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Earth Resources
A Continuing
Bibliography
with Indexes

NASA SP-7041(24)
January 1980

National Aeronautics and
Space Administration

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NASA SP-7041 (24)

EARTH RESOURCES

A Continuing Bibliography
With Indexes
Issue 24

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 October 1, 1979 and December 31, 1979 in

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

NASA Scientific and Technical Information Branch 1980
National Aeronautics and Space Administration
Washington, DC

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 instrumention on orbiting spacecraft or on aircraft.

This literature survey lists 345 reports, articles, and other documents announced between October 1 and December 31, 1979 in *Scientific and Technical Aerospace Reports (STAR)*, and *International Aerospace Abstracts (IAA)*.

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

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

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

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

IAA entries identified by accession number series A79-10,000 in ascending accession number order;

STAR entries identified by accession number series N79-10,000 in ascending accession number order.

After the abstract section, there are five indexes:

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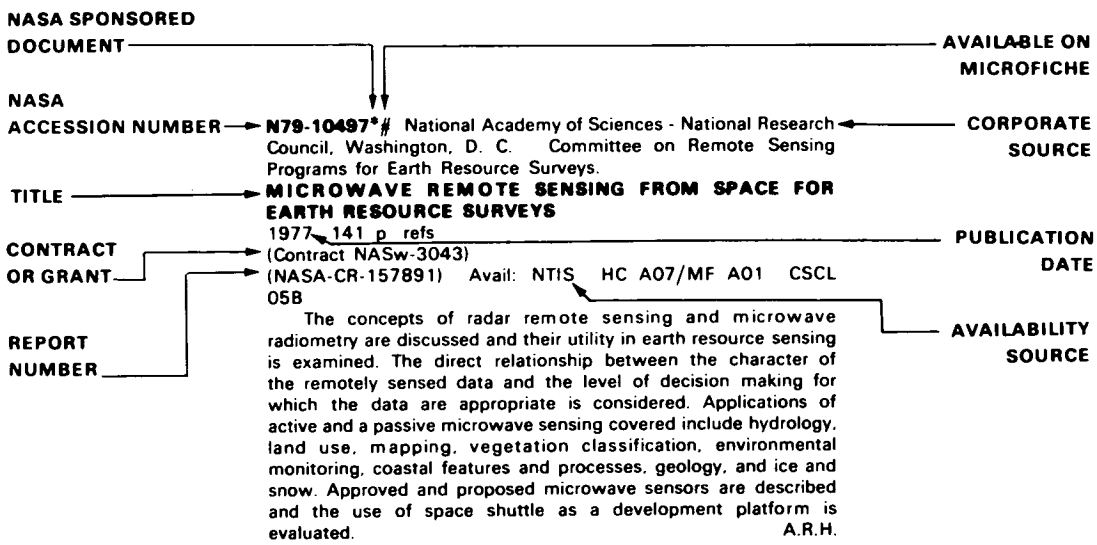

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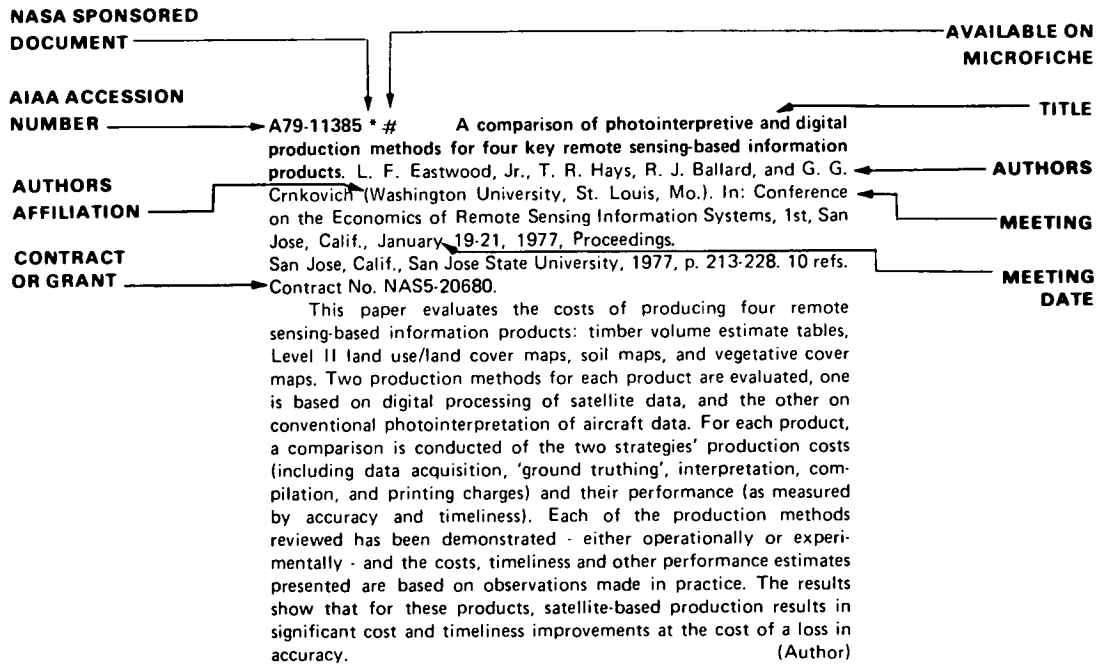

EARTH RESOURCES

A Continuing Bibliography (Issue 24)

JANUARY 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.

A79-44143 # **Experimental evaluation of the possibility of using the method of hyperparallelepiped for automatic decoding aerospace information (Eksperimental'naia otsenka vozmozhnosti ispol'zovaniia metoda giperparallelepipeda dlia avtomatizirovannogo deshifrirovaniia aerokosmicheskoi informatsii).** Iu. M. Benilov and Z. K. Fedotova. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 161-167. In Russian.

A79-44145 # **Automatic processing of multispectral video information for crop recognition (Avtomatizirovannaia obrabotka mnogospektral'noi videoinformatsii v tseliakh raspoznavaniia sel'skokhoziaistvennykh kul'tur).** V. I. Borisenko, I. A. Labutina, and L. S. Chesalin. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 176-184. 5 refs. In Russian.

A79-44395 # **Normalization of radiance data for studying crop spectra over time with a mobile field spectro-radiometer.** E. J. Brach (Agriculture Canada, Engineering Research Service, Canada), A. R. Mack (Agriculture Canada, Soil Research Institute, Canada), and V. R. Rao. *Canadian Journal of Remote Sensing*, vol. 5, May 1979, p. 33-42. 8 refs. Research supported by the National Research Council.

A79-46502 # **Radiation characteristics of vegetation covers in the microwave range (Radiatsionnye kharakteristiki rastitel'nykh pokrovov v SVCh diapazone).** A. E. Basharinov, E. N. Zotova, M. I. Naumov, and A. A. Chukhlantsev. *Radiotekhnika*, vol. 34, May 1979, p. 16-24. 26 refs. In Russian.

The paper surveys mathematical models and experimental data pertaining to the radio scattering and thermal emission characteristics of vegetation covers in agricultural areas. The use of microwave remote sensing techniques for the purposes of crop inventory and vegetation monitoring is discussed. B.J.

A79-46582 * **The influence of false color infrared display on training field identification.** W. A. Coberly (Tulsa, University, Tulsa, Okla.), J. D. Tubbs (Arkansas, University, Fayetteville, Ark.), and P. L. Odell (Texas, University, Dallas, Tex.). *Remote Sensing of Environment*, vol. 8, Aug. 1979, p. 225-236. 8 ref. Grant No. NGL-44-004-026.

The overall success of large-scale crop inventories of agricultural regions using Landsat multispectral scanner data is highly dependent upon the labeling of training data by analyst/photointerpreters. The principal analyst tool in labeling training data is a false color infrared composite of Landsat bands 4, 5, and 7. In this paper, this color display is investigated and its influence upon classification errors is partially determined. (Author)

A79-46583 * **Monitoring corn and soybean crop development with hand-held radiometer spectral data.** C. J. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.), J. H. Elgin, Jr., J. E. McMurtrey, III (U.S. Department of Agriculture, Field Crops Laboratory, Beltsville, Md.), and C. J. Fan (Morgan State University, Baltimore, Md.). *Remote Sensing of Environment*, vol. 8, Aug. 1979, p. 237-248. 22 refs.

A79-46584 **The use of polarized panchromatic and false-color infrared film in the monitoring of soil surface moisture.** P. J. Curran (Bristol, University, Bristol, England). *Remote Sensing of Environment*, vol. 8, Aug. 1979, p. 249-266. 27 refs. Natural Environment Research Council Grant No. GR3/1481.

A79-46585 **Grain yield prediction - Extending the stress-degree-day approach to accommodate climatic variability.** S. B. Idso, J. L. Hatfield, R. D. Jackson, and R. J. Reginato (U.S. Water Conservation Laboratory, Phoenix, Ariz.). *Remote Sensing of Environment*, vol. 8, Aug. 1979, p. 267-273.

The stress-degree day method of plant water stress assessment for the prediction of grain crop yields is extended to take into account climatic variability. The stress-degree day approach, which is based on a sum of the daily differences between crop canopy temperatures and air temperatures above the crop, is combined with the classical growing-degree day parameter, which is based on the differences between the mean air temperature and a base temperature below which physiological activity is assumed to be inhibited. The combined parameters, taken over the grain filling period with allowances made for light and degree day conditions prior to the emergence of grain heads, are found to predict equally well the yields of wheat crops growing in Phoenix, Arizona and Davis, California. The extended approach also allows the prediction of the time of the cessation of growth and of final yields at an early stage of crop development. A.L.W.

A79-46586 * **Equivalence of airborne and ground-acquired wheat canopy temperatures.** J. P. Millard (NASA, Ames Research

Center, Moffett Field, Calif.), J. L. Hatfield (California, University, Davis, Calif.), and R. C. Goettelman (LFE Corp., Richmond, Calif.). *Remote Sensing of Environment,* vol. 8, Aug. 1979, p. 273-275. 5 refs.

The relationship between airborne and ground-based measurements of soil and crop canopy temperatures is investigated for a partial crop canopy. Daily ground-based measurements using a wide-field-of-view radiometer oriented towards the nadir at a height of 1.5 m and airborne thermal imagery at two-week intervals were obtained throughout the entire growing season of a stand of wheat. When corrected for atmospheric effects, the airborne measurements were found to be virtually identical to ground-based measurements, with a regression line slope of 0.985, a standard deviation of 1.8 C and a correlation coefficient of 0.97. A.L.W.

A79-47556 Parameters of cotton cultivation from infrared aerial photography. T. J. Henneberry, L. A. Bariola (U.S. Department of Agriculture, Western Cotton Research Laboratory, Phoenix, Ariz.), W. G. Hart, M. R. Davis, S. J. Ingle (U.S. Department of Agriculture, Science and Education Administration, Weslaco, Tex.), D. L. Kittock (U.S. Department of Agriculture, Cotton Research Center, Phoenix, Ariz.), and H. F. Arle (Arizona, University, Phoenix, Ariz.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Aug. 1979, p. 1129-1133. 8 refs.

Aerial infrared photography was demonstrated to be effective in early determination of the effectiveness of plant growth regulators applied to remove late-season fruiting forms of cotton, Gossypium spp., and associated diapause larvae of the pink bollworm, Pectinophora gossypiella (Saunders). In addition, response to fertilizer, differences in cultivars, and disease were readily identified. (Author)

A79-47557 Forest type mapping from Landsat digital data. J. Beaubien (Department of the Environment, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Aug. 1979, p. 1135-1144. 18 refs.

The results of a computer classification of three forest areas in Quebec are examined. The first, a study on Anticosti Island, showed that it was possible to distinguish mature and overmature balsam fir stands, black spruce stands, level of regeneration after cut-overs or fires, and damage caused by an insect epidemic. The other two studies covered larger areas with a more complex topography and vegetation cover. It is shown that by using unsupervised digital classifications, it was generally possible to map hardwood, mixed-wood, and two or three types of softwood stands depending on the area. Other factors which play the largest role in soft-wood class distribution are age and density, and percent and exposure of the slope. It is noted that it was impossible to separate regeneration and mature stands within mixed or hardwood forest types. It is concluded that the accuracy of a computer classification depends on a number of factors specific to each study but particularly on the type of terrain to be mapped. M.E.P.

A79-47558 * Reflectance of varying mixtures of a clay soil and sand. A. H. Gerbermann (U.S. Department of Agriculture, Weslaco, Tex.) and D. D. Neher (Texas A & I University, Kingsville, Tex.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Aug. 1979, p. 1145-1150. 15 refs. NASA Order S-70251-AG; NASA Task 3.

A79-48459 * Detecting transition in agricultural systems. P. J. Neary (Columbia University, New York, N.Y.) and J. C. Coiner (Hunter College, New York, N.Y.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 477-482. Grant No. NsG-5080. (ASP 79-182)

Remote sensing of agricultural phenomena has been largely concentrated on analysis of agriculture at the field level. Concern has been to identify crop status, crop condition, and crop distribution, all of which are spatially analyzed on a field-by-field basis. A more general level of abstraction is the agricultural system, or the complex of crops and other land cover that differentiate various agricultural economies. The paper reports on a methodology to assist in the analysis of the landscape elements of agricultural systems with Landsat digital data. The methodology involves tracing periods of photosynthetic activity for a fixed area. Change from one agricultural system to another is detected through shifts in the intensity and periodicity of photosynthetic activity as recorded in the radiometric return to Landsat. The Landsat-derived radiometric indicator of photosynthetic activity appears to provide the ability to differentiate agricultural systems from each other as well as from conterminous natural vegetation. S.D.

A79-48460 Vegetation mapping in the gates of the Arctic National Park. J. G. Lyon (Michigan, University, Ann Arbor, Mich.) and T. L. George (U.S. Forest Service, White Mountain Ranger Station, Bishop, Calif.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 483-497. 16 refs. NOAA-sponsored research. (ASP 79-183)

Through vegetation mapping at the 1:63,000-scale and field work, it was possible to evaluate Landsat data products for use in areas of limited resource information. The digital techniques used in the analysis include channel ratioing, edge enhancement, and principal component analysis. Major conclusions are that (1) band 5/7 convoluted (edge enhanced) imagery production is an accurate and rapid method for mapping Alpine tundra and taiga vegetation in the absence of resource information; (2) supervised classification of Landsat data is a useful technique but it potentially requires more ground truth and digital processing than interpretation of computer enhanced imagery; and (3) extensive field work and low-altitude oblique 35 mm photography allowed for satellite data accuracy analysis in the absence of recent aerial photography. S.D.

A79-49819 Mapping China's new agricultural lands. R. Welch, H. C. Lo, and C. W. Pannell (Georgia, University, Athens, Ga.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Sept. 1979, p. 1211, 1212, 1221-1228. 20 refs. Research supported by the University of Georgia; NSF Grant No. SOC-77-27701.

Landsat image data in photographic and computer compatible tape formats were used to map land use and identify crops in the Nun River Basin in China. Landsat scenes showed that 15,300 sq km of rangeland and wetland converted to agricultural uses are characterized by large geometric fields designed for mechanized farming. Soybean, corn/millet, and harvested wheat/millet crops were identified on two farms by computer assisted classification techniques in conjunction with crop calendars and spectral reflectance data. It was shown that food crops such as spring wheat and corn replaced soybeans, kaoliang, and millet as the principal crops in Northeast China. The absence of definitive ground truth in this study was overcome by the correlation of Landsat image data with maps and reports to provide a basis for an objective evaluation of China's land development policies. A.T.

A79-49968 * Satellite-sensed winter nocturnal temperature patterns of the Everglades Agricultural Area. E. Chen, J. F. Bartholic, R. G. Bill, Jr., R. A. Sutherland (Florida, University, Gainesville, Fla.), and L. H. Allen, Jr. (Florida, University; U.S. Department of Agriculture, Gainesville, Fla.). *Journal of Applied Meteorology,* vol. 18, Aug. 1979, p. 992-1002. 11 refs. Contract No. NAS10-8920.

Surface temperature patterns of drained organic soil farmland in the Everglades Agricultural Area south of Lake Okeechobee, Florida, were studied using GOES-1 satellite infrared digital data for the winters of 1976-77 and 1977-78. Local thermal features were explained in terms of soil types, soil depths and climate modification

caused by organic soil drainage. A cold-prone area was delineated in the Everglades Agricultural Area with satellite data. The winter nighttime surface temperatures of this area were more characteristic of north central Florida, approximately 370 km further north, than of surrounding areas of mineral soil or undrained organic soil.
(Author)

A79-50213 Separation of various small grain LACIE spectral signatures using the evolution patterns of Householder transformation generating functions. M. S. Bodner. *Remote Sensing Quarterly,* vol. 1, Jan. 1979, p. 6-37. 8 refs.

The paper presents an investigation made into the time evolution characteristics of several LACIE small grain spectral signatures. Data from one acquisition date is mapped onto the data from another acquisition date using a Householder transformation. The column vectors that generate the 4 x 4 transformation matrices are shown to exhibit patterns that may be characteristic for each crop type. Finally, the possibility of using such an analytical method for crop classification is discussed. M.E.P.

A79-50331 Low cost method of mapping land cover using satellite images. C. D. Elifrits, T. W. Barney, C. J. Johannsen (Missouri-Columbia, University, Columbia, Mo.), and D. J. Barr (Missouri-Rolla, University, Rolla, Mo.). In: Learning to use our environment; Proceedings of the Twenty-fifth Annual Technical Meeting, Seattle, Wash., April 30-May 2, 1979.
Mount Prospect, Ill., Institute of Environmental Sciences, 1979, p. 21-36.

This paper describes some simple, inexpensive methodologies developed for general land cover (Level I) mapping using Landsat images. A step-by-step methodology, using interpretative techniques and direct tracing on an overlay of the image is described in detail. This methodology was developed through working with university students from different academic backgrounds and who had no previous experience in image interpretation. It has been successfully tested by use in workshops taught for regional planning-agencies and agronomy extension agents. The techniques used result in maps that are very accurate in relation to actual land cover and relative to the small investment in skill, time, and money needed to produce the product. (Author)

A79-52501 Determination of the moisture content of soils by microwave radiometry /Review/. A. E. Bashrinov and A. M. Shutko. *(Radiotekhnika i Elektronika,* vol. 23, Sept. 1978, p. 1778-1791.) *Radio Engineering and Electronic Physics,* vol. 23, Sept. 1978, p. 1-12. 60 refs. Translation.

The paper is a survey of theoretical and experimental studies of the microwave radiometry of soil moisture. Consideration is given to the physics of moisture-radiation relationships, the radiation properties of nonuniformly moist soils, and the screening effect of vegetation. B.J.

A79-53380 Multitemporal remote sensing - Satellites provide a new tool for earth resources management. G. Saint (Centre National d'Etudes Spatiales, Toulouse, France). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-258.* 15 p.

This paper considers repeatability of earth observation from satellites and provides examples of the importance of this factor in several areas. Repeatability and fidelity in satellite remote sensing which allows the orbit to be computed so that the satellite returns to each location at fixed time intervals making comparisons and evolution studies feasible are discussed, noting that the raw data from the satellite must be preprocessed to correct their geometry and radiometry for the perturbing effects. The preprocessing of multitemporal data to correct variations between several images on the same site, and processing of multitemporal data to provide more precise sensing data are discussed. Applications of Landsat multitemporal data in agriculture for the evolution of a vegetation index for wheat, oats, and corn; in forestry to identify growth of different tree species; to determine snow cover extensions; and in studies of coastal zones evolution and the interaction between water and land are described. A.T.

A79-53381 * Advances in the development of remote sensing technology for agricultural applications. J. E. Powers, R. B. Erb, F. G. Hall, and R. B. MacDonald (NASA, Johnson Space Center, Houston, Tex.). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-259.* 16 p. 18 refs.

The application of remote sensing technology to crop forecasting is discussed. The importance of crop forecasts to the world economy and agricultural management is explained, and the development of aerial and spaceborne remote sensing for global crop forecasting by the United States is outlined. The structure, goals and technical aspects of the Large Area Crop Inventory Experiment (LACIE) are presented, and main findings on the accuracy, efficiency, applicability and areas for further study of the LACIE procedure are reviewed. The current status of NASA crop forecasting activities in the United States and worldwide is discussed, and the objectives and organization of the newly created Agriculture and Resources Inventory Surveys through Aerospace Remote Sensing (AgRISTARS) program are presented. A.L.W.

A79-53610 A remote sensing application - Preprocessing and postprocessing aspects of forestry data analysis. E. Kan (Lockheed Electronics, Co., Inc., Houston, Tex.). In: Digital signal processing. North Hollywood, Calif., Western Periodicals Co., 1979, p. 285-321. 46 refs.

Preprocessing and postprocessing aspects in the data analysis of a forestry remote sensing application are discussed. These aspects are representative of a major (but not the most general) earth resources application. Techniques used in these analyses range from classical digital filtering procedures to more heuristical scene analysis algorithms and represent recent research and development efforts. Application of these techniques on aircraft and satellite multispectral data is demonstrated. Finally, the outlook of future research and development on data processing of earth resources applications is presented. (Author)

A79-53943 Estimating irrigated land acreage from Landsat imagery. R. C. Heller (Idaho, University, Moscow, Idaho) and K. A. Johnson (Idaho, Dept. of Water Resources, Boise, Idaho). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Oct. 1979, p. 1379-1386. 6 refs.

This article deals with the multistage variable probability sampling using multi-scale remote sensing data to inventory irrigated cropland within a large test site in Idaho. Landsat color transparencies were interpreted for the presence of irrigated agriculture by estimating the percentage of irrigated lands within two by two square mile blocks within the test site. Four interpreters made independent estimates of the irrigated land on all 270 blocks from which nine were selected with probability proportional to prediction. Sampling errors ranged from 6 to 10%, and four estimates were well within one standard deviation of the known acreage of irrigated land for the test site as measured from color infrared aerial phototransparencies. For developing countries with limited computer capabilities, this method requires minimal training and equipment for low cost estimates of irrigated lands. Landsat imagery was also used to determine location and magnitude of irrigated cropland expansion by constructing two date color composite images, so that newly irrigated cropland was indicated where fields had coloration distinct from those previously irrigated. A.T.

A79-53944 Landsat assisted forest land-cover assessment of the Philippine Islands. H. M. Lachowski, D. L. Dietrich (GE Image Processing and Analysis Center, Beltsville, Md.), R. Umali, E. Aquino, and V. Basa (Department of Natural Resources, Natural Resources Management Center, Quezon City, Philippines). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Oct. 1979, p. 1387-1391.

N79-28633*# Auburn Univ., Ala. Cooperative Extension Service.
DETECTION OF PLANT STRESS THROUGH MULTISPECTRAL PHOTOGRAPHY Final Report
T. B. Hagler and Sanford W. Downs, Jr., Principal Investigators (NASA. Marshall Space Flight Center) [1979] 13 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS8-29856)
(E79-10083; NASA-CR-161242; Circular-ANR-72) Avail: NTIS HC A02/MF A01 CSCL 14E

N79-28635*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
UNIFORM COLOR SPACE ANALYSIS OF LACIE IMAGE PRODUCTS Progress Report, 15 Nov. 1977 - 14 Jun. 1978
Richard F. Nalepka, Principal Investigator, R. J. Balon, and R. C. Cicone May 1979 144 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15476)
(E79-10221; NASA-CR-160236; ERIM-132400-10-R) Avail: NTIS HC A07/MF A01 CSCL 02C

The author has identified the following significant results. Analysis and comparison of image products generated by different algorithms show that the scaling and biasing of data channels for control of PFC primaries lead to loss of information (in a probability-of misclassification sense) by two major processes. In order of importance they are: neglecting the input of one channel of data in any one image, and failing to provide sufficient color resolution of the data. The scaling and biasing approach tends to distort distance relationships in data space and provides less than desirable resolution when the data variation is typical of a developed, nonhazy agricultural scene.

N79-28638*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
RESEARCH IN REMOTE SENSING OF AGRICULTURE, EARTH RESOURCES, AND MAN'S ENVIRONMENT Quarterly Report, 1 Mar. - 31 May 1979
D. A. Landgrebe, Principal Investigator 31 May 1979 110 p refs EREP
(Contract NAS9-15466)
(E79-10224; NASA-CR-160241; LARS-CR-053179) Avail: NTIS HC A06/MF A01 CSCL 02C

N79-28639*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). FURTHER EVALUATION OF PROCEDURE 1 SECONDARY ERROR ANALYSIS
K. A. Havens, Principal Investigator May 1979 43 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10225; NASA-CR-160238; JSC-14746; LEC-13180) Avail: NTIS HC A03/MF A01 CSCL 05B

N79-28640*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM. EVALUATION PROCESS FOR THE TEN-ECOSYSTEM STUDY
R. H. Almond, Principal Investigator Apr. 1979 62 p refs Sponsored in part by US Forest Service EREP
(Contract NAS9-15800)
(E79-10226; NASA-CR-160243; LEC-12727; JSC-14872) Avail: NTIS HC A04/MF A01 CSCL 02C

N79-28641*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). EXAMPLES OF PHASE 3 OMISSION LABELING ERRORS
N. James Clinton, Principal Investigator May 1979 15 p ref 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 EREP
(Contract NAS9-15800)
(E79-10227; NASA-CR-160237; JSC-14837; LEC-13198) Avail: NTIS HC A02/MF A01 CSCL 05B

N79-28647*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASSESSING SOYBEAN LEAF AREA AND LEAF BIOMASS BY SPECTRAL MEASUREMENTS
Brent N. Holben, Compton J. Tucker, and Cheng-jing Fan Jul. 1979 22 p refs Submitted for publication
(NASA-TM-80312) Avail: NTIS HC A02/MF A01 CSCL 02C

Red and photographic infrared spectral radiances were correlated with soybean total leaf area index, green leaf area index, chlorotic leaf area index, green leaf biomass, chlorotic leaf biomass, and total biomass. The most significant correlations were found to exist between the IR/red radiance ratio data and green leaf area index and/or green leaf biomass (r squared equals 0.85 and 0.86, respectively). These findings demonstrate that remote sensing data can supply information basic to soybean canopy growth, development, and status by nondestructive determination of the green leaf area or green leaf biomass.
J.M.S.

