIS/PS-77/0676 p0034 N80-13812 #
 NTIS/PS-77/0677 p0043 N80-11553 #
 NTIS/PS-77/0687 p0021 N80-15542 #
 NTIS/PS-78/0789 p0025 N80-13814 #
 NTIS/PS-78/0790 p0025 N80-13815 #
 NTIS/PS-78/0791 p0034 N80-13812 #
 NTIS/PS-78/0792 p0043 N80-11553 #
 NTIS/PS-78/0969 p0021 N80-15542 #
 NTIS/PS-79/0733/0 p0008 N80-10588 #
 NTIS/PS-79/0822/1 p0034 N80-13813 #
 NTIS/PS-79/0842/9 p0025 N80-13814 #
 NTIS/PS-79/0843/7 p0025 N80-13815 #
 NTIS/PS-79/0844/5 p0034 N80-13812 #
 NTIS/PS-79/0845/2 p0043 N80-11553 #
 NTIS/PS-79/0993/0 p0021 N80-15542 #
 ORO-5444-1 p0039 N80-15603 #
 OWRT-B-045-MICH(1) p0043 N80-10590 #
 PB-294616 p0038 N80-12546 #
 PB-295403/9 p0043 N80-10590 #
 PB-296712/3 p0057 N80-10587 #
 PB-297442/6 p0044 N80-12547 #
 PB-297931/8 p0051 N80-15547 #
 PB-298537/2 p0058 N80-12722 #
 PB-299321/0 p0045 N80-15546 #
 PB-300297/9 p0039 N80-15543 #
 PB-300825/7 p0021 N80-15549 #
 PR-1 p0007 N80-12523* #
 PR-1 p0009 N80-13598* #
 PR-1 p0020 N80-15527* #
 PRL-TR-8 p0039 N80-14664 #
 REPT-1003 p0009 N80-13616 #
 RSC-3018-7 p0025 N80-12524* #
 RSC-3556 p0055 N80-12530* #

REPORT/ACCESSION NUMBER INDEX

| | | |
|------------------------------|-------|--------------|
| S-492 | p0021 | N80-15535* # |
| SDSU-RSI-79-15 | p0044 | N80-12518* # |
| SER-1-ORIGINAL-REPT-76 | p0029 | N80-14462 # |
| TB-1609 | p0021 | N80-15549 # |
| US-PATENT-APPL-SN-863024 ... | p0029 | N80-14803* |
| US-PATENT-CLASS-343-100ME | p0029 | N80-14803* |
| US-PATENT-CLASS-343-112D ... | p0029 | N80-14803* |
| US-PATENT-4,170,776 | p0029 | N80-14803* |
| USCG-D-36-79 | p0037 | N80-10583 # |
| VTT-LU-15 | p0054 | N80-11547 # |
| W79-07001 | p0043 | N80-10580 # |

| | | | |
|--|--|--|--------------------------|
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