N79-30596*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EFFECT OF THE ATMOSPHERE ON THE CLASSIFICATION OF LANDSAT DATA
Nelson DeJesusParada, Principal Investigator, T. Morimoto, R. Kumar, and L. C. B. Molion Apr. 1979 11 p refs Presented at Symp. on Machine Processing of Remotely Sensed Data, Lafayette, Ind., 1979 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10235; NASA-CR-158799; INPE-1467-RPE/020) Avail: NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results. In conjunction with Turner's model for the correction of satellite data for atmospheric interference, the LOWTRAN-3 computer program was used to calculate the atmospheric interference. Use of the program improved the contrast between different natural targets in the MSS LANDSAT data of Brasilia, Brazil. The classification accuracy of sugar canes was improved by about 9% in the multispectral data of Ribeirao Preto, Sao Paulo. Author

N79-30597*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CLASSIFICATION OF AREAS USING PIXEL-BY-PIXEL AND SAMPLE CLASSIFIERS
Nelson deJesusParada, Principal Investigator, R. Kumar, M. Niero, A. P. Manso, L. A. M. Lucht, and M. S. S. Barros Apr. 1979 16 p refs Presented at Intern. Conf. on Machine-Aided Image Analysis, Oxford, Engl., 4-6 Sep. 1978 Sponsored by NASA ERTS

(E79-10236; NASA-CR-158800; INPE-1472-RPE/023) Avail: NTIS HC A02/MF A01 CSCL 05B

N79-30600*# 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 Jan. - 15 Apr. 1979
Roger M. Hoffer, Principal Investigator Apr. 1979 8 p EREP
(Contract NAS9-15508)
(E79-10241; NASA-CR-160264; LARS-CR-041579) Avail: NTIS HC A02/MF A01 CSCL 08B

N79-30601*# Texas A&M Univ., College Station. Remote Sensing Center.
LANDSAT RANGE RESOURCE INFORMATION SYSTEM PROJECT, VOLUME 1 Final Report, Dec. 1977 - Aug. 1979
Harold Chilton, J. Clifford Harlan, Principal Investigators, and W. E. Boyd Jun. 1979 73 p EREP
(Contract NAS9-15468)
(E79-10242; NASA-CR-160270; RSC-3697-5) Avail: NTIS HC A04/MF A01 CSCL 02C

N79-30602*# Environmental Research Inst. of Michigan, Ann Arbor.
THE ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 15 Nov. 1978 - 6 Mar. 1979
Quentin A. Holmes, Principal Investigator, R. J. Kauth, R. C. Cicone, and W. A. Malila Mar. 1979 47 p refs EREP
(Contract NAS9-15476)
(E79-10243; NASA-CR-160259; ERIM-132400-20-P) Avail: NTIS HC A03/MF A01 CSCL 02C

N79-30603*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CORN YIELD MODEL FOR RIBEIRAO PRETO, SAO PAULO STATE, BRAZIL
Nelson deJesusParada, Principal Investigator, Sherry Chou Chen, and Lourdes Bernadete daFonseca May 1979 15 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA. Submitted for publication ERTS
(E79-10244; NASA-CR-158807; INPE-1488-RPE/034) Avail: NTIS HC A02/MF A01 CSCL 02C

N79-30604*# Delaware Univ., Newark. Coll. of Marine Studies.
APPLICABILITY OF SPACECRAFT REMOTE SENSING TO THE MANAGEMENT OF FOOD RESOURCES IN DEVELOPING COUNTRIES
V. Klemas and D. J. Leu, Principal Investigators 31 Mar. 1977 55 p refs Sponsored by NASA and NSF ERTS
(E79-10245; NASA-CR-158808; CRS-1-79) Avail: NTIS HC A04/MF A01 CSCL 05A

N79-30605*# Kansas Univ. Center for Research, Inc., Lawrence.
THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTÁL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1978 - 31 Mar. 1979
B. G. Barr, Principal Investigator and E. A. Martinko Jul. 1979 101 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-17-004-024)
(E79-10246; NASA-CR-158809) Avail: NTIS HC A06/MF A01 CSCL 13B

N79-30606*# Texas A&M Univ., College Station. Remote Sensing Center.
CORRELATION OF SPACECRAFT PASSIVE MICROWAVE SYSTEM DATA WITH SOIL MOISTURE INDICES (API) Progress Report, Aug. 1978 - Feb. 1979
Bruce J. Blanchard, Principal Investigator Feb. 1979 9 p ref ERTS
(Grant NsG-5193)
(E79-10247; NASA-CR-158810; RSC-3622-1) Avail: NTIS HC A02/MF A01 CSCL 08M

N79-30610*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DECISION RULES FOR UNBIASED INVENTORY ESTIMATES
P. Argentiero and David Koch Jul. 1979 27 p refs
(NASA-TM-80303) Avail: NTIS HC A03/MF A01 CSCL 05B

An efficient and accurate procedure for estimating inventories from remote sensing scenes is presented. In place of the conventional and expensive full dimensional Bayes decision rule, a one-dimensional feature extraction and classification technique was employed. It is shown that this efficient decision rule can be used to develop unbiased inventory estimates and that for large sample sizes typical of satellite derived remote sensing scenes, resulting accuracies are comparable or superior to more expensive alternative procedures. Mathematical details of the procedure are provided in the body of the report and in the appendix. Results of a numerical simulation of the technique using statistics obtained from an observed LANDSAT scene are included. The simulation demonstrates the effectiveness of the technique in computing accurate inventory estimates. Author

N79-30612*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPRETING VEGETATION REFLECTANCE MEASUREMENTS AS A FUNCTION OF SOLAR ZENITH ANGLE
D. S. Kimes, J. A. Smith (Colorado State Univ., Ft. Collins), and K. J. Ranson (Colorado State Univ., Ft. Collins) Jul. 1979 35 p refs Submitted for publication
(NASA-TM-80320) Avail: NTIS HC A03/MF A01 CSCL 08F

Spectral hemispherical-conical reflectances of a nadir looking sensor were taken throughout the day for a lodgepole pine and two grass canopies. Mathematical simulations of both spectral hemispherical-conical and bi-hemispherical reflectances were performed for two theoretical canopies of contrasting geometric structure. These results and comparisons with literature studies showed a great amount of variability of vegetation canopy reflectances as a function of solar zenith angle. Explanations for this variability are discussed and recommendations for further measurements are proposed. K.L.

N79-30614*# National Aeronautics and Space Administration, Washington, D. C.
LACIE (LARGE AREA CROP INVENTORY EXPERIMENT) PROGRAMME
Ruth I. Whitman *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 13-16 refs Avail: NTIS HC A99/MF A01 CSCL 02C

Large Area Crop Inventory Experiment was a three year experiment conducted jointly by the United States Department of Agriculture, NASA, and NOAA (National Oceanic and Atmospheric Administration) to determine if global wheat production can be forecast from LANDSAT data to within 90% of actual yield for each observed 9 years out of 10. Data for the third crop year (1976-1977) was compiled. The proportional area of cultivated land devoted to wheat was estimated based on a statistical sampling of LANDSAT data. Yield is presently estimated by NOAA using regression models developed from historical weather and yield information. Results are discussed.
Author (ESA)

N79-30616# European Atomic Energy Community, Ispra (Italy).
SUMMARY OF RESULTS OBTAINED DURING A EUROPEAN TELEDETECTION PROGRAM RELATED TO AGRICULTURE AND SILVICULTURE (AGRESTE PROJECT) [SYNTHESE DES RESULTATS ACQUIS DANS LE CADRE D'UN PROGRAMME DE COLLABORATION EUROPEENE EN TELEDETECTION, APPLIQUE A L'AGRICULTURE ET A LA SYLVICULTURE (PROJECT AGRESTE)]
A. Berg, G. Flouzat (Centre d'Etude Spatiale des Rayonnements), and S. GallideParatesi *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 27-40 refs In FRENCH; ENGLISH summary

Avail: NTIS HC A99/MF A01

Different methods for the classification of multispectral data were perfected and used to verify the feasibility of teledetection techniques in Europe for agricultural and silvicultural resources management. Observations made from LANDSAT satellites and aircraft were used. Results are reported refering to the identification of the four vegetal species chosen. The relationship between rice reflectance and vegetation structure makes it possible to predict yield nearly two months before harvest. The early identification of rice virus diseases through the detection of spectral modifications in the vegetal cover is another important result. A model to estimate wood production from the Garonne valley is also discussed.
Author (ESA)

N79-30622# Operation Pilote Interministerielle de Teledetection, Paris (France).
UTILIZATION OF LANDSAT FOR THE INVENTORY AND CARTOGRAPHY OF SOIL USES AND FOR TERRITORIAL ADMINISTRATION. MAIN EXPERIMENTS CARRIED OUT DURING THE FRENCH TELEDETECTION INTERMINISTERIAL PILOT OPERATION (OPIT) [UTILISATION DE LANDSAT POUR L'INVENTAIRE ET LA CARTOGRAPHIE DE L'UTILISATION DU SOL ET L'AMENAGEMENT DU TERRITOIRE: PRINCIPALES EXPERIMENTATIONS MENEES PAR L'OPIT]
Marc Bied-Charreton *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 89-95 refs In FRENCH
Avail: NTIS HC A99/MF A01

Data from LANDSAT (soil use, humid areas, forest fires) pertinent to the Mediterranean region were numerically treated for an area of moderate altitude (Vosge's forests, Vivarais's forests), for an agriculture-sylviculture equilibrium zone (Limousin), and for a polyculture zone (Loire valley) in order to evaluate the usefulness of teledetection techniques vis a vis the needs of several government agencies (OPIT program). Several methodologic conclusions are listed, pointing out the insufficient development of various steps of the technical procedures. Conclusions relative to the contributions of teledetection are also listed. It is estimated that teledetection will satisfy most user's needs some years from now if the system elements are optimized.
Author (ESA)

N79-30636# Ford Aerospace and Communications Corp., Houston, Tex.
AN APPLICATION PROCESSING SYSTEM FOR IMAGERY DATA
John L. Benson, Richard Schell, J. Denton Tarbet, Lewis Bradford, Frank David, Gordon Dickinson, Jim Murphy, and Robert F. Purnell *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 229-232 refs Prepared in cooperation with US Dept. of Agr., Houston

Avail: NTIS HC A99/MF A01

The design approach and system installation for a processing system to support crop inventory using LANDSAT data is presented. The application test system (ATS) is currently being used by the United States Department of Agriculture (USDA) to support performance evaluation of remote sensing technology against USDA information requirements. The ATS described satisfies the USDA requirements in a cost effective manner and represents a major step in the transfer of remote sensing technology to a user organization.
Author (ESA)

N79-30643# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
UTILIZATION OF CLASSIFICATION ALGORITHMS FOR SPECTRAL AND TEXTURAL DATA IN THE STUDY OF AN AGRICULTURAL ZONE [UTILISATION D'ALGORITHMES DE CLASSIFICATION DES INFORMATIONS PECTRALES ET TEXTURALES POUR L'ETUDE D'UNE ZONE AGRICOLE]
T. LeToan, P. Cassirame, J. Quach, and M. Monchant *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 269-276 refs In FRENCH

Avail: NTIS HC A99/MF A01

Classification algorithms were used on multispectral band scanning images from LANDSAT satellites and aerial photography in order to identify crops. The satellite information was introduced after a preliminary study about the fields homogeneity, and the classification done using the texture notion was compared with the results from aerial images. Several classification algorithms were studied and multitemporal date were also considered. Results show that crop inventories are possible using multispectral classification of LANDSAT images. Introduction of multitemporal data improves the results. The best adapted classification method found is the pondered euclidian distance supervised method.
Author (ESA)

N79-30645# Technische Hogeschool, Delft (Netherlands).
THE INTERACTION OF VEGETATED AND BARE FIELDS WITH 3cm WAVELENGTH ELECTROMAGNETIC RADIATION. MODELING AND EXPERIMENT
E. P. W. Attema *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 299-304 refs
Avail: NTIS HC A99/MF A01

An experimental program of ground based short range scatterometry on bare and vegetated test fields planted with different types of crops and natural vegetations was carried out. The acquired data base consists of radar data at X-band frequencies using HH, VV, and HV polarization, accompanied by plant parameter measurements and measurements of soil moisture. These data are used for the evaluation of the potential of available space sensors for agricultural missions. Accomplishing these objectives effectively requires an understanding of the wave interaction with the object. This insight was obtained on the by carefully designed experiments and by modeling the wave interaction using the experimental data. A progress report is presented on the models that were checked against the measurements and the models that were constructed using the experimental results.
Author (ESA)

N79-30677# Centre National d'Etudes Spatiales, Paris (France).
UTILIZATION OF REMOTE SENSING DATA FOR CROP FORECASTING MODELS: ECONOMIC ADVANTAGES [UTILISATION DES DONNEES RECUEILLIES PAR TELEDETECTION POUR LES MODELES DE PREVISION DE RECOLTES: AVANTAGES ECONOMIQUES]
G. Fraysse, P. Mallet, and B. Susplugas *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 549-561 refs In FRENCH

Avail: NTIS HC A99/MF A01

Improvement of crop forecasting models by means of remote sensing data utilization was analyzed. The models studied include climatic regression models, agrometeorological models, and the bio-climatic and bio-structural models. The contributions of remote sensing data are discussed for each of these models. A specific example referring to a corn crop is presented. It is concluded that these models can be effectively improved by remote sensing data and that definite cost advantages are attainable.

Author (ESA)

N79-31710*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). COMPOSITION AND ASSEMBLY OF A SPECTRAL-MET DATA BASE FOR SPRING AND WINTER WHEAT, VOLUME 1
M. H. Trenchard, Principal Investigator, M. L. Sestak, M. C. Kinsler, and D. E. Phinney May 1979 26 p Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10250; NASA-CR-160283; JSC-14901-Vol-1; LEC-13393-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 02C

N79-31711*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). RESEARCH PLAN FOR DEVELOPING AND EVALUATING CLASSIFIERS
C. B. Chittineni, Principal Investigator Jul. 1979 20 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10251; NASA-CR-160285; LACIE-00633; JSC-14849; LEC-13300) Avail: NTIS HC A02/MF A01 CSCL 02C

N79-31719*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
FOREST RESOURCE INFORMATION SYSTEM. PHASE 2: DEMONSTRATION REPORT Quarterly Report, 1 Jan. 30 Apr. 1979
R. P. Mroczyski, Principal Investigator 30 Apr. 1979 139 p refs EREP
(Contract NAS9-15325)
(E79-10259; NASA-CR-160275; LARS-043079) Avail: NTIS HC A07/MF A01 CSCL 02F

N79-31721*# ECON, Inc., Princeton, N. J.
THE ECONOMIC COSTS AND BENEFITS OF AN INTERNATIONAL GRAIN RESERVE PROGRAM WITH AND WITHOUT IMPROVED (LANDSAT) CROP INFORMATION: A CASE STUDY BASED ON THE ECON INTEGRATED MODEL Final Report
31 Dec. 1978 63 p refs ERTS
(Contract NASw-3047)
(E79-10261; NASA-CR-158876; ECON-77-294-1) Avail: NTIS HC A04/MF A01 CSCL 17B

N79-31722*# ECON, Inc., Princeton, N. J.
THE ECONOMIC COSTS AND BENEFITS OF AN INTERNATIONAL GRAIN RESERVE PROGRAM WITH AND WITHOUT IMPROVED (LANDSAT) CROP INFORMATION: A CASE STUDY BASED ON THE ECON INTEGRATED MODEL, SUMMARY AND OVERVIEW Final Report
31 Dec. 1978 25 p refs ERTS
(Contract NASw-3047)
(E79-10262; NASA-CR-158877; ECON-77-294-2) Avail: NTIS HC A02/MF A01 CSCL 17B

N79-31726*# Dartmouth Coll., Hanover, N.H.
AN INVESTIGATION OF VEGETATION AND OTHER EARTH RESOURCE/FEATURE PARAMETERS USING LANDSAT AND OTHER REMOTE SENSING DATA. A: LANDSAT. B: REMOTE SENSING OF VOLCANIC EMISSIONS Semiannual Status Report, 1 Jan. - 30 Jun. 1979
Richard W. Birnie and Richard E. Stoiber, Principal Investigators 30 Jun. 1979 28 p refs ERTS
(Grant NsG-5014)
(E79-10267; NASA-CR-157428; SASR-10) Avail: NTIS HC A03/MF A01

N79-31735*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Quarterly Progress Report, Apr. - Jul. 1979
Wesley D. Rosenthal and James C. Harlan, Principal Investigators 30 Jul. 1979 1 p ERTS
(Contract NAS5-24383)
(E79-10278; NASA-CR-162100) Avail: NTIS HC A02/MF A01 CSCL 02C

N79-32605*# Lockheed Electronics Co., Houston, Tex.
THE ECOLOGICAL VARIATIONS IN THERMAL INFRARED EMISSIVITY OF VEGETATION
G. K. Arp and D. E. Phinney, Principal Investigator Apr. 1979 27 p refs Supersedes LEC-11021-Rev-B EREP
(Contract NAS9-15200)
(E79-10271; NASA-CR-160293; LEC-13390; JSC-14910; LEC-11021-Rev-B) Avail: NTIS HC A03/MF A01 CSCL 08F

The author has identified the following significant results. Through a series of contrasts, the statistical significance of differences in emissivity was determined for vegegation in dry and humid deserts, montane and deciduous rain forests, and the temperate region. No significant differences were found between the two types of desert vegetation or among the types of nondesert vegetation. However, the rain forest vegetation was significantly different from that of the temperate region. On a community-wide level, there is some physiological adaptation in plants to their radiational environment.

N79-32606*# Department of Agriculture, Weslaco, Tex. Science and Education Administration.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Jun. - 1 Sep. 1979
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Sep. 1979 5 p Sponsored by NASA ERTS
(NASA Order S-40198-B)
(E79-10280; NASA-CR-162145) Avail: NTIS HC A02/MF A01 CSCL 08F

N79-32608*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). SAMPLING UNIT SIZE CONSIDERATIONS IN LARGE AREA CROP INVENTORYING USING SATELLITE-BASED DATA
Charles R. Perry, Principal Investigator 1979 17 p refs Presented at Ann. Meeting of the Am. Statistical Assoc., Washington, D. C., 13-16 Aug. 1979 Sponsored by NASA,

NOAA, and USDA EREP
(E79-10283; NASA-TM-80511) Avail: NTIS HC A02/MF A01 CSCL 02C

N79-32610*# Telespazio, S.p.A.,,Rome (Italy).
FEATURE SELECTION VIA ENTROPY MINIMIZATION: AN EXAMPLE USING LANDSAT SATELLITE DATA
Angelo Zandonella and Buzz Sellman, Principal Investigators 1979 12 p refs Presented at the 2d Convegno sulle Metodologic di Trattamento dell'Informazione, Trieste, Feb. 1979 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10286; NASA-CR-162273) Avail: NTIS HC A02/MF A01 CSCL 08F

The author has identified the following significant results. The minimum entropy model may provide several useful advantages over traditional techniques for processing LANDSAT data. Total computer time to conduct a complete pattern recognition process is reduced. Subjective (transformed image), as well as statistically derived information is made available to the analyst/user much earlier in the analysis process. A rapid feedback loop in which numerous training set combinations can be tested for difference and representativeness is available. Additional tests of LANDSAT data processing using the minimum entropy model are clearly justified.

N79-33520*# Environmental Research Inst. of Michigan, Ann Arbor.
ANALYSIS OF SCANNER DATA FOR CROP INVENTORIES Progress Report, 7 Mar. - 6 Jun. 1979
Richard C. Cicone, Principal Investigator, E. Crist, Quentin A. Holmes, Richard J. Kauth, P. Lambeck, William A. Malila, W. Pont, and W. Richardson Aug. 1979 155 p EREP
(Contract NAS9-15476)
(E79-10284; NASA-CR-160304; ERIM-132400-24-P) Avail: NTIS HC A08/MF A01 CSCL 02C

N79-33530*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EFFECTS OF VEGETATION CANOPY STRUCTURE ON REMOTELY SENSED CANOPY TEMPERATURES
Daniel S. Kimes Jul. 1979 20 p refs
(NASA-TM-80331) Avail: NTIS HC A02/MF A01 CSCL 08F

The effects of vegetation canopy structure on thermal infrared sensor response must be understood before vegetation surface temperatures of canopies with low percent ground cover can be accurately inferred. The response of a sensor is a function of vegetation geometric structure, the vertical surface temperature distribution of the canopy components, and sensor view angle. Large deviations between the nadir sensor effective radiant temperature (ERT) and vegetation ERT for a soybean canopy were observed throughout the growing season. The nadir sensor ERT of a soybean canopy with 35 percent ground cover deviated from the vegetation ERT by as much as 11 C during the mid-day. These deviations were quantitatively explained as a function of canopy structure and soil temperature. Remote sensing techniques which determine the vegetation canopy temperature(s) from the sensor response need to be studied. A.R.H.

N79-33533# Colorado State Univ., Fort Collins. Coll. of Forestry and Natural Resources.
TERRAIN FEATURE CANOPY MODELING Final Report
D. S. Kimes, James A. Smith, and K. J. Ranson 30 Apr. 1979 194 p
(Contract DACW39-77-C-0073; Grants DAAG29-78-G-0045; DAAG29-76-G-0105)
(AD-A071793; ARO-13444.2) Avail: NTIS HC A09/MF A01 CSCL 02/6

A thermal canopy signature model (TCSM) was developed to approximate the thermal behavior of a vegetation canopy by a mathematical abstraction of three horizontal layers of vegetation. Canopy geometry within each layer is quantitatively described by the foliage and branch orientation distributions. Canopy geometry, solar irradiance, air temperature, horizontal wind velocity, relative humidity, and ground temperature are used to calculate the energy budgets of average leaves within each layer. The resulting system of conservation equations is solved for the average layer temperature. This information, together with the angular distributions of radiating elements, is then used to calculate the thermal existance as a function of view angle above the canopy. Optical diffraction techniques were developed and employed to measure canopy geometry. Solar radiation absorption with the vegetation terrain elements is calculated using a modification of a Monte Carlo model (SRVC) developed for the reflective energy regime. The models were applied to a lodgepole pine (Pinus contorta) canopy and the results for a diurnal cycle are validated with radiometric measurements. Simulated versus measured radiometric average temperatures of Layer 2 correspond approximately within two degrees centigrade. Simulated results suggest that canopy geometry can significantly influence the effective radiant temperature recorded by a sensor above the canopy as a function of view angle. GRA

02

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.

A79-48472 * Assessing urbanized area expansion through the integration of Landsat and conventional data /79052/. J. B. Davis (U.S. Bureau of the Census, Geography Div., Washington, D.C.) and S. Z. Friedman (California Institute of Technology, Jet Propulsion Laboratory, Earth Resources Applications Group, Pasadena, Calif.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 776-791. 13 refs. Contract No. NAS7-100. (ASP 79-230)

An image base information system (IBIS) is utilized to integrate Landsat and census data for the purpose of mapping urban land and updating urbanized-area outer lines. IBIS is a subset of the video image communication and retrieval digital image processing system developed at JPL. IBIS is used to analyze three urban areas: Orlando, Florida; Seattle, Washington; and Boston, Massachusetts. In all three applications the primary objective is to map the expansion of urban land cover in the urban fringe. Pertinent tabular reports are produced. S.D.

A79-50216 * The detection of urban expansion from Landsat imagery. S. Z. Friedman and G. L. Angelici (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing Quarterly*, vol. 1, Jan. 1979, p. 58-79. 6 refs.

Two methodologies for detecting and mapping land cover changes in and around growing urban regions are being studied at Jet Propulsion Laboratory. Both approaches, primarily based on digital image processing techniques, have been developed to supplement data stored in an Image Based Information System (IBIS). The structure of this information system enables the depiction of land cover changes in image format concurrently with statistical reports in tabular form. To date the expansion of two urban areas, Houston, Texas and Orlando, Florida, has been monitored. (Author)

A79-50217 * Using population statistics for a first look at the utility of Landsat data for urban areas. A. J. Landini (Los Angeles City Planning Dept., Los Angeles, Calif.) and R. G. McLeod (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing Quarterly*, vol. 1, Jan. 1979, p. 80-105. 5 refs.

The paper reviews the Image Based Information System (IBIS), developed at the Jet Propulsion Laboratory (JPL) which provided the city of Los Angeles with Landsat land use data in a format compatible with the city's land use and population files. Landsat data are compared to other land use files and the comparisons are discussed as an attempt to establish a level of validity. Relationships between population and Landsat data are investigated and reveal the strengths and weaknesses of the use of such data for urban areas. Finally, it is noted that the project verified the flexibility of IBIS for reducing and delivering Landsat data to users lacking the ability to process raw satellite data tapes and points to the system as a model for a potential national census of land use. M.E.P.

A79-50218 Distributed parameter modelling of urban residential energy demand. C. Clayton and J. E. Estes (California, University, Santa Barbara, Calif.). *Remote Sensing Quarterly*, vol. 1, Jan. 1979, p. 106-115. 10 refs.

The paper presents a conceptual model illustrating the potential use of remotely sensed imagery for improving the prediction of residential energy demand in urban areas. The model is composed of four seqments: (1) the evaluation, selection, and application of existing econometric models built to predict energy demand; (2) the use of data from remote sensor systems and collateral sources to provide spatially distributed estimates of the magnitude of and change in the independent variables contained in the econometric models; (3) the use of imagery from successive time periods to construct a predictive land use change model; and (4) the development of a predictive energy demand model based on changing land use patterns. Such a model, when fully operational, could effectively attain two important goals: (1) provide the ability to forecast gross future energy consumption; and (2) have the capability to predict the spatial location of such future demand. The research reported describes a conceptual model designed to predict the magnitude and location of residential energy demand in an urban environment and also predict its future location. (Author)

A79-50219 * Solar potential inventory and modeling. G. L. Angelici and N. A. Bryant (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing Quarterly*, vol. 1, Apr. 1979, p. 5-16.

Image processing procedures for calculating the energy that roof-mounted solar collectors can potentially supply in a metropolitan area are presented. Satellite multispectral imagery from which land cover types can be determined digitally was sampled in order to estimate the percentage of land area occupied by flat or south-facing roof tops in residential and commercial/industrial areas. Procedures were applied to the various power subdistricts of the western San Fernando valley of California, and it was found that on the average 120% of the existing power demand could be met if only half the useable rooftop area were utilized, amounting to 385 MW of peak power and indicating the applicability of solar cells to power generation in urban areas. A.L.W.

A79-50222 An overview of land use data availability and accuracy. Y. H. Fan. *Remote Sensing Quarterly*, vol. 1, July 1979, p. 7-13. 17 refs.

There are two ways to obtain land use data: (1) by gathering and using existing general-purpose data with caution; and (2) by producing new custom-made data of one's own design. Both ways have their limitations. The paper identifies some of these limitations that contribute to users' land use data problems, especially those associated with remote sensing. The relatively recent remote sensing technology is considered to be a method to acquire new land use data, while the traditional land use survey is assumed to be the source for existing land use data. The discussion presents a general picture of land use data availability and accuracy, with particular reference to remote sensing. The data exhibit varied reliability, depending on definition, source, the way of acquisition and application. Land-use data users are recommended not to demand accuracy in excess of their actual requirements. S.D.

A79-53430 Some consideration of satellite technology applications for disaster matters - Looking to the future. H. G. S. Murthy and D. Felske (United Nations, Outer Space Affairs Div., New York, N.Y.). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-A-32*. 7 p. 6 refs.

The paper demonstrates that satellite telecommunication and remote sensing technology can be of tremendous help by providing information for early warning of potential disasters or on the area affected and the damage caused by disasters. The role satellite technology can play in predicting, detecting, early warning and relief operations as diverse as the phenomena of disaster occurrence itself. A more distinct assessment of satellite technology applications in coping with disaster situations can be made by distinguishing between sudden and creeping disasters. In future, maximum effort must be devoted to the development of methods for prediction, early detection and early warning of sudden disasters such as earthquakes and volcano eruptions. S.D.

N79-28650# Army Construction Engineering Research Lab., Champaign, Ill.

GRAPHIC MATERIALS TO SUPPORT BIOPHYSICAL QUANTITATIVE ENVIRONMENTAL IMPACT ANALYSIS: SOURCES OF EXISTING MATERIALS Final Report

W. D. Goran and R. E. Riggins Mar. 1979 83 p refs
(DA Proj. 4A7-62720-A-896)
(AD-A069097; CERL-TR-N-68) Avail: NTIS HC A05/MF A01 CSCL 08/2

This report identifies and describes resource materials (maps and imagery) currently available for environmental impact analysis on U.S. Army military installations. Only materials that relate to the biophysical and land use elements of the environment are considered. The report describes procedures for obtaining these materials and lists specific materials relevant to major U.S. Army military installations. This report also provides some tables, formulas, and procedures for quantitatively analyzing these graphical representations of environmental information.

Author (GRA)

N79-29569# Forest Service, Vernal, Utah.

HIGH UINTAS SOUTH SLOPE LAND MANAGEMENT PLAN AND FINAL ENVIRONMENTAL STATEMENT

Mar. 1979 532 p refs Original contains color illustrations
Avail: NTIS HC A23/MF A01

Management alternatives for the High Uintas South Slope and Roadless Area were considered. The principal issues were the coordination of management with the Central Utah Project and the designation of roadless areas to be managed for their wilderness values. The selected alternative calls for developments of recreation facilities around the Central Utah Project reservoirs in the canyon bottoms, and commodity production from the intervening plateaus. J.M.S.

N79-29572# Army Engineer Topographic Labs., Fort Belvoir, Va.

TERRAIN ANALYSIS PROCEDURAL GUIDE FOR VEGETATION

Jeffrey A. Messmore, Theodore C. Vogel, and Alexander R. Pearson Mar. 1979 215 p refs
(DA Proj. 4A7-62707-A-855)
(AD-A068715; ETL-0178) Avail: NTIS HC A10/MF A01 CSCL 08/6

This procedural guide provides the U.S. Army Terrain Analyst with the necessary step-by-step procedures to be used in generation of vegetation factor overlays and supportive data tables. Three potential sources of information on vegetation are considered: (1) military- topographic maps, (2) literature, and (3) aerial imagery. Procedures are presented for each of 13 data elements that characterize vegetation of the geographic area of interest. The included appendixes provide the Terrain Analyst with additional reference information. GRA

N79-29722*# System Planning Corp., Arlington, Va.

POLAR ENVIRONMENTAL MONITORING Final Report

Robert G. Nagler and Andreas C. Schulteis Feb. 1979 95 p refs Sponsored by NASA Prepared for JPL
(Contract JPL-955068)
(NASA-CR-158866; SPC-392) Avail: NTIS HC A05/MF A01 CSCL 08F

The present and projected benefits of the polar regions were reviewed and then translated into information needs in order to support the array of polar activities anticipated. These needs included measurement sensitivities for polar environmental data (ice/snow, atmosphere, and ocean data for integrated support) and the processing and delivery requirements which determine the effectiveness of environmental services. An assessment was made of how well electromagnetic signals can be converted into polar environmental information. The array of sensor developments in process or proposed were also evaluated as to the spectral diversity, aperture sizes, and swathing capabilities available to provide these measurements from spacecraft, aircraft, or in situ platforms. Global coverage and local coverage densification options were studied in terms of alternative spacecraft trajectories and aircraft flight paths. R.E.S.

N79-30629# Centre d'Etudes Phytosociologiques et Ecologiques, Montpellier (France).

COMPATIBILITY BETWEEN MANIFESTED AND POTENTIAL NEEDS AND THE POSSIBILITIES OFFERED BY SPACE-BORNE TELEDETECTION FOR MEDITERRANEAN DEVELOPING COUNTRIES [COMPATIBILITE ENTRE BESOINS EXPRIMES ET POTENTIELS ET POSSIBILITES OFFERTES PAR LA TELEDETECTION SPATIALE DANS LE CAS DES ZONES ARIDES DES PAYS EN VOIE DE DEVELOPPMENT DE LA REGION MEDITERRANEENNE]

Gilbert Long *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 155-160 refs In FRENCH
Avail: NTIS HC A99/MF A01

The conditions necessary to the compatibility of the possibilities offered by spaceborne teledetection with the inventory, evaluation, prevision, and monitoring needs of the zones being considered are examined. The discussion is based on results obtained from the ARZOTU program (LANDSAT, south of Tunisia). The technological, thematic, institutional, and financial problems are pointed out. Author (ESA)

N79-31707*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

UTILIZATION OF THE LANDSAT IMAGES ON THE STUDY OF THE IMPACT OF VICINITY HIGHWAYS [APLICACAO DAS IMAGENS DO LANDSAT AO ESTUDO DE IMPACTOS DE RODOVIAS VICINAIS]

Nelson deJesusParada, Principal Investigator, Madalena Niero, and Luiz Fernando R. H. Rodrigues Mar. 1979 25 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E79-10239; NASA-CR-158803; INPE-1441-NTE/147) Avail: NTIS HC A02/MF A01 CSCL 08B

N79-31736*# National Aeronautics and Space Administration, Washington, D. C.

REMOTE SENSING

Armando Jinich Aug. 1979 25 p refs Transl. into ENGLISH from Ciencia y Desarrollo (Mexico), no. 26, May/Jun. 1979 p 33-41, 45 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75651) Avail: NTIS HC A02/MF A01 CSCL 05B

Various imaging techniques are outlined for use in mapping, land use, and land management in Mexico. Among the techniques discussed are pattern recognition and photographic processing. The utilization of information from remote sensing devices on satellites are studied. Multispectral band scanners are examined and software, hardware, and other program requirements are surveyed. A.W.H.

N79-31839*# National Aeronautics and Space Administration, Langley Research Center, Hampton, Va.

REMOTE MONITORING OF THE GRAVELLY RUN THERMAL PLUME AT HOPEWELL AND THE THERMAL PLUME AT THE SURRY NUCLEAR POWER PLANT ON THE JAMES RIVER

T. A. Talay, K. W. Sykes (Army Corps of Engineers, Norfolk, Va.), and C. Y. Kuo (Virginia Polytechnic Inst. and State Univ., Blacksburg) Jul. 1979 21 p refs Presented at the Virginia Academy of Science, 56th Ann. Meeting, Blacksburg, 9-12 May 1978
(NASA-TM-80124) Avail: NTIS HC A02/MF A01 CSCL 13B

On May 17, 1977, a remote sensing experiment was conducted on the James River, Virginia, whereby thermal spectrometer and near-infrared photography data of thermal discharges at Hopewell and the Surry nuclear power plant were obtained by an aircraft for one tidal cycle. These data were used in subsequent investigations into the near field discharge trajectories. For the Gravelly Run thermal plume at Hopewell,

several empirical expressions for the plume centerline were evaluated by comparisons of the computed trajectories and those observed in the remote sensing images. Author

N79-32604*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
DETERMINATION OF SURFACE CHARACTERISTICS AND ENERGY BUDGET OVER AN URBAN-RURAL AREA USING SATELLITE DATA AND A BOUNDARY LAYER MODEL M.S. Thesis
Joseph Kent Dodd, Principal Investigator Aug. 1979 96 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-24264)
(E79-10269; NASA-CR-162091) Avail: NTIS HC A05/MF A01 CSCL 04B

N79-32613# Geological Survey, Washington, D. C.
GEORGIA FROM SPACE: AN EXPLANATION OF THE NASA LANDSAT 1 SATELLITE IMAGE COLOR MOSAIC OF THE STATE OF GEORGIA
Sam M. Pickering, Jr. and Michael W. Higgins 1979 25 p refs Prepared in cooperation with Georgia Dept. of Natural Resources, Atlanta
(Circ-787) Avail: NTIS HC A02/MF A01 CSCL 08F

Fourteen scenes were precisely joined by computer to make the mosaic of Georgia. On the mosaic, high-contrast features as small as 25 acres can be seen. The mosaic shows the cultural features of the State such as cities, roads, and other developments. It shows land use and land cover-woodlands, wetlands, cultivated areas, reservoirs, and so forth. Landforms and geologic features are also easily seen. A.R.H.

N79-32624# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: EVERGLADES NATIONAL PARK
Janet M. Bonner 1979 105 p
(PB-296353/6) Avail: NTIS HC A06/MF A01 CSCL 13B

Remotely sensed data gathered from spacecraft and aircraft are presented for the Everglades National Park biosphere reserve. Computer listings of the data are given. GRA

N79-33516* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
CATALOG OF EARTH PHOTOGRAPHS FROM THE APOLLO-SOYUZ TEST PROJECT
Farouk El-Baz, ed. (Smithsonian Inst., Washington, D. C.) Sep. 1979 295 p ref
(NASA-TM-58218; JSC-14904) Avail: NTIS HC A13 CSCL 05B

Information is given on earth photographs obtained by the Apollo astronauts during the Apollo Soyuz Test Project. The data are arranged in three sections. A map index shows the boundaries of each photograph and is used for a quick survey of the coverage for a given geographical area. A tabular index provides the following data: list of photographs by serial number, description of geographic location, latitude and longitude of the center point of the photograph, date when photograph was taken, ground elapsed time, revolution number of Apollo spacecraft, approximate spacecraft altitude, tilt, sun angle, camera, and lens. The photographic index provides same size black and white prints made from the original color negatives. A.W.H.

N79-33521*# Montana Univ., Missoula.
GRIZZLY BEAR HABITAT ANALYSIS, SECTION 1
John J. Craighead, Gordon B. Scaggs, and Jay S. Sumner, Principal Investigators 1979 190 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10288; NASA-CR-162275) Avail: NTIS HC A09/MF A01 CSCL 06C

N79-33522*# Arizona Univ., Tucson. Office of Arid Lands Studies.
APPLIED REMOTE SENSING PROGRAM (ARSP) Annual Report, 1978 - 1979
Jack D. Johnson, Kennith E. Foster, David A. Mouat, Principal investigators, Robert Schowengerdt, Kim Mortensen, Charles Sauerwein, Dean Treadwell, and Arye Topor Aug. 1979 89 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57188 ERTS
(Grant NGL-03-002-313)
(E79-10289; NASA-CR-162281) Avail: NTIS HC A05/MF A01 CSCL 05B

N79-33523*# California Univ., Berkeley. Space Sciences Lab.
APPLICATION OF REMOTE SENSING TO SELECTED PROBLEMS WITHIN THE STATE OF CALIFORNIA Annual Progress Report
Robert N. Colwell, Andrew S. Benson, John E. Estes, and Leonard W. Bowden, Principal Investigators 1 May 1979 339 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-7220)
(E79-10290; NASA-CR-162282; SSL-Ser-20-Issue-25) Avail: NTIS HC A15/MF A01 CSCL 08F

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03
GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A79-44132 # **Gridding of satellite scanner imagery using trajectory data (Prostranstvennaia priviazka sputnikovykh skanernykh izobrazhenii po traektornym dannym).** A. P. Tishchenko and V. P. Golovchin. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 56-65. In Russian.

Equations relating the geographical coordinates of a given point on the earth's surface with orbital elements, satellite orientation parameters and the scanning law are derived. The solution of these equations is presented, and a method for applying them to the gridding of imagery from satellite scanners is suggested. C.K.D.

A79-44138 # **A method of defining the components of a mixture of piecewise-homogeneous sections of the earth's surface (Metod opredeleniia komponent smesi kusochno-odnorodnykh uchastkov zemnoi poverkhnosti).** V. V. Egorov and M. V. Khatuntseva. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 126-131. In Russian.

A method is described for partitioning the components of a mixture of piecewise-homogeneous sections of the earth's surface on the basis of an analysis of a unidimensional histogram of the intensity of the electromagnetic radiation received. The computer method is based on application of a fast Fourier transform, and can be extended for use with two-dimensional histograms. C.K.D.

A79-44146 # **Investigation of the brightness field of earth landscapes (Ob izuchenii iarkostnogo polia zemnykh landshaftov).** V. A. Kottsov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 185-192. In Russian.

A79-50215 **The utilization of side-looking airborne radar /SLAR/ in the analysis of karst topography.** C. L. Smith and A. P. Tribble (U.S. Air Force Academy, Colorado Springs, Colo.). *Remote Sensing Quarterly,* vol. 1, Jan. 1979, p. 49-57. 10 refs.

The need for research into the use of remotely sensed imagery to identify geomorphic features within various landscapes is noted. The present paper discusses the possibility of using side-looking airborne radar (SLAR) to identify karst topography. The major features of karst topography are described including sinkholes, hums and haystack hills. In addition, the basic applications of the sensor system are discussed. Finally, examples of SLAR imaged karst topography are presented. M.E.P.

A79-53583 # **Geodetic theory.** D. H. Eckhardt (USAF, Geophysics Laboratory, Bedford, Mass.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Sept. 1979, p. 1353-1358. 110 refs.

A summary of geodetic theory advances during 1974 through 1978 is presented. Geodetic network computations and theory of errors involving redefinition of North American geodetic networks and a collocation technique, physical geodesy statistics and geophysical correlations including investigation of covariance functions of physical geodesy and modeling of the earth's mantle, gravity field modeling from measurements of terrestrial gravity and satellite dynamics and algorithms for computing the potential and attraction of a simple density layer, and satellite altimetry adjustments using the Skylab altimeter data are discussed. A.T.

A79-53584 # **Geodetic instrumentation.** B. L. Decker (U.S. Defense Mapping Agency, Aerospace Center, St. Louis Air Force Station, Mo.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Sept. 1979, p. 1358-1370. 270 refs.

Developments in geodetic instrumentation during 1975 through 1978 are reviewed. Distance measurement including electronic distance measuring (EDM) application and instrumentation; the improvement of astronomic latitude and longitude determinations by the development of Automated Astronomic Positioning System and an instrument capable of measuring atmospheric refraction and evaluation of the magnitude of anomalous refraction at an observing site; new techniques for astronomic azimuth determination, transfer, and monitoring, such as ring laser gyroscopes, nuclear magnetic resonance gyroscopes with optical readout, and fiber optics gyroscopes; absolute gravity measurements, relative gravity measurements with electronic readout system and a portable battery powered microprocessor used with gravimeters and gravity gradiometry are discussed. The Inertial Positioning System, an Aerial Profiling of Terrain System, the Very Long Baseline Interferometry, Satellite Laser ranging, Doppler satellite instrumentation, and radar altimeters are described. A.T.

A79-53585 # **Control surveys.** J. F. Dracup (NOAA, Control Networks Div., Rockville, Md.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Sept. 1979, p. 1371-1380. 95 refs.

The progress of geodetic control surveys during 1975 through 1978 is reviewed. During this period improved instrumentation, observing procedures, and data reduction methods increased accuracies of Doppler satellite determined positions, inertial positioning systems were in greater use, and the multiwavelength distance measuring instruments became available. Horizontal control surveys by the National Ocean Survey, Bureau of Land Management, Defense Mapping Agency Hydrographic/Topographic Center-Geodetic Survey Squadron, TVA, U.S. Army Corps of Engineers, U.S. Geological Survey, and the U.S. Naval Oceanographic Office are discussed. The vertical control program to meet the needs of engineering projects, topographic mapping, and scientific studies related to crustal motion in seismic areas performed by these agencies was described, and, finally, geodetic astronomy developments are examined. A.T.

A79-53590 * # **Dynamic satellite geodesy.** D. E. Smith (NASA, Goddard Space Flight Center, Geodynamics Branch, Greenbelt, Md.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Sept. 1979, p. 1411-1418. 120 refs.

The paper describes operation of the GEOS-3 and Lageos spacecraft launched by NASA as part of the Earth and Ocean Dynamic Program. The investigations conducted by using GEOS-3 include the determination of tracking station coordinates, polar motion, and the use of altimetry in orbit determination. Lageos was designed as a precision target for making geodetic measurements with ground laser systems. Consideration is given to the progress made in

the investigation and determination of tidal parameters by means of satellite perturbation methods. Satellite geodetic methods based on the ability to determine precise satellite orbits and orbit determination are outlined. Emphasis is placed on the future studies employing Spaceborne Laser and Global Positioning System concepts. V.T.

N79-30624# Universite des Sciences et Techniques de Lille (France).
THE CONTRIBUTION OF TELEDETECTION TO THE CARTOGRAPHY OF THE FRENCH AGRARIAN COUNTRYSIDE [APPORTS DE LA TELEDECTION A LA CARTOGRAPHIE DES PAYSAGES AGRAIRES FRANCAIS]
J. Coudoux *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 103-116 refs In FRENCH
Avail: NTIS HC A99/MF A01

The French agrarian countryside was studied based on LANDSAT 1 and 2 image data. The research methods reviewed are visual approach and cartographic survey. The analysis of the agrarian elements and their components made possible the identification of criteria useful in the preliminary selection of raw data, but difficulties are yet foreseen for the choice of an automated selection system. Small scale cartography showing the agrarian countryside's structural features, is suggested. Author (ESA)

N79-30641# Technische Universitaet, Hanover (West Germany). Inst. fuer Photogrammetrie.
CARTOGRAPHIC ASPECTS OF EARTH IMAGERY OBTAINED FROM SPACE
Gottfried Konecny *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 255-261 refs
Avail: NTIS HC A99/MF A01

Requirements related to the mapping of images obtained from space are discussed. The interest in space photograph application to cartography derives from their faster evaluation vis a vis aerial photographs for the same area. Camera operations, as they are being planed for the Spacelab-1 experiment payload are expected to meet the requirements for 1:250,000 and marginally for 1:50,000 mapping with respect to planimetry and resolution. Correction of the geometric distortions of LANDSAT multi-temporal multi-sensor images is proposed, including a geometric accuracy analysis of LANDSAT MSS imagery. Several examples of corrected photographs are given. Author (ESA)

N79-30642# Institut Geographique National, Paris (France).
AUTOMATIC CARTOGRAPHY OF LINEAR OBJECTS [CARTOGRAPHIE AUTOMATIQUE DES OBJETS LINEAIRES]
S. Braconne, F. Brun, and B. Fourcade *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 263-267 refs In FRENCH

Avail: NTIS HC A99/MF A01

Two methods of automatic cartography of linear elements, taken from LANDSAT images, are presented. One method uses the topological parameters of the sub-assemblies of image textures, attempting to characterize each sub-assembly by its shapes while looking only for linear shapes. The other method is based on the fact that the shade of gray of each pixel belonging to a linear element presents a large deviation from the average shade of the neighboring pixels, thus identifying the linear element. Results show that the topological method is adequate for the automatic identification for the important linear elements, such as highways. The method of linear anomaly works well for smaller subjects, but the increase in number may not be desirable in some cases. Author (ESA)

N79-30692# Bayerische Akademie der Wissenschaften, Munich (West Germany).
DETERMINATION OF ASTRO-GEODETIC PLUMB LINE DEFLECTIONS AT PRIMARY TRIANGULATION POINTS IN GERMANY DURING THE PERIOD 1966 TO 1977 [DIE ASTROGEODAETISCHEN LOTABWEICHUNGSBESTIMMUNGEN DER ABTEILUNG 1 DES DEUTSCHEN GEODAETISCHEN FORSCHUNGSINSTITUTS AUF PUNKTEN DES DEUTSCHEN HAUPTDREIECKSNETZES IN DEN JAHREN 1966 BIS 1977]
Klaus Kaniuth and Klaus Stuber Deut. Geodaetische Komm. 1978 32 p refs In GERMAN; ENGLISH summary
(Ser-B-299; ISBN-3-7696-8530-X) Avail: NTIS HC A03/MF A01

Plumb line deflections are determined in order to accurately calculate triangulation networks on a reference ellipsoid, to determine geoids, and to perform 3 dimensional calculations. These deflections were obtained from astronomical latitude and longitude determinations with zeiss Ni 2 astrolabes at 27 points in the triangulation network of Southern Germany. Tables of results are given adjusting horizontal measurements at the earth's surface to the reference ellipsoid. Author (ESA)

N79-30695# Bayerische Akademie der Wissenschaften, Munich (West Germany).
THEORETICAL RESEARCH INTO THE ACCURACY OF THREE DIMENSIONAL POINT DETERMINATIONS OF THE EARTH'S SURFACE Ph.D. Thesis - Stuttgart Univ. [THEORETISCHE UNTERSUCHUNGEN UEBER DIE GENAUIGKEIT DER DREIDIMENSIONALEN TERRESTRISCHEN PUNKTBESTIMMUNG]
Max Mayer Deut. Geodaetische Komm. 1978 169 p refs In GERMAN
(Ser-C/Diss-245; ISBN-3-7696-9299-3) Avail: NTIS HC A08/MF A01

Improvements on three dimensional network determination are considered. It is shown that three-dimensional points can be accurately determined in various coordinate systems from distance measurements, angles of elevation, astronomical latitudes and longitudes, and perhaps some additional information about directions. Relations are established between observations and parameters to be calculated. Mathematical models are developed to overcome the height and refraction problem; they are analyzed from an error point of view. Studies show to what extent the number of observations can be reduced without sacrificing accuracy. Author (ESA)

N79-30696# Bayerische Akademie der Wissenschaften, Munich (West Germany).
A GEODETIC WORLD DATUM FROM TERRESTRIAL AND SATELLITE DATA Ph.D. Thesis - Bonn Univ. [EIN GEODAETISCHES WELTDATUM AUS TERRESTRISCHEN UND SATELLITEDATEN]
Bernd Eitschberger Deut. Geodaetische Komm. 1978 188 p refs In GERMAN
(Ser-C/Diss-245; ISBN-3-7696-9300-0) Avail: NTIS HC A09/MF A01

An analytical description of the earth's surface based on a reference ellipsoid is developed. The earth's gravitational field, deduced from measurements, is expressed as a potential series. Suitable adjustments enable an approximate description of the earth's surface to be obtained in terms of equipotential surfaces (quasi-geoids). An ellipsoid, which corresponds in both an overall and local manner to the earth's surface is then equated to these surfaces. The mathematical treatment of data leading to optimized parameters defining an axisymmetric or triple axed elipsoid is described. The accuracy obtainable with this method is critically examined. Author (ESA)

N79-31864*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF SPACE TECHNOLOGY TO CRUSTAL DYNAMICS AND EARTHQUAKE RESEARCH
Aug. 1979 274 p refs
(NASA-TP-1464) Avail: NTIS HC A12/MF A01 CSCL 08K

In cooperation with other Federal government agencies, and the governments of other countries, NASA is undertaking a program of research in geodynamics. The present program activities and plans for extension of these activities in the time period 1979-1985 are described. The program includes operation

of observatories for laser ranging to the Moon and to artificial satellites, and radio observatories for very long baseline microwave interferometry (VLBI). These observatories are used to measure polar motion, earth rotation, and tectonic plate movement, and serve as base stations for mobile facilities. The mobile laser ranging and VLBI facilities are used to measure crustal deformation in tectonically active areas. G.Y.

N79-31865# European Space Agency, Paris (France).
DEFINITION OF A EUROPEAN PROGRAM FOR EARTHQUAKE PREDICTION RESEARCH
T. D. Guyenne, ed. Apr. 1979 97 p refs Presented at ESA/Council of Europe Seminar, Strasbourg, 5-7 Mar. 1979 (SP-149) Avail: NTIS HC A05/MF A01

The-state-of-the-art concerning earthquake prediction is reviewed in a series of 16 lectures covering different fields, such as national programs for earthquake monitoring and prediction, space techniques in earthquake prediction research, error analysis of geodetically derived strains, real-time monitoring and data acquisition, and strain and tilt measurements in seismic areas.

N79-31868# Freie Univ., Berlin (West Germany). Inst. fuer Geophysikalische Wissenschaften.
TERRESTRIAL AND SPACE TECHNIQUES IN EARTHQUAKE RESEARCH
Andreas Vogel *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 11-15

Avail: NTIS HC A05/MF A01

A report is given on an international workshop which was held to discuss recent advances in experimental techniques for the monitoring of crustal dynamics in earthquake zones. Experts from countries throughout the world, who are concerned with earthquakes and earthquakes disaster prevention, participated and discussed various terrestrial as well as space techniques presently applied or most likely to become applicable in earthquake prediction research. It is proposed that the discussion of instrumental capabilities and natural limitations, the presentation of world-wide experiences and results of recent research, and the conclusions and future aspects documented in the proceedings of the workshop should be evaluated to provide a basis for an European research program on earthquake prediction and disaster prevention. Author (ESA)

N79-31869# Paris-Sud Univ., Orsay (France).
FRENCH PROGRAM FOR THE STUDY OF SEISMIC RISK [PROGRAMME FRANCAIS D'ETUDE DU RISQUE SISMIQUE]
Claude Froidevaux *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 17-18 refs In FRENCH
Avail: NTIS HC A05/MF A01

The conclusions of a working group coordinating the research of French laboratories on the problems of earthquake tectonics and earthquake generating processes in relation to seismic risk are presented. The outcome is an increased interest in the use of satellites in photographing the main buckling of the earth's crust, and to retransmit the data of seismological observatories. However, the necessity of including detailed ground studies by tectonic methods, providing analysis of active or recent geological faults in terms of regional tectonic constraints is emphasized. These constraints should also be measured directly in order to get a quantitative understanding of intracontinental buckling. Author (ESA)

N79-31870# Technische Universitaet, Darmstadt (West Germany). Inst. of Physical Geodesy.
APPLICATION OF GEODETIC TECHNIQUES IN EARTHQUAKE PREDICTIONS
Erwin Groten *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 19-20 refs

Avail: NTIS HC A05/MF A01

Various gravimetric techniques are proposed along with other geodetic techniques such as leveling and space techniques to supplement present geophysical methods of earthquake prediction. Geodetic methods seem to be advantageous in large scale studies. The exact regression of height variations with gravity variations in time provides an additional source of information besides dilatancy. Teleseismic approaches do not yet seem to have sufficient reliability and supplementary methods are still needed. Author (ESA)

N79-31872# Athens Univ. (Greece). Higher Geodesy and Cartography.
ON THE ERROR ANALYSIS OF GEODETICALLY DERIVED STRAINS IN SEISMIC ZONES
E. Livieratos *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 27-32 refs Prepared in cooperation with Triest Univ., Italy

Avail: NTIS HC A05/MF A01

The possibility of computing strain quantities in seismic zones by using geodetic methods and results is illustrated. The finite element method for the computation of the plane strain tensor concerning the displacements of a geodetic triangle is followed by an error analysis of the geodetically extracted strain rates with respect to the uncertainties of the geodetic results. An actual example of the importance and validity of the maximum shear strain computations at seismic zones shows the potentialities of the geodetic methods. Author (ESA)

N79-31875# Bureau de Recherches Geologiques et Minieres, Orleans (France).
ASSESSMENT OF EARTHQUAKE HAZARDS IN FRANCE WITH SPECIAL REFERENCE TO REMOTE SENSING DATA
C. Weber, J. Vogt, and G. Weecksteem *In* ESA Definition of a European Program for Earthquake Prediction Res. Apr. 1979 p 47-55 refs
Avail: NTIS HC A05/MF A01

Seismotectonic mapping is considered as the basis of analysis of seismic hazards and earthquake forecasting. It requires a correlation of a large range of data. The map prepared in France is the synthesis of six thematic maps (especially an instrumental, and macroseismic map), whose characteristics are given. However, emphasis is put on lineaments from satellite imagery, whose significance is discussed. They should be considered as an important element of a multidisciplinary approach to the evaluation of seismic hazards. Provided a given interpretation procedure is used, lineaments are an important contribution to solving neotectonic problems and to detecting possible active faults, especially when fair correlations with epicenters exist. A certain coherence already appears with the distribution of stress fields. These results encourage field controls and seismological monitoring. Author (ESA)

N79-31879# Academy of Sciences (USSR), Moscow. Inst. of Physics of the Earth.
PATTERN RECOGNITION IN EARTHQUAKE-BORNE AREAS IN ITALY
V. Keilis Borok, E. Oficerova, E. Ranzman, I. Rotwain, A. Solofjef, and A. Caputo (Rome Univ.) *In* ESA Definition of a European Problem for Earthquake Prediction Res. Apr. 1979 p 67-68 Submitted for publication

Avail: NTIS HC A05/MF A01

In accordance with the map of lineaments of the Italian region, the intersections of the lineaments where one may expect strong earthquakes to occur, were determined. The parameters used for the pattern recognition method are mostly based on elevation and slope. Many control experiments were made to test the validity and the stability of the results obtained. The results show several locations where strong earthquakes have not occured in historic times, and may occur in the future. Author (ESA)

N79-32769# Ohio State Univ., Columbus. Dept. of Gaodetic Sciences.

A GLOBAL 1 DEG. x 1 DEG. ANOMALY FIELD COMBINING SATELLITE, GEOS-3 ALTIMETER AND TERRESTRIAL ANOMALY DATA

Tichard H. Rapp Hanscom AFB, Mass. AFGL Sep. 1978 20 p refs

(Contract F19628-76-C-0010)

(AD-A064740; AFGL-TR-78-0282; Rept-278; SR-22) Avail: NTIS HC A02/MF A01 CSCL 04/1

A method for combining satellite derived potential coefficient, mean 1 deg x 1 deg anomalies derived from the Geos-3 altimeter data, and mean 1 deg x 1 deg anomalies estimated from terrestrial gravity data is described. The combination procedure is designed to obtain an adjusted set of potential coefficients and an adjusted set of 64800 1 deg x 1 deg mean anomalies. The adjusted anomalies can be developed into potential coefficients to as large a degree as is reasonable considering the 1 deg x 1 deg data. Such anomalies will be exactly consistent with the adjusted potential coefficients. G.Y.

N79-33232* National Aeronautics and Space Administration, Washington, D. C.

SATELLITE TO STUDY EARTH'S MAGNETIC FIELD

19 Oct. 1979 34 p

(NASA-News-Release-79-129; P79-10131) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The Magnetic Field Satellite (Magsat) designed to measure the near earth magnetic field and crustal anomalies is briefly described. A scalar magnetometer to measure the magnitude of the earth's crustal magnetic field and a vector magnetometer to measure magnetic field direction as well as magnitude are included. The mission and its objectives are summarized along with the data collection and processing system. J.M.S.

N79-33528*# Massachusetts Inst. of Tech., Cambridge.

TECTONIC STRESS: MODELS AND MAGNITUDES

S. C. Solomon, R. M. Richardson (Arizona Univ., Tucson), and E. A. Bergman, Principal Investigators 2 Aug. 1979 32 p refs Presented at USGS Conf. on the Magnitude of Deviatoric Stresses in the Earth's Crust and Upper Mantle, Carmel, Calif., 29 Jul. - 2 Aug. 1979 ERTS

(Grants NsG-7329; NSF EAR-74-21894; NSF EAR-78-12936) (E79-10296; NASA-CR-162327) Avail: NTIS HC A03/MF A01 CSCL 08G

N79-33683*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROPOSED SATELLITE LASER RANGING AND VERY LONG BASELINE INTERFEROMETRY SITES FOR CRUSTAL DYNAMICS INVESTIGATIONS

P. D. Lowman, R. J. Allenby, and H. V. Frey Sep. 1979 71 p refs

(NASA-TM-80563; Rept-922) Avail: NTIS HC A04/MF A01 CSCL 08G

Recommendations are presented for a global network of 125 sites for geodetic measurements by satellite laser ranging and very long baseline interferometry. The sites were proposed on the basis of existing facilities and scientific value for investigation of crustal dynamics as related to earthquake hazards. Tectonic problems are discussed for North America peripheral regions and for the world. The sites are presented in tables and maps, with bibliographic references. R.E.S.

04
GEOLOGY AND MINERAL RESOURCES

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

A79-46580 Simultaneous use of geological, geophysical, and LANDSAT digital data in uranium exploration. A. Missallati, A. E. Prelat, and R. J. P. Lyon (Stanford University, Stanford, Calif.). *Remote Sensing of Environment,* vol. 8, Aug. 1979, p. 189-210. 14 refs. Research sponsored by the Alfateh University.

The simultaneous use of geological, geophysical and Landsat data in uranium exploration in southern Libya is reported. The values of 43 geological, geophysical and digital data variables, including age and type of rock, geological contacts, aeroradio-metric and aeromagnetic values and brightness ratios, were used as input into a geomathematical model. Stepwise discriminant analysis was used to select grid cells most favorable for detailed mineral exploration and to evaluate the significance of each variable in discriminating between the anomalous (radioactive) and nonanomalous (nonradioactive) areas. It is found that the geological contact relationships, Landsat Bands 6 and Band 7/4 ratio values were most useful in the discrimination. The procedure was found to be statistically and geologically reliable, and applicable to similar regions using only the most important geological and Landsat data. A.L.W.

A79-47554 * Geologic interpretation from composited radar and Landsat imagery. M. I. Daily (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California, University, Santa Barbara, Calif.), T. Farr, C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and G. Schaber (U.S. Geological Survey, Branch of Astrologic Studies, Flagstaff, Ariz.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Aug. 1979, p. 1109-1116. 13 refs. U.S. Geological Survey Contract No. W-13576; Contract No. NAS7-100.

Dual polarization L-band (lambda = 25 cm) radar imagery and Landsat multispectral scanner (MSS) data from central Death Valley have been computer processed and combined digitally in order to utilize the complementary information contained in multisensor data sets. Physically, like-polarized radar data gives roughness information on a scale proportional to radar wavelength. Cross-polarized data adds information on the overall roughness, particle shape, and packing density. Visible and near IR reflectivities pertain to surface chemistry. Surficial geologic units in Death Valley are defined on the basis of compositional and textural differences: optical and microwave scattering properties encoded in the multisensor image are sufficient to discriminate most of the units. This synergistic effect is most pronounced for the alluvial fans. Using radar scattering data and measured sun angle, passively-sensed (passive microwave, visible, near IR) images can be corrected for shadowing effects. (Author)

A79-48457 Potential for near ultraviolet spectral data to delineate geologic materials. L. H. Alger (Indiana State University, Terre Haute, Ind.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 379-389. 9 refs. (ASP 79-149)

Near ultraviolet spectral data (0.33-0.38 micron) were analyzed independently and multispectrally with visible and near infrared spectral data for the purpose of delineating selected surficial geologic materials and particle size groups. Specific capabilities of the near ultraviolet band were determined via implementation of data conversion techniques employing the algebraic combination of two bands to produce a third. Results demonstrated that near ultraviolet data (1) can, in a multispectral approach, delineate selected geologic particle size groups; and (2) was the only band capable of identifying unweathered, recent basalt features. (Author)

A79-48467 * Development of a tree classifier for discrimination of surface mine activity from Landsat digital data. J. L. Solomon, W. F. Miller, and D. A. Quattrochi (Mississippi State University, Mississippi State, Miss.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 607-613. 5 refs. Grant No. NGL-25-001-054. (ASP 79-208)

In a cooperative project with the Geological Survey of Alabama, the Mississippi State Remote Sensing Applications Program has developed a single purpose, decision-tree classifier using band-ratioing techniques to discriminate various stages of surface mining activity. The tree classifier has four levels and employs only two channels in classification at each level. An accurate computation of the amount of disturbed land resulting from the mining activity can be made as a product of the classification output. The utilization of Landsat data provides a cost-efficient, rapid, and accurate means of monitoring surface mining activities. (Author)

A79-48522 * The grabens of Canyonlands National Park, Utah - Geometry, mechanics, and kinematics. G. E. McGill and A. W. Stromquist (Massachusetts, University, Amherst, Mass.). *Journal of Geophysical Research,* vol. 84, Aug. 10, 1979, p.4547-4563. 25 refs. Grant No. NGR-22-010-076.

Results are reported for three years of field and analytical study of a system of young and very well exposed grabens in southeastern Utah. A kinematic and mechanical model is developed for these specific grabens with the hope that this will aid in interpreting graben systems elsewhere on the earth and other planets. Because studies on other planets must be based entirely on photo analysis, an attempt is made to determine to what extent three-dimensional geometry could be inferred from photographs alone. An equation based on the model of graben geometry and kinematics relates thickness of faulted plates to graben parameters measurable on photographs. The initial width of a nascent graben is a simple function of the dip of the faults bounding the graben and of the thickness of the faulted brittle plate. The uniform spacing of the grabens is a natural result of the geometry of the system. S.D.

A79-50221 Remote sensing and landform analysis. B. F. Richason, III (St. Cloud State University, St. Cloud, Minn.). *Remote Sensing Quarterly,* vol. 1, Apr. 1979, p. 44-48.

The application of remote sensing imagery and techniques to geology-physiography is discussed. Uses of and information obtainable from remote sensing imagery are considered, and attention is given to interpretative techniques utilizing stream patterns and densities, shadows, tone, aerial photomosaics and multi-scale photography. Types of imagery used for geologic-physiographic studies, including black and white panchromatic and infrared photography, conventional and infrared color aerial photography, multispectral and thermal infrared scanning and microwave radar are also presented. A.L.W.

A79-53586 # Land gravimetry. W. E. Strange (NOAA, National Geodetic Survey, Rockville, Md.) and L. E. Wilcox (U.S. Defense Mapping Agency, Aerospace Center, St. Louis Air Force Station, Md.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Sept. 1979, p. 1380-1387. 65 refs.

The major activities of U.S. governmental organization in land gravimetry are reviewed. The NGS, NOAA, USGS, DOE, NRC, DoD, and AFGL work is included, and recent developments provided

accurate portable absolute gravity measurement devices, new gravity surveys and anomaly maps, and a helicopter gravity measuring system. Absolute gravity measurement, the analysis of base networks and gravity standards, land gravity surveys and gravity mapping activities, gravity depository activities, secular changes in gravity, and new measurement techniques including the cryogenic tidal gravimeter and the rotating gravity gradiometer are described. It is concluded that a complete listing of the new land gravity survey work can be obtained in the Quarterly Accessions List of the DoD Gravity Library. A.T.

N79-28637*# Geological Survey, Menlo Park, Calif.
DETECTION AND MAPPING OF HYDROTHERMALLY ALTERED ROCKS IN THE VICINITY OF THE COMSTOCK LODE, VIRGINIA RANGE, NEVADA, USING ENHANCED LANDSAT IMAGES
R. P. Ashley, Principal Investigator, A. F. H. Goetz (JPL), L. C. Rowan (Geological Survey, Reston, Va.), and M. J. Abrams (JPL) 1979 46 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10223; NASA-CR-158749; Rept-79-960) Avail: NTIS HC A03/MF A01 CSCL 08G

The author has identified the following significant results. LANDSAT images enhanced by the band-ratioing method can be used for reconnaissance alteration mapping in moderately heavily vegetated semiarid terrain as well as in sparsely vegetated to semiarid terrain where the technique was originally developed. Significant vegetation cover in a scene, however, requires the use of MSS ratios 4/5, 4/6, and 6/7 rather than 4/5, 5/6, and 6/7, and requires careful interpretation of the results. Supplemental information suitable to vegetation identification and cover estimates, such as standard LANDSAT false-color composites and low altitude aerial photographs of selected areas is desirable.

N79-28825*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
BIBLIOGRAPHY OF GEOLOGIC STUDIES USING IMAGING RADAR
M. Leonard Bryan 1 Jul. 1979 125 p Presented at NASA/JPL Radar Geology Workshop, Snowmass, Colorado, 16-20 Jul. 1979 Prepared for DOE
(Contract NAS7-100)
(NASA-CR-158820; JPL-Pub-79-53) Avail: NTIS HC A06/MF A01 CSCL 08G

Articles concerning imaging studies on the geomorphology, mineralogy, and topology of various landforms are reported. One hundred and ninety citations are listed and an index by National Technical Information service citation number is included. Several illustrations of L-band radar imagery are presented.
M.M.M.

N79-29564 Delaware Univ., Newark.
A TWO-LEVEL WEIGHTED FACTOR EVALUATION OF THE METALLIC MINERALIZATION POTENTIAL OF CENTRAL BAJA CALIFORNIA USING SATELLITE DATA AND COMPUTER-ASSISTED ENHANCEMENT TECHNIQUES Ph.D. Thesis
Ralph Norbert Baker 1979 339 p
Avail: Univ. Microfilms Order No. 7918796

Remote sensor data (primarily LANDSAT) were analyzed by photogeologic and computer-assisted enhancement techniques to evaluate the metallic mineral potential of Baja California. Overlays were prepared at 1:1,000,000 and 1:500,000 and included known geologic relationships and mineral occurrences; lineament, drainage and structural patterns; tonal anomalies; and results of computer-assisted extractive processing. Computer-assisted enhancement and classification of the test sites was performed using multispectral image analysis system to identify subtle tonal anomalies thought related to mineralization using known sites as analysis guides. The probability for mineralization within the entire central Baja California study area was quantified using a weighted factor approach. Mineral potential maps of Baja California were generated from these analyses.
Dissert. Abstr.

N79-29565 Stanford Univ., Calif.
QUANTITATIVE RELATIONSHIPS OF SURFACE GEOLOGY AND SPECTRAL HABIT TO SATELLITE RADIOMETRIC DATA Ph.D. Thesis
Stuart Emmet Marsh 1979 290 p
Avail: Univ. Microfilms Order No. 7917258

Integrating the sampling, correlation, and mixture research established the quantitative accuracy of the LANDSAT multispectral data for a variety of geologic terrains. Within defined contrast constraints, and after compensation is made for atmospheric attenuation and scattering, the system can accurately depict the spectral character of the Earth's surface. Dissert. Abstr.

N79-29580# Texas Instruments, Inc., Dallas.
AERIAL RADIOMETRIC AND MAGNETIC RECONNAISSANCE SURVEY OF PORTIONS OF ARIZONA, NEW MEXICO. VOLUME 1: INSTRUMENTATION AND METHODS Final Report
Nov. 1978 63 p refs
(Contract EY-76-C-13-1664)
(GJBX-23(79)-Vol-1) Avail: NTIS HC A04/MF A01

Instrumentation and methods are described for a high-sensitivity, aerial gamma ray spectrometer and magnetometer survey of the Mesa, Tucson, Nogales, Clifton, Silver City, and Douglas, NTMS, 1:250,000-scale quadrangles in southeastern Arizona and southwestern New Mexico. A Bell 212 helicopter equipped with gamma ray spectrometer and six large-volume sodium iodide detectors, two 400 channel analyzers, and ancillary geophysical and electronic equipment, and a DC-3 aircraft equipped with nine detectors were used. Gamma ray spectrometric data were processed to correct for variations in atmospheric, flight, and instrument conditions and were statistically evaluated to remove the effects of surface geologic variations. The resulting first-priority uranium anomalies were interpreted to evaluate their origin and significance. Results in the form of a preferred anomaly map, along with significance-factor profile maps, stacked profiles, and histograms, are presented. DOE

N79-29584# Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.
A SELECTED BIBLIOGRAPHY: REMOTE SENSING TECHNIQUES FOR EVALUATING THE EFFECTS OF SURFACE MINING
David M. Carneggie and Donald O. Ohlen 6 Mar. 1979 15 p refs
(Contract DI-14-08-0001-16439)
(PB-294299/3) Avail: NTIS HC A02/MF A01 CSCL 08I

Thirty-one citations of technical papers and other publications dealing with the monitoring surface mining are presented. These references summarize recent developments in methods used to identify, map, analyze, and monitor surface mining, particularly coal surface mining. GRA

N79-30592*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOLOGICAL FAULT ON A MILLIONTH SCALE, SAN FRANCISCO RIVER [FOLHA GEOLOGICA AOMILLIONESIMO, RIO SAO FRANCISCO]
Nelson DeJesusParada, Principal Investigator, Paulo Roberto Meneses, Athos Ribeiro dosSantos, Ubiratan Porto dosSantos, Paulo Veneziani, and Chan Chiang Liu Sep. 1978 123 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10231; NASA-CR-158795) Avail: NTIS HC A06/MF A01 CSCL 08G

N79-30593*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GEOLOGIC APPLICATIONS OF THERMAL INERTIA IMAGE USING HCMM DATA Quarterly Report, Jan. - Mar. 1979
Anne B. Kahle, Principal Investigator, Helen H. Paley, and Stuart E. Marsh 30 May 1979 7 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS7-100)

(E79-10232; NASA-CR-158796; HCM-028) Avail: NTIS HC A02/MF A01 CSCL 08G

The author has identified the following significant results. Comparison of a simulated HCMM image of the Pisgah Crater, California test site obtained from aircraft data with an image generated from the preliminary satellite data tape of the area indicates that the HCMM satellite data appears much as predicted by the simulation. Author

N79-30598*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

USE OF AUTOMATIC EXTRACTION OF LANDSAT DATA DEFINING AREAS OF ILMENITE IN THE FOREST OF THE STATE OF PERNAMBUCO [USO DA CLASSIFICACAO AUTOMATICA DE DADOS DO SATELITE LANDSAT NA DEFINICAO DE AREAS DE ILMENITA PRIMARIA EN FLORESTA, PERNAMBUCO]

Nelson deJesusParada, Principal Investigator, Sylvio de Queiros Mattoso, Waldir Renato Paradella, and Paulo Roberto Meneses Jan. 1979 35 p refs In PORTUGUESE; ENGLISH summary ERTS

(E79-10237; NASA-CR-158801; INPE-1415-RPE/003) Avail: NTIS HC A03/MF A01 CSCL 02F

The author has identified the following significant results. Classification results point out 600 alarm areas of high potentiality of titanium occurrence. Almost 80 of these 600 alarm areas were checked by field work, and in 56 of them, titanium occurrences were confirmed and four new ore deposits were found. Author

N79-30599*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

REMOTE SENSORS APPLIED TO THE PROSPECTING OF THERMOMINERAL WATERS IN THE MUNICIPALITY OF CALDAS NOVAS-GOIAS [SENSORES REMOTOS APLICADOS A PROSPECCAO DE AGUAS TERMOMINERAIS NO MUNICIPIO DE CALDAS NOVAS-GOIAS]

Nelson deJesusParada, Principal Investigator, Paulo Veneziani, and Celio Eustaquio dosSanjos Jan. 1979 16 p refs In PORTUGUESE Sponsored by NASA ERTS

(E79-10238; NASA-CR-158802; INPE-1413-RPE/001) Avail: NTIS HC A02/MF A01 CSCL 08H

N79-30625# Bureau de Recherches Geologiques et Minieres, Minieres, Paris (France).

EXAMPLES OF THE CONTRIBUTIONS OF TELEDETECTION TO MINING RESEARCH [ILLUSTRATION PAR L'EXEMPLE D'UN MODE D'APPUI ET D'INTERVENTION DE LA TELEDETECTION SPATIALE EN RECHERCHE MINIERE]

Jean-Yves Scanvic *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 117-131 refs In FRENCH

Avail: NTIS HC A99/MF A01

LANDSAT satellite images of mountainous regions of France were used to study geological structures in order to define the potential teledetection for mining research. Several dozen circular structures were discovered, ten of which are discussed as typical examples. It was also found that the alignments observed in the satellite images correspond to the phenomena described by Hobbs. The correlations with previous data show several possible origins for the circular structures. It is concluded that teledetection can be very important for mining research planning.

Author (ESA)

N79-30626# Institut Francais du Petrole, Rueil-Malmaison.

CONTRIBUTION OF LANDSAT IMAGES TO GEOLOGICAL PROSPECTING IN THE WESTERN MEDITERRANEAN REGION [CONTRIBUTION DES IMAGES LANDSAT A LA PROSPECTION GEOLOGIQUE DANS LES REGIONS DE LA MEDITERRANEE OCCIDENTALE]

E. Hilali (Min. de l'Energie et des Mines, Rabac, Morocco), A Demnati (Min. de l'Energie et des Mines, Rabac, Morocco), J. C. Rivereau, and B. Soulhol *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 133-140 refs In FRENCH

Avail: NTIS HC A99/MF A01

Several morphostructural studies were carried out using LANDSAT images in order to provide techniques complementary to other methods of geological research. A local example for the region of Palomares in the southeast of Spain shows a good correlation between the surface and subsurface geology and one interpretation of the contours. At a regional level, in the zone of the Gibraltararc, a simultaneous study of the contours on earth and of the sea bathimetry permitted the formulation of a coherent structural model. It is concluded that the study of the contours can be used to formulate these models.

Author (ESA)

N79-30628# Milan Univ. (Italy). Cattedra di Fisica Terrestre.

LANDSAT IMAGE ANALYSIS IN THE FIELD OF REGIONAL GEOLOGY: THE LIGURIAN ARC

C. M. Marino *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 147-153 refs Original contains color illustrations

Avail: NTIS HC A99/MF A01

Two geological research projects were undertaken in a test area located in northern Italy, using LANDSAT 2 satellite data. Landslide hazard detection was investigated based on the analysis of selected parameters from LANDSAT 2 images. Many landslide areas characterized by marine silts and clays were found along the northern Appennines range. The geological structures, with special references to linear phenomena, were studied in the selected zone. Unclassified lineaments (17%) were found and from a sample of eight measured in situ, six showed positive tectonic response. Author (ESA)

N79-30635# Geosat Committee, Inc., San Francisco, Calif.

GEOSAT PROGRAM 1978: FUTURE GEOLOGICAL REMOTE SENSING FROM SPACE

F. B. Henderson *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 217-224 refs

Avail: NTIS HC A99/MF A01

The Geosat committee's objectives and the Geosat program are explained. Formed in 1976, with the support of 100 exploration and engineering companies, the Geosat committee suggested the use of supplementary sensing systems to optimize geological remote sensing from space within the NASA LANDSAT program. The recommendations include the use of rock/soil sensitive spectral bands, worldwide high resolution film, LANDSAT compatible digital stereoscopic imaging data, and synthetic aperture radars. Some Geosat required data may become available from France's SPOT, Japan's EARTH, Germany's ARGUS and other non-US, earth remote sensing satellites. Author (ESA)

N79-30638# Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).

APPLICATION OF DIGITAL IMAGE PROCESSING MODULES TO LANDSAT SCENES FOR THEIR IMPROVEMENT AND GEOLOGICAL EVALUATION

P. Hoppe and K. A. Ulbricht *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 237-241 refs Prepared in cooperation with DFVLR, Oberpfaffenhofen, West Ger.

Avail: NTIS HC A99/MF A01

The application of DIBIAS (Digital Image Processing System) to geological questions and problems was tested using LANDSAT image tapes. It was possible to obtain multispectral ortho-images of large areas of the earth by using the two LANDSAT satellites. Images were taken repetitively in six to twelve day sequences at the same time in the morning. This allows combination and comparison of images from different orbits for geoscientific interpretation. Results for a test area in Morocco and another in

Sudan are discussed. In Morocco, supervised and unsupervised classifications produced unsatisfactory results because the existing vegetation led to misinterpretation by changing and disturbing the spectral reflectance of the ground. Author (ESA)

N79-30685# Bendix Field Engineering Corp., Grand Junction, Colo.
HELICOPTER-ASSISTED RADIOMETRIC SURVEY OF THE DIXON ENTRANCE QUADRANGLE, ALASKA
W. A. Burgett and K. J. Krause Feb. 1979 11 p refs
(Contract EY-76-C-13-1664)
(GJBX-19(79)) Avail: NTIS HC A02/MF A01

Known uraniferous rocks at Bokan Mountain were well expressed radiometrically, and the type of survey conducted is capable of detecting similar geologic environments that might exist at the surface elsewhere in the quadrangle. No similar uraniferous environments were indicated, however. Strong radiometric (eU) anomalies were detected in a limestone terrane in which uranium is not generally expected to occur in anomalous concentrations. DOE

N79-30689# Oak Ridge National Lab., Tenn. Analytical Chemistry Div.
POLAR CONSTITUENTS OF A SHALE OIL: COMPARATIVE COMPOSITION WITH OTHER FOSSIL-DERIVED LIQUIDS
I. B. Rubin, N. A. Goeckner (University of Western Ill., Macomb), and B. R. Clark 1979 22 p refs Presented at the Oil Shale Symp., Denver, 26 Mar. 1979
(Contract W-7405-eng-26)
(CONF-790334-2) Avail: NTIS HC A02/MF A01

Similarities and differences in the polar portions of a variety of types of fossil fuel oils including oil from shale, from several coal liquefaction processes and from a mixture of natural petroleum crudes are described. Samples were fractionated by acid/base distribution as well as by gel partition chromatography which was then followed by acid/base distribution and adsorption chromatography. One subfraction of particular interest was that obtained from the hydrophilic fraction after gel partition chromatography, extracted into a neutral subfraction, and then eluted from an alumina column by methanol. This subfraction was not gas chromatographable, and was partially characterized by elemental analysis, NMR spectroscopy and infrared spectrophotometry. DOE

N79-30703# Arizona State Univ., Tempe. Dept. of Geology.
GEOLOGIC APPLICATIONS OF LANDSAT IMAGES IN NORTHEASTERN ARIZONA TO THE LOCATION OF WATER SUPPLIES FOR MUNICIPAL AND INDUSTRIAL USES Final Report
Elizabeth Babcock, Philip Briggs, Kenneth DeCook, Lock Ethridge, Kennith Foster, Charles Glass, and Robert Schowengerdt Apr. 1979 103 p refs Prepared in cooperation with Arizona Univ., Tucson and Arizona Water Comm., Phoenix
(Contract DI-14-34-0001-8060)
(PB-294816/4; W79-06164; OWRT-B-066-ARIZ(1)) Avail: NTIS HC A06/MF A01 CSCL 13B

Photolineaments of the entire northeast quadrant of Arizona were mapped from standard EROS Data Center false color LANDSAT composites. In addition, photolineaments were mapped using computer enhanced LANDSAT imagery of two intensive study sites. A third source of geologic structure data were existing large scale lineament maps derived from aerial photography of the study sites. Results indicate that LANDSAT imagery may be used to survey large areas for lineaments, and to cue the hydrogeologist to promising regions, which can then be mapped at aerial photography scales. GRA

N79-30709# HRB-Singer, Inc., State College, Pa.
INVESTIGATION OF COLOR AND COLOR INFRARED AERIAL PHOTOGRAPHIC TECHNIQUES FOR MINING AND RECLAMATION PLANNING AND MONITORING Open File Report, 30 May 1975 - 28 Apr. 1978
William M. Knuth, Eric L. Fritz, and James A. Schad 29 Sep. 1978 215 p refs
(Contract DI-BM-JO-155041)
(PB-294707/5; HRB-4936-F; BM-OFR-37-79) Avail: NTIS HC A10/MF A01 CSCL 08I

The technical and economical feasibility of using color and color infrared aerial photography to satisfy some informational needs for premine planning, mine progress monitoring, and reclamation monitoring was evaluated. Interpretability accuracies were also evaluated for parameters in the broad categories of land use, soils, water, vegetation, and geology. Seasonal interpretation characteristics were noted for infrared photography. Man hours for photointerpretation and costs of aerial data collection were monitored closely and incorporated into a cost benefit analysis. GRA

N79-31111* National Aeronautics and Space Administration, Washington, D. C.
A BIBLIOGRAPHY OF PLANETARY GEOLOGY PRINCIPAL INVESTIGATORS AND THEIR ASSOCIATES, 1978 - 1979
Joseph M. Boyce, comp. Aug. 1979 83 p
(NASA-TM-80540) Avail: NTIS HC A05 CSCL 03B

Approximately 450 articles on planetary geology are reported. M.M.M.

N79-31708*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOLOGICAL MAP OF PARTS OF THE STATE OF SAO PAULO BASED ON LANDSAT IMAGES [MAPA GEOLOGICO DE PARTE DO ESTADO DE SAO PAULO BASEADO EN IMAGENS LANDSAT]
Nelson deJususParada, Principal Investigator, Gilberto Amaral, Chan Chiang Liu, and Raimundo Almeida Filho Mar. 1979 33 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA ERTS
(E79-10240; NASA-CR-158804; INPE-1437-RPE/012) Avail: NTIS HC A03/MF A01 CSCL 08B

The author has identified the following significant results. Interpretation of LANDSAT images revealed the subdivision of the Bauru formation into three distinct lithofacies. Delineation of structural features yielded new information on paleoenvironmental reconstitution and hydrogeology. Structural features and photogeological units were revealed in the precambrian basement at the eastern portion of the state.

N79-31709*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF THE AUTOMATIC CLASSIFICATION OF LANDSAT DATA ON THE DEFINITION OF AREAS OF PRIMARY ILMENITE IN FLORESTA, PERNAMBUCO
Nelson deJesusParada, Principal Investigator, Sylvio deQueiros-Mattos, Waldir Renato Paradella, and Paulo Roberto Menezes Jan. 1979 25 p refs In PORTUGUESE Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10249; NASA-CR-158857; INPE-1415-RPE/003) Avail: NTIS HC A02/MF A01 CSCL 02F

N79-31712*# Stanford Univ., Calif. Dept. of Geology.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA
Ernest I. Rich, Principal Investigator 21 Jul. 1979 3 p refs ERTS
(Contract NAS5-24479)
(E79-10252; NASA-CR-158858) Avail: NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results. First-look qualitative geologic evaluation of day- and night-IR images discloses several en echelon linear features extending throughout the central part of the northern coast range in California, across the Mendocino triple junction and into southern Oregon. Preliminary examination of these features with respect to topographic expression, vegetation, sun angle and azimuth, and atmospheric conditions suggests that they may be related to the intracontinental plate boundary (Lake Mountain Fault zone of Herd) of the Humbolt Plate. The linear features, which cut across several climatic zones and differently vegetated regions

are not confined to topographic valleys, but cross the ridges and valleys at varying angles. Lithology within the Great Valley Sequence can be detected on a few of the images; however, preliminary evaluation suggests that the thermal banding observed may be a function of sun azimuth or late-day sun angle. Soil moisture, related to lithologic composition cannot be ruled out at this time.

N79-31716*# Geological Survey, Denver, Colo.
ALTERED ROCK SPECTRA IN THE VISIBLE AND NEAR INFRARED
Graham R. Hunt and Roger P. Ashley, Principal Investigators [1979] 57 p refs Sponsored by NASA ERTS
(E79-10256; NASA-CR-158862) Avail: NTIS HC A04/MF A01 CSCL 08G

The author has identified the following significant results. Visible and near-infrared (0.35 to 2.5 micron m) bidirectional reflection spectra recorded for a suite of well-characterized hydrothermally altered rock samples typically display well defined bands caused by both electronic and vibrational processes in the individual mineral constituents. Electronic transitions in the iron-bearing constituent minerals produce diagnostic minima near 0.43, 0.65, 0.85, and 0.93 micron m. Vibrational transitions in clay and water-bearing mineral constituents produce characteristic single or multiple features over limited spectral ranges near 1.4, 1.75, 1.9, 2.2, and 2.35 micron m. The most abundant feature-producing minerals present in these rocks are hematite, goethite, and alunite. Others frequently present are jarosite, kaolinite, potassium micas, pyrophyllite, montmorillonite, diaspore, and gypsum. The spectral region near 2.2 micron m is particularly important for detecting altered rocks by remote sensing.

N79-31717*# Geological Survey, Reston, Va.
EVALUATION OF LANDSAT MULTISPECTRAL SCANNER IMAGES FOR MAPPING ALTERED ROCKS IN THE EAST TINTIC MOUNTAINS, UTAH
Lawrence C. Rowan and Michael J. Abrams, Principal Investigators (JPL) [1979] 136 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS (E79-10257; NASA-CR-158863; Rept-78-736) Avail: NTIS HC A07/MF A01 CSCL 08G

The author has identified the following significant results. Positive findings of earlier evaluations of the color-ratio compositing technique for mapping limonitic altered rocks in south-central Nevada are confirmed, but important limitations in the approach used are pointed out. These limitations arise from environmental, geologic, and image processing factors. The greater vegetation density in the East Tintic Mountains required several modifications in procedures to improve the overall mapping accuracy of the CRC approach. Large format ratio images provide better internal registration of the diazo films and avoid the problems associated with magnifications required in the original procedure. Use of the Linoscan 204 color recognition scanner permits accurate consistent extraction of the green pixels representing limonitic bedrock maps that can be used for mapping at large scales as well as for small scale reconnaissance.

N79-31718*# Geological Survey, Reston, Va.
DISCRIMINATION OF HYDROTHERMALLY ALTERED ROCKS ALONG THE BATTLE MOUNTAIN-EUREKA, NEVADA MINERAL BELT USING LANDSAT IMAGES
M. Dennis Krohn, Michael J. Abrams (JPL), and Lawrence C. Rowan, Principal Investigators [1979] 92 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10258; NASA-CR-158864) Avail: NTIS HC A05/MF A01 CSCL 08G

The author has identified the following significant results. Limonitic alteration halos associated with two copper prophyry deposits were successfully mapped at Battle Mountain. Alteration halos from both a hypogene system at Copper Canyon and a supergene system at Copper Basin are recognizable in the composite. Both copper porphyry deposits are located in sedimentary rock units that commonly have ferruginous coatings; yet, in most cases, the hydrothermally derived limonite was distinguishable in the CRC from sedimentary limonite. Large format playback images with pixel sizes from 200 to 400 micron m provided details of spatial resolution and color separation unachievable on enlargements from 70 mm film chips. Details of the alteration halos could be resolved only in the large format images. Two aspects of the alteration halos of the porphyry copper deposits were not mapped on the CRC. The optimum CRC image for the area studied consists of MSS 4/5 as blue, MSS 4/6 as yellow, and MSS 6/7 as magenta using diazo films. The disseminated gold deposits at Gold Acres are not depicted in the CRC image.

N79-31730*# Stanford Univ., Calif. School of Applied Earth Sciences.
GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION Quarterly Report, 1 Nov. 1978 - 28 Feb. 1979
R. J. P. Lyon and A. E. Prelat, Principal Investigators 28 Feb. 1979 2 p ERTS
(Contract NAS5-24232)
(E79-10273; NASA-CR-162094) Avail: NTIS HC A02/MF A01 CSCL 08B

N79-31731*# Stanford Univ., Calif. School of Applied Earth Sciences.
GEOLOGICAL AND GEOTHERMAL DATA USE INVESTIGATIONS FOR APPLICATION EXPLORER MISSION-A, HEAT CAPACITY MAPPING MISSION Quarterly Report, 1 Mar. - 30 Jun. 1979
R. J. P. Lyon and J. C. Broderick, Principal Investigators 30 Jun. 1979 2 p ERTS
(Contract NAS5-24232)
(E79-10274; NASA-CR-162095) Avail: NTIS HC A02/MF A01 CSCL 08B

N79-31733*# Consiglio Nazionale delle Ricerche, Milan (Italy).
HEAT CAPACITY MAPPING MISSION (HCMM) PROGRAM Progress Report
Roberto Cassinis, Giovanni Maria Lechi, Principal Investigators, Pietro Alessandro Brivio, Alberto Marini, Renzo Moretti, and Eugenio Zilioli 25 Aug. 1979 20 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10276; NASA-CR-162097; PR-1) Avail: NTIS HC A02/MF A01 CSCL 08G

N79-31734*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GEOLOGIC APPLICATION OF THERMAL INERTIA IMAGING USING HCMM DATA Quarterly Report, Apr. - Jun. 1979
Helen N. Paley and Anne B. Kahle, Principal Investigators Aug. 1979 4 p ERTS
(Contract NAS7-100)
(E79-10277; NASA-CR-162099) Avail: NTIS HC A02/MF A01 CSCL 08G

N79-32607*# Geological Survey, Denver, Colo. Petrophysics and Remote Sensing Branch.
GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Dec. 1978 - Feb. 1979
Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Feb. 1979 5 p Sponsored by NASA ERTS
(E79-10282; NASA-CR-162147) Avail: NTIS HC A02/MF A01 CSCL 08B

N79-33518*# Geological Survey, Denver, Colo. Petrophysics and Remote Sensing Branch.

GEOLOGIC APPLICATIONS OF THERMAL-INERTIA MAPPING FROM SATELLITE Progress Report, 1 Mar. - 31 May 1979

Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson May 1979 6 p Sponsored by NASA ERTS (E79-10279; NASA-CR-162144) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. After digitization, a noise rejection filter was applied to data obtained by USGS aircraft. An albedo image was formed by combining three bands of visible data. Along with the day and nighttime thermal data, the albedo image was used to construct a relative thermal-inertia image. This image, registered to a topographic base, shows there are thermal property differences in the vicinity of the contact between the Fort Union and Wasatch formations in the Powder River Basin, Wyoming.

05

OCEANOGRAPHY AND MARINE RESOURCES

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

A79-44343 * **Multibeam synthetic aperture radar for global oceanography.** A. Jain (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *IEEE Transactions on Antennas and Propagation,* vol. AP-27, July 1979, p. 535-538. Contract No. NAS7-100.

A single-frequency multibeam synthetic aperture radar concept for large swath imaging desired for global oceanography is evaluated. Each beam iilluminates a separate range and azimuth interval, and images for different beams may be separated on the basis of the Doppler spectrum of the beams or their spatial azimuth separation in the image plane of the radar processor. The azimuth resolution of the radar system is selected so that the Doppler spectrum of each beam does not interfere with the Doppler foldover due to the finite pulse repetition frequency of the radar system. (Author)

A79-44676 * # **The GEOS 3 project.** H. R. Stanley (NASA, Wallops Flight Center, Wallops Island, Va.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 3779-3783.

The GEOS 3 project was designed to provide useful data for determining oceanographic and geophysical parameters. The project organization, experiment package, and mission profile are described, and results and conclusions are highlighted. They serve as background material for the detailed results presented in this special volume. Attention is given to Ocean geoid, sea state, quasi-stationary departures from the marine geoid, wind speed, and terrain and ice. S.D.

A79-44682 * **Oceanic geoid and tides derived from GEOS 3 satellite data in the Northwestern Atlantic Ocean.** I. J. Won (North Carolina State University, Raleigh, N.C.) and L. S. Miller (Applied Science Associates, Inc., Apex, N.C.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 3833-3842. 10 refs. Contract No. NAS6-2810.

Two sets of GEOS 3 altimeter data which fall within about a 2.5-deg width are analyzed for ocean geoid and tides. One set covers a path from Newfoundland to Cuba, and the other a path from Puerto Rico to the North Carolina coast. Forty different analyses using various parameters are performed in order to investigate convergence. Profiles of the geoid and four tides, M2, O1, S2, and K1, are derived along the two strips. While the analyses produced convergent solutions for all 40 cases, the uncertainty caused by the linear orbital bias error of the satellite is too large to claim that the solutions represent the true ocean tides in the area. A spot check of the result with the Mode deep-sea tide gauge data shows poor agreement. A positive conclusion of this study is that despite the uncertain orbital error the oceanic geoid obtained through this analysis can improve significantly the short-wavelength structure over existing spherical harmonic geoid models. (Author)

A79-44685 * **The geoid spectrum from altimetry.** C. A. Wagner (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 3861-3871. 18 refs.

Preliminary estimates of the global spectrum of the sea surface and geoid are made using altimeter data from the GEOS 3 and Skylab spacecraft. In all, the equivalent of about seven revolutions of data has served from the 'global' estimates. It is found that the power spectrum of the sea surface generally follows the expected values from Kaula's rule applied to the geoid. Analysis of overlapping altimetry arcs (and oceanographic data) reveals that the surface spectrum is dominated by the geoid to about 500 cycles, but the sea state departures are significant starting at about 250 cycles. At less than 500 cycles (40 km half-wavelength) the total power in the marine geoid may be negligible (much less than 20 cm). S.D.

A79-44687 * **GEOS 3 ocean geoid investigation.** S. M. Yionoulis, A. Eisner, V. L. Pisacane, H. D. Black, and L. L. Pryor (Johns Hopkins University, Applied Physics Laboratory, Laurel, Md.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 3883-3888. 5 refs. Contract No. N00024-78-C-5384. NASA Task I.

A determination of the fine-scale sea surface topography in the GEOS 3 calibration area using the radar altimeter data is presented. Estimates of the north-south and east-west components of the deflections of the vertical as well as values of the geoidal heights are made. Three major stages of processing are used in obtaining the final results. The first two use pass processors; in the final stage the processor combines all the pass results to compute the final results. Comparison with a gravimetrically determined geoid for the calibration area, provided by the National Aeronautics and Space Administration, yielded a mean and standard deviation of 0.45 and 1.5 m, respectively. (Author)

A79-44689 # **Observation of sea surface topography with GEOS 3 altimeter data.** B. C. Douglas and P. D. Gaborski (NOAA, National Geodetic Survey, Rockville, Md.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 3893-3896. 11 refs.

Surface truth data, including an empirical tide model, geoidal undulations, dynamic heights, and infrared imagery in the GEOS 3 Atlantic calibration area, have been compared with features in GEOS 3 altimeter profiles of sea surface height. The 5 arcmin x 5 arcmin gravimetric geoid computed by J. G. Marsh agrees with altimeter profiles to the level of the sea surface topography (about 50 cm). After removal of a low-degree polynomial the differences of collinear passes of altimeter data reveal apparent time-dependent ocean surface features. Some of these can be identified from the surface truth information, but others cannot be correlated with known features, probably owing to limitations of the surface truth data. Independent collinear pairs also indicate that the best of the many orbit computation models used to compute the GEOS 3 altitude ephemeris introduces a bias of about 1 m (rms) on a typical pass of altimeter data. (Author)

A79-44698 * **Monitoring of thickness changes of the continental ice sheets by satellite altimetry.** R. L. Brooks (EG & G Washington Analytical Services Center, Inc., Pocomoke City, Md.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 3965-3968. Contract No. NAS6-2639.

Radar altimeter measurements from the GEOS 3 satellite are being utilized to define the topography of the southern Greenland ice sheet between latitudes 60 deg N and 65 deg N. The resultant elevations have been correlated with two geoceiver sites on the ice surface; the agreement is within a few meters. The internal repeatability of the altimeter-derived elevations has been assessed at the crossovers of the satellite ground tracks; the observed agreements vary from 0.07 to 3.10 m, intervening times being 1 day and 674 days, respectively. Improved knowledge of the temporal changes in the topographic expression of the continental ice sheets, via satellite altimetry, will significantly add to the understanding of glaciological and climatological processes. (Author)

A79-44702 **Surface roughness slope density estimates for low sea state conditions.** G. S. Brown (Applied Science Associates, Inc., Apex, N.C.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 3987-3989. 6 refs.

Surface roughness slope density estimates for low sea state conditions have been obtained using data from the integrating samplers of the Geos 3 radio altimeter located at approximately 0.3 and 1 deg angle of incidence. The altimeter data imply that the joint

slope density is closer to a Laplacian form than a Gaussian form. Under conditions of very low surface wind speed, the slopes of the surface roughness may deviate markedly from the Gaussian form, possibly because surface waves are troichoidal in shape. C.K.D.

A79-44703 * # **Satellite altimeter measurements of sea state - An algorithm comparison.** L. S. Fedor, R. Guptill, C. L. Rufenach (NOAA, Wave Propagation Laboratory, Boulder, Colo.), T. W. Godbey (General Electric Co., Utica, N.Y.), J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada), G. S. Hayne (Applied Science Associates, Inc., Apex, N.C.), and E. J. Walsh (NASA, Wallops Flight Center, Applied Science Directorate, Wallops Island, Va.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 3991-4001. 18 refs.

Six algorithms for extracting significant wave height from Geos 3 altimeter data have been compared using simulated Geos 3 data for a single long pass including a variety of sea states and for short segments in the vicinity of NOAA data buoys. The study included algorithms reported by Walsh (1979), Rufenach and Alpers (1978), Gower (1979), Godbey (1965), Fedor (1978) and a real-time model (Miller and Hayne, 1972). Individual differences in results obtained by the algorithms were small, and calculations were found to be in good agreement with surface truth data. C.K.D.

A79-44704 * # **Extraction of ocean wave height and dominant wavelength from Geos 3 altimeter data.** E. J. Walsh (NASA, Wallops Flight Center, Wallops Island, Va.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 4003-4010. 15 refs.

Some data from the Geos 3 satellite altimeter are examined in detail to demonstrate the techniques used for extracting wave height and skewness of the sea surface. The approach used in determining the dominant wavelength of the ocean waves is discussed. Improvements incorporated into the Seasat 1 altimeter as the result of experience with Geos 3 are described. C.K.D.

A79-44705 * # **Geos 3 wave height measurements - An assessment during high sea state conditions in the North Atlantic.** C. L. Parsons (NASA, Wallops Flight Center, Wallops Island, Va.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 4011-4020; Comments, p. 4027, 4028. 26 refs.

The sea state in the North Atlantic Ocean has been monitored in February, 1977 to obtain data for verification of Geos 3 radio altimeter wave form data. The altimeter sea state data were found to be in good agreement with in situ sea state measurements and with aircraft remote sensing measurements of wave height. The average difference between the supporting data and Geos 3 was 0.34 m, and the standard deviation 0.61 m. Contour maps of sea state constructed for large regions of the earth's oceans on the basis of Geos 3 altimeter measurements exhibited systematic differences from operationally available computerized maps. It is thought that the underestimation of significant wave height maxima in the operational maps and the underestimation of the speed of movement of oceanic cyclones may be due to basic errors in the output of atmospheric primitive-equation models. Because of the narrow swath width of the Geos-3 sensor, data from several satellite orbits must be combined to construct contour maps, leading to low values of significant wave heights. C.K.D.

A79-44707 * ** **A brief summary of verification results for the spectral ocean wave model /SOWM/ by means of wave height measurements obtained by Geos 3. W. J. Pierson and R. E. Salfi (City College, New York, N.Y.). *Journal of Geophysical Research,* vol. 84, July 30, 1979, p. 4029-4040. 9 refs. Contract No. NAS6-2439.

Significant wave heights calculated using a computer-based spectral ocean wave model (Pierson et al., 1966; Salfi, 1974; Lazanoff and Stevenson, 1975) from meteorological data have been compared with significant wave heights measured by Geos 3 for 44 orbit segments obtained during 1975 and 1976. The model specifications were found to be biased too low. Discrepancies between calculated and measured wave heights are also attributable to the poor specifications of the winds over the northern hemisphere oceans. C.K.D.

A79-45050 # **Radar survey of sea roughness from flight vehicles (Radiolokatsionnaia s'emka morskogo volneniia s letatel'nykh apparatov).** A. A. Zagorodnikov. Leningrad, Gidrometeoizdat, 1978. 240 p. 154 refs. In Russian.

Sea roughness is a serious obstacle in the construction of harbor structures and ocean drilling equipment, has a significant effect on ship movements and safety, and it inhibits operations of ship, shore, and aircraft radar installations. This monograph reviews the principles of airborne and spaceborne remote sensing of various sea roughness parameters, including two-dimensional spectra. The basic characteristics of wind-induced wave disturbances are investigated. Sea roughness is represented as a three-dimensional random space-time field with a Gaussian distribution of wave slopes. Amplitude and phase (Doppler) characteristics of centimeter and optical waves are analyzed and the results of wave measurements are given. The physical principles of two dimensional harmonic analysis of radar and optical images of the sea surface are presented. Finally, some methods of roughness measurement from satellites using remote sensing methods are described. A.T.

A79-45618 # **Satellite observation of the sea ice boundary in the coastal region extending from Queen Maud Land to the Filchner shelfice (Satellitenbeobachtung der Seeisgrenze im Küstengebiet 'Königin-Maud-Land' bis 'Filchner-Schelfeis').** H. Gernandt (Aerologisches Observatorium, Lindenberg, East Germany). *Zeitschrift für Meteorologie,* vol. 29, no. 2, 1979, p. 127-131. In German.

The sea ice about the Antarctica exhibits strong annual variations of the outer sea ice boundary. In the present paper, the variation of the sea ice boundary in the Antarctic coastal region extending from 40 degrees East to 40 degrees West is studied on the basis of satellite photography over the period from November 1976 to January 1977. V.P.

A79-45781 # **Regional-scale sea surface temperature determination from the geostationary environmental operational satellite.** G. A. Maul (NOAA, Atlantic Oceanographic and Meteorological Laboratories, Miami, Fla.). In: Ocean thermal energy for the 80's; Ocean Thermal Energy Conversion Conference, 6th, Washington, D.C., June 19-22, 1979, Preprints. Volume 1. Laurel, Md., Johns Hopkins University, 1979, p. 2C-2/1 to 2C-2/6. 12 refs.

Sea surface temperatures determined from the digital GOES data base require five steps for quantification: first, the data have to be remapped into a rectangular matrix. Second, using optional decision strategy, cloud-free pixels are identified from joint visible-infrared probability distributions. Third, atmospheric corrections for infrared radiative transfer are calculated from upper air soundings in the region of interest. Fourth, the corrected satellite data are least-squares adjusted to surface observations because the GOES data have no absolute blackbody reference calibration. Fifth, the data are composited and prepared for analysis of variability with application to OTEC thermal resource. Error analysis of this scheme suggests that the rms error for 10 km resolution surface temperature will be + or - 1 K or less. (Author)

A79-45782 # **Large cold tongues in the eastern Gulf of Mexico and their potential effect to OTEC.** F. M. Vukovich (Research Triangle Institute, Research Triangle Park, N.C.). In: Ocean thermal energy for the 80's; Ocean Thermal Energy Conversion Conference, 6th, Washington, D.C., June 19-22, 1979, Preprints. Volume 1. Laurel, Md., Johns Hopkins University, 1979, p. 2C-3/1 to 2C-3/4.

A large, narrow, cold tongue was detected in May 1978, extending southward from the northern boundary of the Loop Current. Similar tongues were detected in the spring of 1977 and 1975. The 1977 intrusion was described by Vukovich, et al (1978). These tongues penetrate as far as 400 km southward, and persisted for as long as 73 days. They originated as meanders on the northern

boundary of the Loop Current. Limited in situ data (one case study) has indicated that there is greater cooling in the subsurface layers than in the surface layers in the cold tongues. This, in fact, produced an increase in the vertical temperature difference, or enhancement of the OTEC resource. Further study is needed to provide more substantial statistics. (Author)

A79-45845 # **Use of satellite-derived sea surface temperatures by cruising OTEC plants.** F. K. Hill and G. L. Dugger (Johns Hopkins University, Laurel, Md.). In: Ocean thermal energy for the 80's; Ocean Thermal Energy Conversion Conference, 6th, Washington, D.C., June 19-22, 1979, Preprints. Volume 2. Laurel, Md., Johns Hopkins University, 1979, p. 2C-4/1 to 2C-4/6.

The collection and use of satellite data on sea surface temperatures by cruising OTEC plants is reviewed. A 360,000 sq nautical mile tropical area near the equator with temperature differences of 22 to 23.9 C between surface and 900 m deep water is of particular interest to early OTEC plantship deployment. To attain the highest temperature, a plantship must cruise continually to seek out the warmest spot each month, and must know what course to follow in terms of increasing relative sea surface temperature. This temperature gradient can be obtained less expensively from satellite observations than from surface vessels or aircraft. Data supplied by the NOAA from the NODC files are compared to sea surface temperature data provided by ITOS/NOAA polar orbiting satellites. Comparison of satellite measurements with surface measurements indicates that the view from space provides the aereal coverage and the necessary resolution with respect to sea surface temperature gradients to navigate OTEC plantships to stay in the warmest water. A.T.

A79-48197 **Shelf sea fronts' adjustments revealed by satellite IR imagery.** J. H. Simpson and D. Bowers (North Wales University College, Anglesey, Wales). *Nature,* vol. 280, Aug. 23, 1979, p. 648-651. 8 refs.

IR imagery from NOAA 5 has been used to study the movement of shelf sea fronts. After the elimination of tidal advection, the fronts show remarkable consistency of position and do not adjust to the strong semi-monthly variation in tidal stirring which indicates the operation of a feedback process in vertical mixing. (Author)

A79-48461 **Aerial photography and seaplane reconnaissance to produce the first total distribution inventory of submersed aquatic vegetation in Chesapeake Bay, Maryland.** R. T. Macomber (Earth Satellite Corp., Washington, D.C.) and G. H. Fenwick (Johns Hopkins University, Baltimore, Md.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 498-503. (ASP 79-185)

A79-48470 **A comparison of atmospheric correction methods used in airborne sea surface temperature mapping.** E. Wedler (Newfoundland, Memorial University, St. John's, Canada) and R. D. Worsfold (Remotec Applications, Inc., St. John's, Newfoundland, Canada). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 672-693. 25 refs. (ASP 79-217)

Six airborne radiation thermometer (ART) atmospheric correction methods are outlined. These methods are the Pickett correction method, the Weiss-Garnier correction method, the Muller correction method, the Saunders correction method, the Henderson-Frank correction method, and the AES correction method. The last four methods are compared in the form of sea surface temperature maps for a cold ocean environment. All the correction methods alter the original ART values. The Muller correction method consistently alters the original ART values by a fixed positive value, regardless of ART value or atmospheric conditions; it is invalid for the cold ocean environment. The Saunders and Henderson-Frank correction methods attempt to compensate for changes in environment conditions. The AES correction method appears to be the most sensitive over the range of original ART values and to changes in atmospheric conditions; it provides both positive and negative temperature corrections. S.D.

A79-48750 # **Sea ice ridging over the Alaskan Continental Shelf.** W. B. Tucker, III, W. F. Weeks, and M. Frank (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, N.H.). *Journal of Geophysical Research,* vol. 84, Aug. 20, 1979, p. 4885-4897. 24 refs. Research supported by the U.S. Bureau of Land Management.

Sea ice ridging statistics obtained from a series of laser surface roughness profiles are examined. Each set of profiles consists of six 200 km long flight tracks oriented approximately perpendicular to the coastline of the Chukchi and Beaufort seas. It was found that although there was a systematic variation in mean ridge height with season, with the highest values occurring in late winter, there was no systematic spatial variation in height at a given time. The number of ridges/km also are high during the late winter with the highest values occurring in Barter Island and Cross Island profiles. Finally, it is concluded that the main factors currently limiting the accurate prediction of the temporal recurrence of large pressure ridges are limited knowledge of the drift of near-shore ice and data that would permit the assessment of year to year variability in the number of ridges/km. M.E.P.

A79-50041 * **Measure of Arctic Sea ice characteristics using microwave scatterometry.** B. L. Jackson, W. D. Stanley (Old Dominion University, Norfolk, Va.), and W. L. Jones, Jr. (NASA, Langley Research Center, Hampton, Va.). In: SOUTHEASTCON '79; Proceedings of the Region 3 Conference and Exhibit, Roanoke, Va., April 1-4, 1979. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 278-280.

Results from a radar scatterometer used in the NASA microwave remote sensing experiment off the Alaska north shore are presented. The experiment was performed to determine whether various radars could be used from aircraft to provide definitive measurement of ice parameters such as pressure ridge height and direction, ice age, and ice type. With the aircraft at 300 m altitude, the 13.9 GHz scatterometer measured the normalized radar cross section of the ice using a pencil beam horizontally polarized antenna which pointed at either nadir or 50 deg incidence angle. Simultaneous laser altimeter and stereo photography measurements are presented as the 'surface truth' for comparison with the radar measurements. The results demonstrate that the scatterometer backscattered power is modulated by ice features and that a correlation exists between the radar cross section and the 'surface truth' derived from these ancillary instruments. A.T.

A79-50228 * **Growth mechanisms of 'Katie's Floeberg'.** S. A. Barrett and W. J. Stringer (Alaska, University, Fairbanks, Alaska). *Arctic and Alpine Research,* vol. 10, no. 4, 1978, p. 775-783. 7 refs. Contracts No. NOAA-03-5-022-55; No. NAS5-20959. NOAA Task 8.

The growth mechanism of the grounded ice feature on Hanna's Shoal, located at approximately 162 deg W, 72 deg N in the Chukchi Sea, has been analyzed using Landsat I and II satellite imagery. The primary mechanism of growth was deduced to be the formation of large wedges of ice against the upstream edge of the feature. These wedges of piled ice form in three stages and may or may not become permanently affixed to the core of the feature. Remains of these growth patterns can sometimes be seen in the interior of the feature on the satellite imagery. (Author)

A79-50510 **The fourth dimension in ocean remote sensing.** R. E. Stevenson (California, University, La Jolla, Calif.). In: Space instrumentation for atmospheric observation; Region V Annual Conference, El Paso, Tex., April 3-5, 1979, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 51-56.

The techniques of real-time space oceanography are discussed using data from Skylab, the Apollo/Soyuz Test Project, and the Defense Meteorological Satellite. The relationship between the thermal ocean and the surface textural dynamics of the upper ocean layers is outlined. Consideration is given to the requirement for the reduction of data bits to acquire the resolution necessary for the tactical navy, and the necessity of transmitting satellite data through the atmosphere to a few receiving centers. It is noted that for the required scale, resolution, and timeliness, the space platform most usable is the Space Shuttle. V.T.

A79-51699 * Modulation of centimetric waves by long gravity waves - Progress report on field and laboratory results. O. H. Shemdin (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Turbulent fluxes through the sea surface, wave dynamics, and prediction. New York, Plenum Publishing Corp., 1978, p. 235-253; Discussion, p. 254, 255. 17 refs. NASA-supported research; NSF Grant No. OCE-76-02713; Grant No. NOAA-NG-29-72.

Results are presented from laboratory and field experiments on the modulation of short waves by long waves. The field study employed a wave follower capable of tracking ocean waves with frequencies less than 1.0 Hz and heights less than 2.0 m. A high-response laser-optical system was used to detect upwind-downwind and cross-wind slopes of short waves. The laboratory study was conducted with wind over periodic long waves. The laboratory findings are discussed and compared with laboratory radar measurements and also short wave measurements obtained in the field. It is found that long waves significantly modulate the short wave dispersion by their orbital velocity, and that demodulation is necessary if the data collected by remote sensors are to be compared to surface penetrating devices. The modulation level is weak for wavelengths in the range 2.76-3.30 cm. Other relevant results are also presented. S.D.

A79-52795 Oceanic whitecaps and sea state. J. Wu (Delaware, University, Newark, Del.). *Journal of Physical Oceanography*, vol. 9, Sept. 1979, p. 1064-1068. 10 refs. NSF Grant No. OCE-77-26508.

Results of whitecap coverages of the ocean surface obtained by previous investigators in both the Atlantic Ocean and the Pacific Ocean are reanalyzed. The variation of coverage with wind velocity appears to be related to the rate of energy supplied by the wind. The coverage is also found to vary with stability conditions of the atmospheric surface layer. Empirical formulas are deduced for various sea states and stability conditions, and application of these formulas to remote sensing of marine wind velocity is discussed. (Author)

A79-53225 Satellite-tracked drifter in the Benguela Current System. T. F. W. Harris (Cape Town, University, Rondebosch, Republic of South Africa) and L. V. Shannon (Department of Industries, Sea Fisheries Branch, Sea Point, Republic of South Africa). *South African Journal of Science*, vol. 75, July 1979, p. 316, 317. 8 refs. Research sponsored by the South African Committee for Oceanographic Research.

Investigation of the Benguela Current System by the satellite-tracked drifter is reported. A free floating spar buoy was released west of Cape Town and its movements were determined by fixes from NASA's Nimbus 6 satellite. The trajectory of the drifter superimposed on the surface dynamic isobars was divided into three sections: (1) between days 67 and 128, the mean direction was 328 deg and the mean velocity 24 cm/s, and the prevailing wind stress suggested that the eastward deflections from the mean course can be explained by westerly winds or the formation of coastal lows along the South West African coast; (2) between days 129 and 219 the mean direction was 300 deg and the mean drifter velocity dropped to 12 cm/s; and (3) between days 220 and 245 the drifter direction was more zonal (275 deg) and the velocity increased to 20 cm/s. A.T.

A79-53367 The design of a satellite-based system for coastal oceans monitoring. H. M. Mooney (British Aerospace, Dynamics Group, Filton, England). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-232.* 15 p.

Current plans for a European remote sensing satellite program include proposals for a system designed to monitor the coastal regions of Europe and the world. The paper summarizes the main conclusions of a design study (Phase A) of the Coastal Oceans Monitoring Satellite System (COMSS). The key constraints to system design set at the beginning of the study are identified. Coastal oceans monitoring is discussed in terms of the need for monitoring, selected sensors and performance characteristics, mission requirements, and coastal and ocean image quality. Particular attention is given to major system elements, the space segment, the ground segment, and earth coverage characteristics. The system design aspects discussed represent a first step in the definition of the COMSS mission. It is clear that additional work is necessary on various design aspects of the identified payload and system elements. S.D.

A79-53378 Ocean color scanner observations in the North Sea. H. van der Piepen, H. Helbig, G. Kritikos, M. Schroeder, R. Staetter (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen, West Germany), and R. Doerffer (Gesellschaft für Kernenergieverwertung in Schiffbau und Schiffahrt mbH, Geesthacht, West Germany). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-254.* 8 p. 7 refs.

Dedicated multispectral image scanners of adequate sensitivity are capable of deriving various water parameters, provided suitable atmospheric-correction algorithms are available. During the second test flight of NASA's Space Shuttle, a modified version of NASA's ocean color scanner (OCS) will be flown above open ocean areas to test correction techniques that are being developed. The present paper deals with some results obtained with the OCS above the North Sea. V.P.

A79-53379 The significant application of LANDSAT data to monitoring of marine environment. H. Ochiai (Toba Merchant Marine College, Toba, Japan). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-255.* 14 p.

The paper deals with an analog and digital analysis of LANDSAT MSS data and analog analysis of LANDSAT RBV data and the application of these data to the monitoring of effluents from the Kumano, Yoshino, and Ishikari rivers. A classification of the water mass in the Seto Inland Sea is given. V.P.

A79-53591 * # Satellite altimetry. H. R. Stanley (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, Sept. 1979, p. 1418-1421. 45 refs.

The present status of the instrumentation and applications of satellite altimetry are reviewed. The earth-orbiting altimeters launched thus far are all basically conventional monostatic tracking radars which make three fundamental measurements: (1) time of arrival (altitude), (2) shape (waveform sample gates), and (3) amplitude (automatic gain control). A comparison of the fundamental characteristics of the present altimeter systems is given, along with evaluation of the preliminary results of altimeter data collected by Seasat-1. The application results described are mainly from the analysis of approximately 1/3 of the 2000 hours of altimeter data obtained from GEOS-3 through October 1978. V.T.

A79-53843 * On the remote detection of swell by satellite radar altimeter. C. L. Parsons (NASA, Wallops Flight Center, Wallops Island, Va.). *Monthly Weather Review*, vol. 107, Sept. 1979, p. 1210-1218. 10 refs.

A technique is developed and discussed which utilizes only significant wave height and wind speed measurements available from the GEOS-3 radar altimeter in real time to locate swell dominated regions of the earth's oceans. It is shown that reasonable agreement exists between the GEOS-3 map of the North Atlantic for 24 February 1976 and a map produced from hindcasted values of sea and swell obtained from the Special Projects Branch of the National Weather Service. Only data presently available from existing satellite radar altimeters are needed to map those areas of the oceans dominated by swell. It is concluded that the example given indicates that the decision boundary developed in this study to distinguish swell-dominated seas is a realistic choice. M.E.P.

N79-28645*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEASAT-A SATELLITE SCATTEROMETER MISSION SUMMARY AND ENGINEERING ASSESSMENT REPORT
James W. Johnson, Wendell H. Lee, and Leon A. Williams May 1979 146 p
(NASA-TM-80122) Avail: NTIS HC A07/MF A01 CSCL 08C

The SeaSat-A satellite was launched on June 26, 1978 and operated in orbit through October 9, 1978. The SeaSat-A satellite scatterometer ocean surface wind field sensor began taking data on July 10, 1978 with virtually continuous operation for 95-1/2 days. A review of mission events significant to the scatterometer and a report on the hardware and software engineering assessment are presented. G.Y.

N79-28863*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SEA-SURFACE TEMPERATURE AND SALINITY MAPPING FROM REMOTE MICROWAVE RADIOMETRIC MEASUREMENTS OF BRIGHTNESS TEMPERATURE
C. Blume Hans-Juergen, Bruce M. Kendall, and John C. Fedors Dec. 1977 29 p refs
(NASA-TP-1077; L-11763) Avail: NTIS HC A03/MF A01 CSCL 08J

A technique to measure remotely sea surface temperature and salinity was demonstrated with a dual frequency microwave radiometer system. Accuracies in temperature of 1 C and in salinity of part thousand for salinity greater than 5 parts per thousand were attained after correcting for the influence of extraterrestrial background radiation, atmospheric radiation and attenuation, sea-surface roughness, and antenna beamwidth. The radiometers, operating at 1.43 and 2.65 GHz, comprise a third-generation system using null balancing and feedback noise injection. Flight measurements from an aircraft at an altitude of 1.4 km over the lower Chesapeake Bay and coastal areas of the Atlantic Ocean resulted in contour maps of sea-surface temperature and salinity with a spatial resolution of 0.5 km.
Author

N79-30649# Ecole Polytechnique, Palaiseau (France).
DETERMINATION OF THE SURFACE TEMPERATURE OF THE SEA FROM RADIOMETRIC MEASUREMENT IN TWO ATMOSPHERIC WINDOWS [DETERMINATION DE LA TEMPERATURE DE SURFACE DE LA MER A PARTIR DE MESURES RADIOMETRIQUES DANS DEUX FENETRES ATMOSPHERIQUES]
D. Imbault, N. A. Scott, and A. Chedin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 321-333 refs In FRENCH

Avail: NTIS HC A99/MF A01

A parametric procedure for determining the temperature of the sea surface from differential radiometric measurements is presented. An ARIES (Surface Emission Infrared Radiation Analyzer) was employed using the atmospheric windows 10.5 to 12.5 and 7.9 to 9.6 micrometers. A set of computer programs were utilized (1) to extract spectroscopic data from data banks, (2) to compute the atmospheric transmission line by line with direct integration in altitude and in frequency, and (3) to calculate the radiancies (attenuated sun radiancy and atmospheric energy emission) from which the equivalent temperature, seen, by a spaceborne or airborne radiometer can be obtained. Computerized simulations were performed. Results show that the procedure is sufficiently simple for rapid computation of sea temperature, even for real-time operation. Author (ESA)

N79-30674# Barcelona Univ. (Spain). Dept. Termologia.
TECHNIQUE OF CALIBRATION ON REMOTE INFRARED SENSORS: APPLICATION TO OCEANOGRAPHIC PURPOSES
J. I. Jimenez, J. E. Llebot, C. Romeu-Nedwed (Inst. de Invest.), and A. Ballester (Inst. de Invest.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 527-532 refs Sponsored by Comm. Nacl. de Investigation del Espacio (CONIE) Original contains color illustrations

Avail: NTIS HC A99/MF A01

A calibration technique for an infrared remote sensing system on board a research aircraft is described. The equipment includes an infrared line scanner (IRLS) operating in the 8 to 14 micrometer range, a Barness precision radiometer thermometer (PRT), and Hasselblad cameras with infrared filters. For the sea data, a marine unit with in situ temperature sensing instrumentation continuously recorded sea surface temperature while a CASA 212 aircraft flew over it. The PRT data were used as a calibration for the IRLS. Both remotely sensed data from the IRLS, calibrated following our method, and sea information are in good agreement. Three examples are given: temperature pattern in front of a nuclear power plant; temperature pattern at the Ebro fan; determination and location of fresh water sources at the south of Peniscola. Author (ESA)

N79-30680# Canada Centre for Remote Sensing, Ottawa (Ontario).
BENEFITS OF SPACEBORNE REMOTE SENSING FOR OCEAN SURVEILLANCE
A. K. McQuillan and Donald J. Clough (Waterloo Univ.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 585-596 refs

Avail: NTIS HC A99/MF A01

Cost effectiveness and cost benefit studies were carried out by the Canada Center for Remote Sensing to assess the potential contribution and value of satellite data in meeting Canada's expanding ocean information requirements. The potential role of satellites as part of a network of platforms providing surveillance data including satellites, aircraft, data buoys, ships and coastal stations is discussed. Analysis indicates that, considering only Canadian and ocean areas of responsibility, a single surveillance satellite system (including ground data handling) would provide almost 10 times as much aerial coverage as an aircraft system having the same annual cost. Results of potential benefits studies of the effect of improved weather, ice, and sea state environmental information on offshore petroleum production and transportation, fishing, and coastal as well as offshore transport activities based on a scenario for growth rates in these activities are presented.
Author (ESA)

N79-30707# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN. VOLUME 2, PART 1: PHYSICAL, CHEMICAL, AND GEOLOGICAL PROPERTIES, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - May 1979
Robena J. Brown Jun. 1979 107 p Supersedes NTIS/PS-78/0563; NTIS/PS-77/0532; NTIS/PS-76/0468; NTIS/PS-75/446
(NTIS/PS-79/0585; NTIS/PS-78/0563; NTIS/PS-77/0532; NTIS/PS-76/0468; NTIS/PS-75/446) Avail: NTIS HC $28.00/MF $28.00 CSCL 08J

Studies on remote sensing methods as they apply to ocean temperature, sea ice, marine biology, and sound and light transmission are described. (This updated bibliography contains 99 abstracts, 24 of which are new entries to the previous edition). GRA

N79-30708# National Technical Information Service, Springfield, Va.
REMOTE SENSING OF THE OCEAN. PART 2: DYNAMICS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - May 1979
Robena J. Brown Jun. 1979 172 p Supersedes NTIS/PS-78/0564; NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75-447
(NTIS/PS-79/0586; NTIS/PS-78/0564; NTIS/PS-77/0533; NTIS/PS-76/0469; NTIS/PS-75/447) Avail: NTIS HC $28.00/MF $28.00 CSCL 08J

Studies on remote sensing methods as they apply to ocean currents, wind sediment transport, ocean waves, sea states, and water interactions are presented. The various techniques of measurement are described. (This updated bibliography contains 166 abstracts, 23 of which are new entries to the previous edition). GRA

N79-31714*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
FISHING CHARTS: A MODEL OF FISHING CHARTS UTILIZING OCEANOGRAPHIC DATA AND REMOTE SENSORS; AS APPLIED TO SARDINES, SARDINELLA BRASILIENSIS [CARTAS DE PESCA: UM MODELO DE CARTAS DE PESCA UTILIZANDO DADOS OCEANOGRAFICOS E DE SENSORIAMENTO REMOTO, APLICADO A SARDINHA, SARDINELLA BRASILIENSIS]
Nelson deJesusParada, Principal Investigator and Sydnea Maluf Feb. 1979 234 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10254; NASA-CR-158860; INPE-1423-TDL/03) Avail: NTIS HC A11/MF A01 CSCL 08A

N79-31720*# ECON, Inc., Princeton, N. J.
STATUS OF SEASAT COMMERCIAL DEMONSTRATION PROGRAM
Larrain Luckl and B. P. Miller, Principal Investigators Dec. 1978 86 p refs Workshop held at Pasadena, Calif., 31 Oct. - 1 Nov. 1978 Sponsored by NASA ERTS
(E79-10260; NASA-CR-158875; ECON-78-292) Avail: NTIS HC A05/MF A01 CSCL 17B

N79-31737*# ECON, Inc., Princeton, N. J.
SEASAT-A ASVT: COMMERCIAL DEMONSTRATION EXPERIMENTS. RESULTS ANALYSIS METHODOLOGY FOR THE SEASAT-A CASE STUDIES
28 Aug. 1979 62 p refs Revised
(Contract NASw-3047)
(NASA-CR-162162; DOC-79-292-2-Rev-2) Avail: NTIS HC A04/MF A01 CSCL 05B

The SEASAT-A commercial demonstration program ASVT is described. The program consists of a set of experiments involving the evaluation of a real time data distributions system, the SEASAT-A user data distribution system, that provides the capability for near real time dissemination of ocean conditions and weather data products from the U.S. Navy Fleet Numerical Weather Central to a selected set of commercial and industrial users and case studies, performed by commercial and industrial users, using the data gathered by SEASAT-A during its operational life. The impact of the SEASAT-A data on business operations is evaluated by the commercial and industrial users. The approach followed in the performance of the case studies, and the methodology used in the analysis and integration of the case study results to estimate the actual and potential economic benefits of improved ocean condition and weather forecast data are described. A.W.H.

N79-32611*# Lancaster Univ. (England).
SATELLITE MONITORING OF SEA SURFACE POLLUTION Progress Report, period ending 31 Aug. 1979
Gilbert Fielder and Duncan John Telfer, Principal Investigators 31 Aug. 1979 35 p refs Sponsored by NASA ERTS
(E79-10287; NASA-CR-162274; PR-2-13/P5) Avail: NTIS HC A03/MF A01 CSCL 13B

N79-32615# Environmental Research Inst. of Michigan, Ann Arbor. Applications Div.
BASIC REMOTE SENSING INVESTIGATION FOR COASTAL RECONNAISSANCE
D. Lyzenga, R. Shuchman, C. Davis, and G. Suits Jun. 1979 58 p refs Presented at the 13th Intern. Symp. on Remote Sensing of Environ., 23-27 Apr. 1979
(Contract N00014-78-C-0458)
(AD-A070770; ERIM-134400-7-T) Avail: NTIS HC A04/MF A01 CSCL 17/8

Contents: The use of Remote Sensing in the Determination of Beach Sand Parameters; Shallow-Water Reflectance Modeling with Applications to Remote Sensing of the Ocean Floor; and Evaluation of an Algorithm for Mapping Bottom Features Under a Variable Depth of Water. GRA

N79-33525*# Centre National d'Etudes Spatiales, Paris (France).
SEA SURFACE TEMPERATURE OF THE COASTAL ZONES OF FRANCE
P. Y. Deschamps (Lille Univ., France), M. Crepon (Museum National d'Histoire Naturelle, France), J. M. Monget (Ecole National Superieure des Mines de Paris), and F. Verger, Principal Investigators (Ecole Normale Superieure, France) Aug. 1979 39 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10293; NASA-CR-162324) Avail: NTIS HC A03/MF A01 CSCL 08J

N79-33779*# Mississippi State Univ., State College. Dept. of Geology and Geography.
BEACH EROSION CONTROL STUDY AT PASS CHRISTIAN
31 Dec. 1978 173 p refs
(Grant NGL-25-001-054)
(NASA-CR-162349) Avail: NTIS HC A08/MF A01 CSCL 08C

The methods of measuring the existence of erosion and the effects of sand stabilization control systems are described. The mechanics of sand movement, the nature of sand erosion, and the use of satellite data to measure these factors and their surrogates are discussed using the locational and control aspects of aeolian and litoral erosion zones along the sand beach of the Mississippi coast. The aeolian erosion is highlighted due to the redeposition of the sand which causes high cleanup costs, property damage, and safety and health hazards. The areas of differential erosion and the patterns of beach sand movement are illustrated and the use of remote sensing methods to identify the areas of erosion are evaluated. A.W.H.

06

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.

A79-44394 # **Soil water content estimation in fallow fields from airborne thermal scanner measurements.** J. Cihlar (Canada Centre for Remote Sensing, Ottawa, Canada), T. Sommerfeldt (Agriculture Canada, Lethbridge, Alberta, Canada), and B. Paterson (Alberta Agriculture, Irrigation Div., Lethbridge, Canada). *Canadian Journal of Remote Sensing*, vol. 5, May 1979, p. 18-32. 11 refs.

A79-48446 **Use of geoencoded aerial photography as a regional data base for water resources and environmental planning studies.** J. D. Fellows (Maryland, University, College Park, Md.) and J. C. Stewart (Maryland-National Capital Park and Planning Commission, Silver Spring, Md.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 1-8. (ASP 79-101)

A79-48447 * **The use of microwave approaches in hydrology.** T. J. Schmugge (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, Md.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 9-28. 29 refs.

Passive (radiometry) and active (radar) microwave approaches and their application to the study of the earth's hydrologic problem are examined and parameters including soil moisture content, snowpack properties, surface water area and the detection of precipitation overland are studied. Results show that these methods are capable of monitoring the moisture content in the surface layer of the soil in 5 cm thickness, detecting the presence of liquid water in snow and observing oil slicks. In addition, the methods make it possible to determine the water equivalent of snow packs and to delineate areas of rainfall over land. C.F.W.

A79-48448 **Remote sensing of suspended sediments in Lake Chicot, Arkansas.** J. C. Ritchie and F. R. Schiebe (U.S. Department of Agriculture, Sedimentation Laboratory, Oxford, Miss.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 29-39. (ASP 79-104)

An eighteen month study on Lake Chicot has shown that reflected solar radiation can be used to estimate the concentration of suspended solids in the surface water. Wavelength between 700 and 900 nm give the best estimates of the concentration of solids. This study shows that it should be possible to estimate the concentration of suspended solids in the surface water of Lake Chicot using remote sensing technology. Thus, Landsat images, aerial photography, or a sensor mounted directly over the water surface transmitting data to satellites for relay could give a reservoir manager valuable data about suspended sediment concentration which would be useful in the decisionmaking process on how to route water to a reservoir. (Author)

A79-48449 **Trophic classification of Tennessee Valley area reservoirs.** F. L. Scarpace (Wisconsin, University, Madison, Wis.), D. Malone, D. Meinert, and A. Voss (Tennessee Valley Authority, Chattanooga, Tenn.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 40-55. 20 refs. (ASP 79-105)

The study evaluates the application of Landsat multispectral scanner (MSS) imagery for assessing the trophic status of the major lakes and reservoirs in the Tennessee Valley. Landsat MSS data from two different dates were extracted from computer tapes using a semiautomated digital data handling and analysis system at the University of Wisconsin-Madison. These data were correlated with water quality data collected by the Environmental Protection Agency during the 1973 National Eutrophication Survey (NES) at 15 reservoirs in the Tennessee Valley. Significant correlations (larger than 0.85) between the MSS statistics and many trophic indicators were identified. Regression models were developed to predict from the MSS data individual indicators of trophic condition (Secchi disk depth, conductivity, and total phosphorus) as well as an overall trophic state index. To illustrate the spatial variations within the reservoirs, a table-look-up elliptical classification was used in conjunction with each reservoir's trophic state index to classify each reservoir on a pixel-by-pixel basis. (Author)

A79-48450 * **A methodology for dam inventory and inspection with remotely sensed data.** J. P. Berger, W. R. Philipson, and T. Liang (Cornell University, Ithaca, N.Y.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 56-67. 5 refs. Research supported by the U.S. Department of the Interior; Grant No. NGL-33-010-171. (ASP 79-106)

A methodology is presented to increase the efficiency and accuracy of dam inspection by incorporating remote sensing techniques into field-based monitoring programs. The methodology focuses on New York State and places emphasis on readily available remotely sensed data - aerial photographs and Landsat data. Aerial photographs are employed in establishing a state-wide data base, referenced on county highway and U.S. Geological Survey 1:24,000 scale, topographic maps. Data base updates are conducted by county or region, using aerial photographs or Landsat as a primary source of information. Field investigations are generally limited to high-hazard or special problem dams, or to dams which cannot be assessed adequately with aerial photographs. Although emphasis is placed on available data, parameters for acquiring new aircraft data for assessing dam condition are outlined. Large scale (1:10,000) vertical, stereoscopic, color-infrared photography, flown during the spring or fall, is recommended. (Author)

A79-48456 * **A thermal scanning study of coastal upwelling in Lake Superior.** F. L. Scarpace, T. Green, III, and R. P. Madding (Wisconsin, University, Madison, Wis.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 349-378. 10 refs. NASA-supported research; NSF Grant No. 33140. (ASP 79-147)

The use of a thermal scanner to monitor the time evolution of the thermal structure of the coastal waters in Lake Superior during an upwelling event is described. Mosaics of thermal imagery from ten different times are described. Qualitative descriptions of the imagery give insight into the upwelling event. Recommendations for future use of a thermal scanner to monitor an upwelling event are discussed. (Author)

A79-48468 * **Developing in situ flood estimators using multi-date Landsat imagery.** J. N. McLeester and W. R. Philipson (Cornell University, Ithaca, N.Y.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24,

1979, Proceedings. Volume 2. (A79-48445 21-43) Falls Church, Va., American Society of Photogrammetry, 1979, p. 625-637. Grant No. NGL-33-010-171. (ASP 79-211)

Landsat satellite imagery is being used as the primary source of information on flooding in the Black River Basin of northern New York State. Landsat images (Band 7) depicting flood conditions during several flood seasons since 1973 were obtained for analysis. Visual interpretation of these images is providing the basis for quantitatively relating in situ measurements of river discharge with the total area and geographic locations of inundation. This, in turn, will provide real-time estimation of flood losses over the entire river basin. This practical and inexpensive approach can provide sufficiently reliable information, and is applicable in other similar river basins. (Author)

A79-48469 Digital Landsat processing to assess New York Bight acid dump. R. M. Hord (Institute for Advanced Computation, Moffett Field, Calif.) and R. T. Macomber (Earth Satellite Corp., Washington, D.C.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 638-661. (ASP 79-212)

To show the benefits of remote sensing data acquisition applied to studies of the coastal marine ecosystem in the New York Bight area, and the benefits of remote sensing based information products which can be provided to area users, a demonstration of using remote sensor records for the study of circulation, dispersion, and related environmental characteristics is undertaken. A major objective was to determine the dye implant specifications necessary to create a streamer large enough and bright enough to be imaged by Landsat. The combination of various data sources contributed to a basic understanding of the interactions of the major New York Bight current components including the Hudson and Raritan River discharges, flood and ebb tidal currents, wind-driven currents, and the drift and dispersion rates of the acid dumps. The digital processing of the Landsat data succeeded in detecting the dye implant locations. S.D.

A79-49347 * # Remote sensing of phytoplankton density and diversity in Narragansett Bay using an airborne fluorosensor. F. H. Farmer, C. A. Brown, Jr., O. Jarrett, Jr., J. W. Campbell, and W. L. Staton (NASA, Langley Research Center, Hampton, Va.). *International Symposium for Remote Sensing of Environment, 13th, Ann Arbor, Mich., Apr. 23-27, 1979, Paper.* 14 p. 12 refs.

An aircraft-borne remote system is presented that utilizes narrow-band light from multiple dye lasers to excite selected algae photopigments and then measures the resultant flourescence emitted from chlorophyll a at 685 nm. Tests were conducted with both pure and mixed cultures of marine algae from a series of field tests taken from piers and bridges of Narragansett Bay, and a prototype remote fluorosensor was flown over the Bay during the 1978 winter-spring diatom bloom. Remote fluorescence obtained at hover points over sea-truth stations showed correlations with in situ fluorescence, total chlorophyll a, and cell count. It was concluded that the ratio of remote fluorescence to direct chlorophyll a concentration was less variable than expected, and the distribution of total chlorophyll a between two major photoplankton color groups showed three distinct areas, within the Bay, of green and golden-brown species. C.F.W.

A79-53581 * Remote sensing of snow and ice. A. Rango (NASA, Goddard Space Flight Center, Greenbelt, Md.). *(International Union of Geodesy and Geophysics, General Assembly, 17th, Canberra, Australia, Dec. 2-15, 1979.) Reviews of Geophysics and Space Physics,* vol. 17, Sept. 1979, p. 1262-1264, 1282-1288. 255 refs.

This paper reviews remote sensing of snow and ice, techniques for improved monitoring, and incorporation of the new data into forecasting and management systems. The snowcover interpretation of visible and infrared data from satellites, automated digital methods, radiative transfer modeling to calculate the solar reflectance of snow, and models using snowcover input data and elevation zones for calculating snowmelt are discussed. The use of visible and near infrared techniques for inferring snow properties, microwave monitoring of snowpack characteristics, use of Landsat images for collecting glacier data, monitoring of river ice with visible imagery from NOAA satellites, use of sequential imagery for tracking ice flow movement, and microwave studies of sea ice are described. Applications of snow and ice research to commercial use are examined, and it is concluded that a major problem to be solved is characterization of snow and ice in nature, since assigning of the correct properties to a real system to be modeled has been difficult. A.T.

A79-53884 * Theory and experiment for passive microwave remote sensing of snowpacks. J. A. Kong, R. Shin, L. Tsang (MIT, Cambridge, Mass.), and J. C. Shiue (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Geophysical Research,* vol. 84, Sept. 10, 1979, p. 5669-5673. 7 refs. Contracts No. NAS5-24139; No. F08635-78-C-0115.

Both the theory and experiment for the passive remote sensing of snow with microwave radiometers have been studied. The volume scattering effects of snow are accounted for by incorporating Mie scattering theory into a radiative transfer model. The theory is applied to the interpretation of experimental data obtained from various snow measurements. The spectral and angular dependences of the brightness temperatures are illustrated and show good agreement between the theory and experiment. Brightness temperatures as a function of snow depths are also interpreted and discussed. It is observed that as the snow depth increases, the brightness temperature increases when the subsurface is an aluminum plate due to the fact that the plate is cold and snow absorption induces a brightening effect and the brightness temperature decreases when the subsurface is soil due to the fact that snow scattering induces darkening effects. (Author)

N79-28634*# Environmental Research and Technology, Inc., Concord, Mass.

INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, Apr. - Jun. 1979

James C. Barnes, Principal Investigator 6 Jul. 1979 5 p ERTS

(Contract NAS5-24316)

(E79-10213; NASA-CR-158685; QPR-7) Avail: NTIS HC A02/MF A01 CSCL 08L

N79-28794*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

A REGRESSION TECHNIQUE FOR EVALUATION AND QUANTIFICATION FOR WATER QUALITY PARAMETERS FROM REMOTE SENSING DATA

Charles H. Whitlock and Chin Y. Kuo (Old Dominion Univ., Norfolk, Va.) May 1979 17 p refs Presented at 13th Intern. Symp. on Remote Sensing of the Environ., Ann Arbor, Mich., 23-27 Apr. 1979

(NASA-TM-80101) Avail: NTIS HC A02/MF A01 CSCL 13B

The objective of this paper is to define optical physics and/or environmental conditions under which the linear multiple-regression should be applicable. An investigation of the signal-response equations is conducted and the concept is tested by application to actual remote sensing data from a laboratory experiment performed under controlled conditions. Investigation of the signal-response equations shows that the exact solution for a number of optical physics conditions is of the same form as a linearized multiple-regression equation, even if nonlinear contributions from surface reflections, atmospheric constituents, or other water pollutants are included. Limitations on achieving this type of solution are defined. F.O.S.

N79-28864*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
INVESTIGATION OF EFFECTS OF BACKGROUND WATER ON UPWELLED REFLECTANCE SPECTRA AND TECHNIQUES FOR ANALYSIS OF DILUTE PRIMARY-TREATED SEWAGE SLUDGE
Charles H. Whitlock, J. W. Usry, William G. Witte, Franklin H. Farmer, and E. A. Gurganus Aug. 1979 36 p refs
(NASA-TP-1446; L-12694) Avail: NTIS HC A03/MF A01 CSCL 08J

In an effort to improve understanding of the effects of variations in background water on reflectance spectra, laboratory tests were conducted with various concentrations of sewage sludge diluted with several types of background water. The results from these tests indicate that reflectance spectra for sewage-sludge mixtures are dependent upon the reflectance of the background water. Both the ratio of sewage-sludge reflectance to background-water reflectance and the ratio of the difference in reflectance to background-water reflectance show spectral variations for different turbid background waters. The difference in reflectance in the only parameter considered. Author

N79-29567 Delaware Univ., Newark.
SPECTRAL REFLECTANCE OF TIDAL WETLAND PLANT CANOPIES AND IMPLICATIONS FOR REMOTE SENSING Ph.D. Thesis
David Scott Bartlett 1979 253 p
Avail: Univ. Microfilms Order No. 7918797

In order to assess the potential for extending quantitative remote sensing capabilities into collection of data on tidal wetlands an investigation was carried out in Delaware with particular emphasis on application of Landsat/MSS data. Spectral contrast between S. alterniflora and Salt Hay (a mixed category containing S. patens and D. spicata) depended primarily on species-specific differences in the amount and growth form of vegetation. Contrast was seasonally variable and was controlled by a variety of factors related to canopy composition and structure. It was determined that potential exists for use of spectral data in estimating mean green and total biomass for areas of S. alterniflora using either hand-held instruments in the field or Landsat/MSS data. Dissert. Abstr.

N79-30594*# Great Lakes Basin Commission, Ann Arbor, Mich.
STATE-REGIONAL FUTURE GREAT LAKES REGION: THE 1975 NATIONAL WATER ASSESSMENT
Jul. 1976 179 p refs Sponsored by NASA ERTS
(E79-10233; NASA-CR-158797) Avail: NTIS HC A09/MF A01 CSCL 08H

N79-30607*# 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, Jr., and Michael Matson 17 Jul. 1979 11 p ERTS
(NASA Order S-40229-B)
(E79-10248; NASA-CR-158794) Avail: NTIS HC A02/MF A01 CSCL 08M

N79-30608# RAND Corp., Santa Monica, Calif.
ADJUSTMENT AND VERIFICATION OF THE RAND-DELTA 2 MODEL
A. Langerak (Delft Hydraulics Lab.), M. A. M. Deras (Rijkswaterstaat), and J. J. Leendertse Sep. 1978 24 p refs Presented at the 16th Intern. Conf. on Coastal Eng., Hamburg, 1978
(P-6247) Avail: NTIS HC A02/MF A01

In the mid-1950s the Netherland government embarked on a massive dike and dam construction program, called the Delta Plan. Its purpose was to enhance protection from floods caused by the North Sea in the estuaries of the Rhine, Meuse and Scheldt. In support of engineering and environmental studies related to the construction and operation of a storm barrier (revised plan), a large numerical model was developed which covers the Eastern and Western Scheldt and the adjacent offshore area. The section of the North Sea which is included in the model is about 120 km long and 30 kn wide, running from Blankengerghe in Belgium to Scheveningen in the Netherlands. Topics discussed include: (1) model formulation; (2) computation approximation; (3) modeling system; (4) aspects of tidal wave propagation in the model area; (5) submodels; and (6) model adjustment and verification. G.Y.

N79-30611*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPARATIVE STUDY OF MICROWAVE RADIOMETER OBSERVATIONS OVER SNOWFIELDS WITH RADIATIVE TRANSFER MODEL CALCULATIONS
A. T. C. Chang and J. C. Shiue May 1979 31 p refs Submitted for publication
(NASA-TM-80267) Avail: NTIS HC A03/MF A01 CSCL 08L

Truck mounted microwave instrumentation was used to study the microwave emission characteristics of the Colorado Rocky Mountain snowpack in the vicinity of Fraser, Colorado during the winter of 1978. The spectral signatures of 5.0, 10.7, 18, and 37 GHz radiometers with dual polarization were used to measure the snowpack density and temperature profiles, rain profile, and free water content. These data were compared with calculated results based on microscopic scattering models for dry, surface melting, and very wet snowpacks. K.L.

N79-30617# Centre National d'Etudes Spatiales, Toulouse (France).
ESTIMATION OF IRRIGATED SURFACES IN THE SEINE-NORMANDY BASIN [ESTIMATION DES SURFACES IRRIGUEES DU BASSIN SEINE-NORMANDIE]
G. Saint, G. Bediot (Agence Financiere de Bassin Seine-Normandie, Paris), and D. Clergeot (Univ. of Paris 1) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 41-48 In FRENCH

Avail: NTIS HC A99/MF A01

A feasibility study for the estimation of irrigated surfaces in the Seine-Normandy basin was made from numerically treated LANDSAT satellite images. Results show that precision in measuring irrigated surfaces is better than that demanded by the regional agency. Nevertheless, an extension to the whole basin was limited by image availability. Author (ESA)

N79-30618# Waterloo Univ. (Ontario).
APPLICATION OF REMOTE SENSING TO THE ASSESSMENT OF WATER RESOURCES
S. I. Solomon and W. Klohn *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 49-61 refs Sponsored in part by WMO

Avail: NTIS HC A99/MF A01

A state of the art review of the applications of spatial remote sensing techniques for the assessment of the variables affecting the water cycle is presented. Emphasis is on the hydrological aspects and particularly the problems of flooding, snow, and ice. The application of remote sensing techniques to assess the geomorphical characteristics of river basins is also dealt with. A brief discussion of the future development needs of hydrologists and water resources managers is included.
Author (ESA)

N79-30619# Ecole Superieure de Genie Civil, Bucharest (Rumania).
RESULTS OBTAINED IN THE EVALUATION OF THE LOWER DANUBE BASIN AND DANUBE DELTA BY TELEDETECTION. TECHNOLOGY ADAPTED TO CURRENTLY AVAIL-

ABLE EQUIPMENT [RESULTATS OBTENUS DAN L'INVENTAIRE DES RESSOURCES DU BASSIN INFERIEUR DU DANUBE ET DANS LE DELTA DU DANUBE PAR TELEDETECTION; TECHNOLOGIES ADAPTEES AU CAS DES MOYENS RESTREINTS]

N. Oprescu and E. Mandescu (Comm. Roumaine de l'Activite Spatiale) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 63-76 refs In FRENCH

Avail: NTIS HC A99/MF A01

A teledetection technique limited to the use of available equipment is presented. A mixed analog-digital data processing system was used, working with successive approximations and starting with a digital treatment. Data from the LANDSAT satellite were employed in monitoring specific variables in the domains of agriculture, hydrology, pollution, and geology. It is concluded that multispectral data processing must be digital and that teledetection will be helpful in predicting crop yield, pollution, water reserves, flooding, and other important environmental parameters. Conditions necessary to perfect the methods are discussed. Author (ESA)

N79-30620# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Munich (West Germany).

MASS APPEARANCE OF BLUE GREEN ALGAE IN THE BALTIC SEA: EVALUATION OF MULTISPECTRAL LANDSAT SCENES BY IMAGE PROCESSING

K. A. Ulbricht, D. Schmidt (Ger. Hydrographic Inst.), and U. Horstmann (Kiel Univ.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 77-89 refs

Avail: NTIS HC A99/MF A01

Accumulation of blue green algae, Nodularia spumigena and Alphanisomenon flos aquae, was detected from digital image processing of LANDSAT scenes of the Baltic sea. White traces appear in some spectral regions (MSS 4 and MSS 5), which are shown to be due to algae. Blue green algae participate in the fixing of nitrogen from the air and its abnormal growth is probably related to an increase in phosphate concentrations due to sewage discharge having a high phosphorus content in the regions near the sea coast. It is also concluded that space detected traces are to be complimented by in situ measurements in order to get reliable quantitative information. Author (ESA)

N79-30623# Operation Pilote Interministerielle de Teledetection, Paris (France).

TELEDETECTION AND WATER RESOURCES [TELEDETECTION ET RESSOURCES EN EAU]

Claudine Valerio and Yves Vuillaume *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 97-102 refs In FRENCH

Avail: NTIS HC A99/MF A01

The role of interministerial collaboration in the Teledetection Interministerial Pilot Operation is pointed out and the main phases of the program are described. Two examples involving water pollution are given, covering the subjects of aircraft monitoring with teledetection of hydrocarbon pollution on the sea and simulation of sea water pollution by Rhodamine diffusion in the Propiano bay. Author (ESA)

N79-30683# Army Construction Engineering Research Lab., Champaign, Ill.

BASIC ANALYTICAL MODEL FOR ENVIRONMENTAL IMPACT ASSESSMENT OF SURFACE WATER RESOURCES Final Report

Robert E. Riggins, V. Kothandaraman, and Bruce C. Goettel May 1979 41 p refs

(DA Proj. 4A7-62720-A-896)

(AD-A069977; CERL-TR-N-64) Avail: NTIS HC A03/MF A01 CSCL 08/8

This report discusses and provides user instructions for a computerized water quality model that will help satisfy the Army environmental planner's need for quantitative information on dissolved oxygen resources in a stream caused by new Army projects or activities. The information provided by output from this model will be useful for providing data for impacts on the dissolved oxygen content of a stream for a single-reach, single-point-source pollutant inflow situation with steady-flow conditions. Three subprograms within the model are used to calculate the impact of carbonaceous and nitrogenous waste discharges on the oxygen resources in a receiving water body, the ultimate biological oxygen demand and deoxygenation coefficients for both carbonaceous and nitrogenous waste discharges, and annual variations in temperature of a water body. Author

N79-30704# National Environmental Satellite Service, Washington, D. C.

SATELLITES AS AN AID TO WATER RESOURCE MANAGERS

D. F. McGinnis, Jr., R. A. Scofield, S. R. Schneider, and C. P. Berg Apr. 1979 25 p refs Presented at Convention and Exposition of Am. Soc. of Civil Engr., Boston, 2-6 Apr. 1979

(PB-296048/2; NOAA-79040901; ASCE/Preprint-3486) Avail: NTIS HC A02/MF A01 CSCL 04B

Examples of satellite data applications to water resource problems are presented to draw attention to a current source of data often overlooked by water managers. Although spatial and temporal constraints exist, satellite data can contribute useful information toward solutions of mesoscale and macroscale water resource problems; e.g., areal snow cover determinations, river ice, flood extent, and short-term precipitation estimates. GRA

N79-31713*# South Dakota State Univ., Brookings. Remote Sensing Inst.

HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUND WATER POLLUTION Interim Report, Apr. - Jun. 1979

Donald G. Moore, Principal Investigator and J. Heilman Jun. 1979 3 p ERTS

(Contract NAS5-24206)

(E79-10253; NASA-CR-158859; SDSU-RSI-79-13) Avail: NTIS HC A02/MF A01 CSCL 08H

N79-31724*# Pakistan Water and Power Development Authority, Lahore.

WATER RESOURCES INVESTIGATION IN PAKISTAN WITH THE HELP OF ERTS IMAGERY, SNOW SURVEYS, 1975-1976

Asrar Ahmad Qureshy and Mohammed Umar, Principal Investigators Mar. 1978 92 p Sponsored by NASA ERTS

(E79-10265; NASA-CR-157455) Avail: NTIS HC A05/MF A01 CSCL 08H

N79-31728*# Texas A&M Univ., College Station. Remote Sensing Center.

MEASUREMENT OF SOIL MOISTURE TRENDS WITH AIRBORNE SCATTEROMETERS Progress Report, 1 Jun. 1978 - 1 Jun. 1979

Bruce J. Blanchard, Principal Investigator 1 Jun. 1979 15 p ERTS

(Grant NsG-5134)

(E79-10270; NASA-CR-162092; RSC-3458-3) Avail: NTIS HC A02/MF A01 CSCL 08M

N79-31729*# Department of Agriculture, Phoenix, Ariz. Water Conservation Lab.
HCMM HEAT CAPACITY MAPPING MISSION Quarterly Progress Report, 1 May - 31 Jul. 1979
Ray D. Jackson, Principal Investigator 31 Jul. 1979 1 p ERTS
(NASA Order S-40255-B)
(E79-10272; NASA-CR-162101) Avail: NTIS HC A02/MF A01 CSCL 05B

N79-31732*# Bern Univ. (Switzerland). Dept. of Geography.
TOPOCLIMATOLOGICAL AND SNOWHYDROLOGICAL SURVEY OF SWITZERLAND Progress Report
Matthias Winiger, Principal Investigator Aug. 1979 5 p Sponsored by NASA ERTS
(E79-10275; NASA-CR-162096; PR-1) Avail: NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results. The chosen time of overflight of HCMM seems to be ideal for the study of basic climatological events. Nocturnal temperature inversion zones are easily detectable and their dependency on the relief is clearly seen. Especially the alpine valleys show a very differentiated pattern of cold lakes, separated by warmer zones as a consequence of rock and forrest barriers or changes in the valley profile. Wet areas are usually colder than dry parts under comparable topographic conditions. Even very small topographic obstacles are able to block up the flow of cold air masses (or ground water flow). Urban areas are clearly detectable. Differences to the surface temperatures of surrounding rural land are much more significant during day-time (mainly during the summer months). Fog layers are clearly defined in the visible channel (day-time), but much more difficult to identify in the IR (mainly during the night). There is not a fundamental difference to NOAA-analysis of cloud systems. The most important advantage is the better detectability of convective cloud systems (small cumulus clouds).

N79-32603*# National Environmental Satellite Service, Washington, D. C.
SELECTED HYDROLOGIC APPLICATIONS OF LANDSAT-2 DATA: AN EVALUATION Final Report
Donald R. Wiesnet, David F. McGinnis, Jr., and Michael Matson, Principal Investigators 1978 205 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-3991)
(E79-10264; NASA-CR-162098) Avail: NTIS HC A10/MF A01 CSCL 08H

The author has identified the following significant results. Estimates of soil moisture were obtained from visible, near-IR gamma ray and microwave data. Attempts using GOES thermal-IR were unsuccessful due to resolutions (8 km). Microwaves were the most effective at soil moisture estimates, with and without vegetative cover. Gamma rays provided only one value for the test site, produced by many data points obtained from overlapping 150 meter diameter circles. Even though the resulting averaged value was near the averaged field moisture value, this method suffers from atmospheric contaminants, the need to fly at low altitudes, and the necessity of prior calibration of a given site. Visible and near-IR relationships are present for bare fields but appear to be limited to soil moisture levels between 5 and 20%. The densely vegetated alfalfa fields correlated with near-IR reflectance only; soil moisture values from wheat fields showed no relation to either or near-IR MSS data.

N79-32609*# Telespazio, S.p.A., Rome (Italy).
EVALUATION OF WATER TRANSPARENCY MEASUREMENTS DERIVED FROM LANDSAT DATA AND GROUND TRUTH: AN EXAMPLE FROM THE TIBER RIVER MOUTH
Angelo Zandonella, Principal Investigator 1979 18 p refs Presented at 4th UN Intern. Training Course on the Application of Remote Sensing Techniques to Fisheries in Cooperation with FAO and Italian Government, Rome, May 1979 Sponsored by NASA ERTS
(E79-10285; NASA-CR-162271) Avail: NTIS HC A02/MF A01 CSCL 08H

N79-33524*# Louisiana State Univ., Baton Rouge. Div. of Engineering Research.
INTERPRETATION OF REMOTE SENSING DATA IN THE BAYOU LAFOURCHE DELTA OF SOUTH LOUISIANA Final Report, 1 Jun. 1972 - 15 Aug. 1979
C. A. Whitehurst, Principal Investigator Sep. 1979 34 p refs ERTS
(Grant NGL-19-001-105)
(E79-10291; NASA-CR-162285) Avail: NTIS HC A03/MF A01 CSCL 05B

N79-33527*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, 1 Jul. - 30 Sep. 1979
James C. Barnes, Principal Investigator 10 Oct. 1979 5 p ERTS
(Contract NAS5-24316)
(E79-10295; NASA-CR-162326; QPR-8) Avail: NTIS HC A02/MF A01 CSCL 08H

N79-33534# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SNOWPACK OPTICAL PROPERTIES IN THE INFRARED
Roger H. Berger May 1979 16 p refs
(DA Proj. 4A7-62730-AT-42)
(AD-A071004; CRREL-79-11) Avail: NTIS HC A02/MF A01 CSCL 08/12

A theory of the optical properties of snow in the 2-20 microns region of the infrared has been developed. Using this theory it is possible to predict the absorption and scattering coefficients and the emissivity of snow, as a function of the snow parameters of grain size and density, for densities between 0.17 and 0.4 g/cu. cm. The absorption and scattering coefficients are linearly related to the density and inversely related to the average grain size. The emissivity is independent of grain size and exhibits only a weak dependence upon density. GRA

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07
DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing, computer technology, satellite and aircraft hardware, and imagery.

A79-44126 **Aerial and spaceborne observations of the earth: Computer processing of video data (Aerokosmicheskie issledovaniia zemli: Obrabotka videoinformatsii na EVM).** Edited by V. G. Zolotukhin. Moscow, Izdatel'stvo Nauka, 1978. 246 p. In Russian.

The methods and algorithms used to process video data from aerospace platforms are discussed. Techniques used in coordinate gridding and geometric transformation of imagery from airplane- and satellite-based scanners are described, together with the classification of multispectral measurements. Special attention is given to methods of thematic analysis for the evaluation of earth resources. C.K.D.

A79-44127 # **The problem of processing and utilizing spacecraft observations in studies of the earth (O probleme obrabotki i ispol'zovaniia kosmicheskoi informatsii v issledovaniiakh zemli).** Ia. L. Ziman and G. A. Avanesov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 5-11. In Russian.

The specific characteristics of space-based observations are outlined, and difficulties encountered in their processing and interpretation are examined. The basic steps in processing data from spacecraft scanners are described. C.K.D.

A79-44131 # **Compression of multispectral video data (O szhatii mnogozonal'noi videoinformatsii).** Iu. M. Shtar'kov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 36-55. 7 refs. In Russian.

The characteristics of multispectral video data are examined together with the most adequate performance criterion for the description of these data by different problems in thematic processing. General methods of discrete description of an uninterrupted series of measurements carried out at a constant rate are presented, and a broad class of adaptive procedures for fixed-rate encoding is discussed. The application of these methods to compression of remote sensing data is described, and a preliminary assessment of the efficacy of these methods for compression of multispectral video data is given. C.K.D.

A79-44135 # **The discrimination of natural features in multispectral sensing (Raspoznavanie prirodnykh obrazovanii pri mnogospektral'nom zondirovanii).** V. A. Krasikov and Iu. M. Shtar'kov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 87-107. In Russian.

Different formulations of the problem of discrimination in processing multispectral observations are examined. A random vector of measurement model is developed, and the selection of discrimination regions on the basis of 'training' samples is discussed. Interfering parameters are classified, and their effect on the accuracy of discrimination is considered. C.K.D.

A79-44136 # **Discrimination of natural targets according to their spectral features (Raspoznavanie prirodnyk ob'ektov po spektral'nym priznakam).** I. G. Rozanov and A. P. Tishchenko. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 107-112. In Russian.

A method of discriminating natural targets on the basis of their spectral features is presented. The approach is based on the utilization of a priori information on the spectral characteristics of the desired class of targets and application of multivariable statistical, analysis techniques. Some results obtained by application of this method in the discrimination of forest tracts from satellite imagery are discussed. C.K.D.

A79-44137 # **Cluster analysis methods for thematic processing of multizone video data (Metody klasternogo analiza v zadachakh tematicheskoi obrabotki mnogozonal'noi videoinformatsii).** V. A. Krasikov, M. V. Khatuntseva, and Iu. M. Shtar'kov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 112-126. 5 refs. In Russian.

The fundamental principles of cluster analysis are discussed, and the different types of cluster procedures are examined. Results obtained with several cluster analysis algorithms used in the classification of measurements from 4- and 6-zone scanners are described. C.K.D.

A79-44144 # **Parametric methods for the identification of earth resources from multispectral data (Parametricheskie metody raspoznavaniia prirodnykh obrazovanii po materialam mnogozonal'nykh s'emok).** V. A. Krasikov, M. V. Khatuntseva, and Iu. M. Shtar'kov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 167-176. In Russian.

A79-44149 # **Use of multispectral photography for studying the dynamics of vegetation (Primenenie mnogozonal'nogo fotografirovaniia dlia izucheniia dinamiki rastitel'nykh ob'ektov).** V. A. Kottsov. In: Aerial and spaceborne observations of the earth: Computer processing of video data. Moscow, Izdatel'stvo Nauka, 1978, p. 207-212. In Russian.

A79-44397 # **Geometric correction, registration, and resampling of Landsat imagery.** S. Shlien (Canada Centre for Remote Sensing, Ottawa, Canada). *(Canadian Remote Sensing Society, Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb. 21, 1977.) Canadian Journal of Remote Sensing,* vol. 5, May 1979, p. 74-89. 29 refs.

The geometric distortions introduced by the Landsat imaging system are well known. However, the satellite does not provide attitude information with sufficient accuracy to determine the geographical position of each picture element or pixel. Thus, to map the data onto the desired space it is necessary to model a geometric transformation from a set of ground control points. Transformation of a Landsat image to a UTM co-ordinate grid to 50 meters accuracy (rms) under optimum conditions had been demonstrated. The main factor limiting the ultimate accuracy of the corrected image is the precision to which ground control points on the UTM maps can be mapped to pixels in the Landsat image. Digital correlation methods have been used successfully in image-to-image registration to improve the accuracy by 25%, but for map registration, this requires accurately located ground control photographic chips. Various resampling techniques including Lagrange polynomials are described. The errors introduced by these resampling methods are investigated both theoretically and experimentally. (Author)

A79-45125 **Photointerpretation and multispectral classification for land use mapping (Luftbildinterpretation und multispektrale Klassifizierung zur Gewinnung von Landnutzungsdaten).** F. Quiel (Karlsruhe, Universität, Karlsruhe, West Germany). *Bildmes-*

sung und Luftbildwesen, vol. 47, July 1, 1979, p. 107-117. 5 refs. In German.

The interpretation of aerial photographs and computer aided classification of multispectral scanner data are compared for a land use inventoy. Problems and necessary working and computer time are demonstrated with the results from three test areas near Freiburg, West Germany. A cost estimation for an inventory of Baden-Württemberg indicates that a computer aided classification of Landsat data would be the most favorable solution despite some disadvantages such as somewhat limited precision. M.E.P.

A79-47555 Planimetric restitution of Landsat imagery using the Zeiss stereotop. E. Clerici and I. A. Harley (Queensland, University, Brisbane, Australia). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Aug. 1979, p. 1123-1127. 10 refs.

A method of plotting planimetric detail using a Zeiss Stereotop is described. The method is based on a general affine transformation which has been shown to give accuracies of the same order of magnitude as the normal element of Landsat. Attention is given to practical implementation and restitution in three steps, inner-, relative-, and absolute orientation. Test results are given and it is concluded that because of the method's simplicity and the wide availability of the Zeiss Stereoscope, it should be particularly attractive to earth scientists. M.E.P.

A79-48445 American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volumes 1 & 2. Falls Church, Va., American Society of Photogrammetry, 1979. Vol. 1, 410 p.; vol. 2, 413 p. Price of two volumes, members, $7.50; nonmembers, $12.50.

The proceedings include such topics as the use of geoencoded aerial photography as a regional data base for water resources and environmental planning studies, a methodology for dam inventory and inspection with remotely sensed data, the potential for near ultraviolet spectral data to delineate geological materials, and map characteristics of Landsat mosaics. Remote sensing of suspended sediments in Lake Chicot, Arkansas, trophic classification of Tennessee Valley area reservoirs, and a thermal scanning study of coastal upwelling in Lake Superior are considered. Attention is given to a perceptually-based texture feature extractor for similarity measurements of imagery data and determination of lens falloff through digital analysis of photographic imagery. V.T.

A79-48453 * Map characteristics of Landsat mosaics. A. L. Zobrist and N. A. Bryant (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 260-273. 13 refs. Contract No. NAS7-100. (ASP 79-131)

Map characteristics of the Landsat mosaics developed at JPL are considered. Procedures for digital mosaicking of Landsat frames to standard map projections were used to mosaic at full resolution ten scenes over the California desert region and twenty-one scenes over Arizona. The procedures are analyzed for horizontal positioning error (global and local) and the potential for classification error associated with the adjustment of brightness of Z values between frames; the use of this technology for the mapping of extensive features is discussed. Mosaicking facilities, techniques, mapping accuracy, and thematic mapping characteristics are described. A comparative analysis of Landsat mosaicking technology developed at Goddard Space Flight Center, IBM Gaithersburg, and USGS Flagstaff is made, and suggestions are given for algorithm development to improve systems capacity and ability to handle a variety of cases. A.T.

A79-48455 Principal components analysis and canonical analysis in remote sensing. S. K. Jenson and F. A. Waltz (Technicolor Graphic Services, Inc., EROS Data Center, Sioux Falls, S. Dak.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 337-348. 5 refs. U.S. Geological Survey Contract No. 14-08-0001-16439. (ASP 79-143)

During 1977, principal components analysis and canonical analysis programs were implemented and tested at the EROS Data Center. The present paper gives mathematical definitions of both procedures, describes the effects the procedures have on imaged data, and suggests circumstances under which the techniques can be most effectively applied to analysis of aircraft and satellite data. B.J.

A79-48466 Ground settlement monitoring by digital photogrammetry. J. K. Crossfield (Arkansas, University, Fayetteville, Ark.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 600-606. 5 refs. (ASP 79-207)

A semi-automated digital photogrammetric process is described that facilitates ground settlement or subsidence monitoring. Relatively oriented stereomodels from a series of overlapping aerial photographs are adjusted to a common coordinate system by manipulation of model and state plane coordinates of imaged control points. Points chosen for settlement study in an initial stereomodel are also converted into the common coordinate system. These points are quite precisely located, sampled and adjusted in later date stereomodels. Elevation comparisons are made for sampled points. Application to ground subsidence monitoring problems in mining and construction activities show promise. The stereoplotter, digital computer, and human interactions necessary to accomplish ground settlement monitoring by digital photogrammetry are outlined in detail. (Author)

A79-50214 The problem of resolution in the Landsat imagery. R. J. Kalush, Jr. (Michigan State University, East Lansing, Mich.). *Remote Sensing Quarterly,* vol. 1, Jan. 1979, p. 38-48.

The paper surveys some sources of error which occur in Landsat imagery. Attention is given to geometrical error including deviation from vertical. It is shown that the dynamic root-mean-squared error of the satellite from vertical is plus or minus 0.7 degrees which means 11.3 km at ground level. Other error sources discussed included nonperiodic variations in the scanning mirror, the oblateness of the earth and path distortion. Spectral error is also covered. Finally, the operating and design characteristics of the multispectral scanner are described. M.E.P.

A79-50220 * Landsat-D thematic mapper simulation in an urban area using aircraft multispectral scanner data. J. Clark (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Remote Sensing Quarterly,* vol. 1, Apr. 1979, p. 17-32. Contract No. NAS7-100.

A simulation of imagery from the Landsat-D thematic mapper was conducted in order to determine its usefulness for urban land-use classification. Aircraft 24-channel multispectral scanner imagery of the Los Angeles area at 7.5-m resolution was processed digitally by means of matrix averaging and image smoothing techniques to simulate the 30-m resolution of the thematic mapper. Mean and standard deviation statistics of training sites for resolutions of 7.5, 15, 30 and 60 m were used to generate final classification maps. Plots of relative standard deviation showed that for larger training sites, as the resolution decreased, the distribution range of density values also decreased, while plots of relative classification accuracies showed that as resolution decreased, classification accuracies for three levels

of standard deviation increased. A point of diminishing returns was indicated, however, confirming the utility of the resolution intended for Landsat-D. A.L.W.

A79-50223 Thermal data from Landsat III. R. Lougeay (New York, State University Geneseo, N.Y.). *Remote Sensing Quarterly*, vol. 1, July 1979, p. 15-17. 6 refs.

The paper discusses the capabilities of the new experimental thermal imaging system aboard Landsat III launched on March 5, 1978. The thermal imaging system consisted of a fifth channel on the multispectral scanner, with a spectral sensitivity between 10,400 and 12,600 nm. Data acquired with this system provided imagery of terrestrial emittance which can be compared with patterns of reflected solar energy displayed in visible and near-visible-infrared spectral bands of Landsat multispectral scanners. Unfortunately, this thermal imaging system has not provided data of as high quality as initially expected, due to a series of system malfunctions. Both thermal and spatial resolution have been affected. S.D.

A79-50330 The application of reflected infrared color film to the study of environmental problems. R. K. Holz (Texas, University, Austin, Tex.). In: Learning to use our environment; Proceedings of the Twenty-fifth Annual Technical Meeting, Seattle, Wash., April 30-May 2, 1979. Mount Prospect, Ill., Institute of Environmental Sciences, 1979, p. 14-18. 14 refs.

The technique of color infrared photography in the near, or reflected, infrared range is explained and its several applications to the remote sensing of environmental problems are presented. The development of infrared photography is traced from the discovery of infrared radiation by Herschel in 1800, considering the development of photographic media from colloidion emulsions to present-day cyanine dyes. The properties of three-layer color infrared, or false-color, film are examined, and the problems of the instability of infrared dyes and the color balance of color infrared photography are considered. Finally, applications of color infrared photography to the study of the health of farm crops, forests and grazing lands, the estimation of crop yields and the determination of land/water interfaces, water quality and flood plains are discussed. A.L.W.

A79-52690 * Map-guided interpretation of remotely-sensed imagery. J. M. Tenenbaum, H. G. Barrow, R. C. Bolles, M. A. Fischler, and H. C. Wolf (SRI International, Menlo Park, Calif.). In: Conference on Pattern Recognition and Image Processing, Chicago, Ill., August 6-8, 1979, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 610-617. 9 refs. Contract No. NASw-2865; Grant No. DAAG29-76-C-0057.

A map-guided approach to interpretation of remotely sensed imagery is described, with emphasis on applications involving continuous monitoring of predetermined ground sites. Geometric correspondence between a sensed image and a symbolic reference map is established in an initial stage of processing by adjusting parameters of a sensor model so that image features predicted from the map optimally match corresponding features extracted from the sensed image. Information in the map is then used to constrain where to look in an image and what to look for. With such constraints, previously intractable remote sensing tasks can become feasible, even easy, to automate. Four illustrative examples are given, involving the monitoring of reservoirs, roads, railroad yards, and harbors. (Author)

A79-53374 * Improvement of selected satellite applications through the use of microwave data. D. W. Mooneyhan (NASA, National Space Technology Laboratories, Bay Saint Louis, Miss.). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-244*. 22 p. 6 refs.

This paper describes an analysis of a data set in which satellite acquired microwave data (Seasat Synthetic Aperture Radar) have been registered with Landsat Multispectral Scanner data and the combined data processed using conventional multichannel spectral pattern recognition programs. Results of this analysis indicate that the combined data set offers improvement in surface classification that is significant to certain applications. A brief description of the registration procedure is given. The improvement in results rendered to selected resource management applications is discussed. The presented results are preliminary due to the short time that the satellite microwave data have been available; however, a more comprehensive analysis is in progress and will be completed during the coming year. (Author)

A79-53377 Processing and using SAR data. P. Murino, L. G. Napolitano (Napoli, Università, Naples, Italy), and B. Apolloni (Calabria, Università, Cosenza, Italy). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-252*. 13 p. 32 refs.

The paper presents and discusses some possible methods of processing synthetic aperture radar (SAR). Topics discussed include: the SAR signal, radar backscatter, and filtering. Particular attention is given to the various processing algorithms in order to stress their influence on the quality of the reconstructed image. Finally, digital processing is discussed in detail since recent advances in digital technology have expanded the flexibility of SAR imagery processing techniques. M.E.P.

A79-53382 Region extraction for thematic analysis of remote sensed images. B. Apolloni (Calabria, Università, Cosenza, Italy) and P. Murino (Napoli, Università, Naples, Italy). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-260*. 9 p. 11 refs.

A region extraction method proposed to construct a segmentation procedure and the performance of the corresponding algorithm used for the analysis of remotely sensed images is presented. The method is aimed to analyze the relevant parameters of the region model, its adaptability to real images, and its filtering action especially at the edges of the regions. The image is partitioned into topographical regions on the basis of a special region model, and then the regions are classified by per-field methods using the most relevant features. The corresponding segmentation algorithm results have small sensitivity to noise and to small variations of the mean values of the features in each region. A trade-off between enhancement and smoothness of the image can be made by proper tuning of parameters, concluding that the numerical implementation of the algorithm provides a sequential procedure of limited computational cost suitable for a large range of images. A.T.

A79-53529 * # Information adaptive system of NEEDS. W. M. Howle, Jr. and W. L. Kelly (NASA, Langley Research Center, Flight Electronics Div., Hampton, Va.). In: Remote sensing of earth from space: Role of 'smart sensors'; Proceedings of the Conference, Hampton, Va., November 14-16, 1978. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 213-220. 5 refs.

The NASA End-to-End Data System (NEEDS) program was initiated by NASA to improve significantly the state of the art in acquisition, processing, and distribution of space-acquired data for the mid-1980s and beyond. The information adaptive system (IAS) is a program element under NEEDS Phase II which addresses sensor specific processing on board the spacecraft. The IAS program is a logical first step toward smart sensors, and IAS developments - particularly the system components and key technology improvements - are applicable to future smart efforts. The paper describes

the design goals and functional elements of the IAS. In addition, the schedule for IAS development and demonstration is discussed. S.D.

A79-53530 # **End-to-end design concept.** P. A. Castruccio (Ecosystems International, Inc., Gambrills, Md.). In: Remote sensing of earth from space: Role of 'smart sensors'; Proceedings of the Conference, Hampton, Va., November 14-16, 1978. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 221-230. (AIAA 78-1738)

A significant fraction of NASA's space systems are designed to obtain and supply information. A meaningful analytical concept is to look at these systems as end-to-end information systems in which nature generates data. End-to-end data systems analysis has two valuable aspects: (1) in the system design phase, it sets forth the performance requirements to guide the subsequent tasks of the hardware designers; and (2) in the system verification phase, it provides the system's quality control or performance assurance function as to whether the system provides the results needed by the marketplace. Experimental and theoretical findings for Landsat crop classification are discussed. Optimal discrimination is achievable by means of several optimally positioned temporal 'cuts'. If the timings of observation are chosen properly, it is not necessary to observe an entire Landsat scene. S.D.

A79-53942 **Landscape drawing from Landsat MSS data.** S. Tanaka and Y. Suga (Remote Sensing Technology Center of Japan, Tokyo, Japan). *Photogrammetric Engineering and Remote Sensing,* vol. 45, Oct. 1979, p. 1345-1351. 7 refs.

A method to produce a landscape drawing from Landsat MSS data and the evaluation of the landscape drawing, along with an example, are addressed. Landscape drawing from Landsat MSS data is mathematically performed by using the central projection method. Particular attention was given to comparing the landscape drawing performed by such a method with the same landscape as viewed from the ground. To clarify this point, a landscape drawing of Mt. Fuji, one of the typical mountains in Japan, was produced and compared with pictures and photographs of it. The result of the work shows that the landscape drawing from Landsat MSS data is better than one might have expected. (Author)

N79-28642*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

ACCEPTANCE TEST SPECIFICATIONS OF THE LANDSAT IMAGERY VERIFICATION AND EXTRACTION SYSTEM (LIVES)

J. M. Everette, Principal Investigator Mar. 1979 46 p refs EREP

(Contract NAS9-15800)

(E79-10228; NASA-CR-160246; LEC-12900; JSC-14635) Avail: NTIS HC A03/MF A01 CSCL 05B

N79-29570# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

STATISTICAL ANALYSES OF TERRAIN DATA Final Report

Anthony J. Larocca and J. Robert Maxwell Feb. 1979 246 p refs

(Contract N60530-78-C-0009)

(AD-A068389; ERIM-132300-2-F) Avail: NTIS HC A11/MF A01 CSCL 08/7

Data on various terrain backgrounds were collected and analyzed to present their statistical features. Some of those characteristics are described in the form of histograms, ellipse 'pictures,' and power spectra for the following infrared spectral bands: 2.0 - 2.6, 3.0 - 4.2, 3.5 - 3.9, 3.9 - 4.7, 4.5 - 5.5, 5.1 - 5.7, and 9.0 - 11.4 micrometers. An attempt is made to demonstrate various meteorological and other influences on the statistics by comparing the data in different spectral regions taken at different times and under differing conditions. Using these results and those from future analyses of other scenery, one would hope eventually to be able to categorize terrain backgrounds according to a few recognizable parameters. GRA

N79-30615# Deutsche Akademie der Wissenschaften, Berlin (East Germany).

FIRST RESULTS OF THE EXPERIMENT RADUGA FOR PHOTOGRAPHIC REMOTE SENSING

H. Kautzleben, K.-H. Marek, A. Geschke, and R. Joachim *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 17-26 refs Original contains color illustrations

Avail: NTIS HC A99/MF A01

An experiment in photographic remote sensing, RADUGA (rainbow), carried out jointly by the USSR and the German Democratic Republic in 1976 is described. A multispectral camera MKF-6 and a multispectral projector MSP-4 were employed. Some examples of picture reprocessing techniques with additive color viewing are presented. Results concerning the interpretation of the photos obtained in this experiment are discussed. It is found that photos which are well suited for studying photogrammetrical and thematic sensing problems can be obtained from satellites and aircraft. Author (ESA)

N79-30637# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Nachrichtentechnik.

DIBIAS: THE DIGITAL IMAGE PROCESSING SYSTEM: SYSTEM DESIGN AND APPLICATIONS

P. Haberaecker (Fed. Inst. for Geosci. and Natural Resources, Hannover) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 233-236

Avail: NTIS HC A99/MF A01

The DIBIAS system is reviewed and some applications of image processing in the field of remote sensing are explained. The DIBIAS system is intended to be a research oriented image processing system. Very little training should allow the user to handle the system. Immediatly after processing, the user can see the results on a color TV screen. The DIBIAS software is structured into modules; input and output programs are separated from actual image processing and several programs can be run simultaneously. The DIBIAS system can be put to optimal use when the experimenter processes pre-selected data. For most of the programs a few minutes are necessary for processing a typical multispectral image of 512x512 pixels. Author (ESA)

N79-30639# Engins Matra, Velizy (France).

IMAGE DATA COMPRESSION BY SHAPE RECOGNITION AND CLUSTERING [COMPRESSION DES DONNEES IMAGES PAR RECONNAISSANCE DES FORMES ET CLUSTERING]

Gabriel Lowitz *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 243-250 refs In FRENCH

Avail: NTIS HC A99/MF A01

A process of image compression was developed applying the thematic extraction concept to small blocks instead of the entire image while using previously developed algorithms. The theoretical aspects of the problems, the compression process of pattern identifcation by the clustering algorithm, the compression coding, the pre-treatment and pre-compression, and the global compression performances are discussed. An efficient coding was developed, consisting of limiting the transmission by pixel to a two or three bits address (instead of eight) by reference to a list of patterns in dictionary form. The reconstruction to three bits results in negligible errors. Some examples are given. Author (ESA)

N79-30640# Engins Matra, Velizy (France).
PRETREATMENT OF ONBOARD SIGNALS. STUDY ON THE IMPLEMENTATION OF AN IMAGE COMPRESSOR [PRETRAITEMENT DU SIGNAL A BORD: ETUDE DE LA MECANISATION D'UN COMPRESSEUR D'IMAGES]
A. Spiwack *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 251-253 refs In FRENCH
Avail: NTIS HC A99/MF A01

A compression algorithm for images, to be used in real time cabled logic data processing, is presented. The method consists of dividing the image in blocks of 256 pixels and then analyzing the statistics of the gray levels by histogram computation. Simple criteria permit the grouping of points in classes (clustering). Only the class averages and the numbers of the pixels belonging to a class are transmitted. The implementation of the compressor is described. Author (ESA)

N79-30657# Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).
OPTICAL PROCESSOR FOR SYNTHETIC APERTURE RADAR [PROCESSEUR OPTIQUE POUR RADAR A OUVERTURE SYNTHETIQUE]
M. Laug and D. Leger *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 395-399 refs In FRENCH
Avail: NTIS HC A99/MF A01

The principle of optical processors is reviewed, showing the analogies with holography. Formulas are developed that can be used to develop specialized processors adapted to particular missions. The design of the optical processor for signal reception on the SEASAT satellite is described. It is concluded that optical processors are competitive with other techniques due to their ability to handle large rates of simultaneous data both in distance and azimuth. Author (ESA)

N79-30658# European Space Agency, Paris (France).
SYNTHETIC APERTURE RADAR DESIGN FOR EARTH OBSERVATION MISSIONS
D. Macoll and G. Dieterle *In its* Earth Observation from Space and Management of Planetary Resources May 1978 p 401-406

Avail: NTIS HC A99/MF A01

The design of a synthetic aperture radar (SAR) for use in Earth Observation Satellite missions is discussed. After highlighting all weather capability, the basic concept of the SAR and the problem of image quality is reviewed. Several SAR systems are then described and an evaluation of current technological problems and limitations is given. A brief outline of the ESA activities in preparing SAR payloads for future missions is included. Author (ESA)

N79-30663# Centre National d'Etudes Spatiales, Toulouse (France).
OBLIQUE OBSERVATION BY AIRCRAFT OR SPACECRAFT [OBSERVATION OBLIQUE PAR AVION OU SATELLITE]
M. Vieillefosse *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 441-447 refs In FRENCH
Avail: NTIS HC A99/MF A01

The variation of the ground reflection coefficient with direction was studied. Data from aerial photography and multispectral scanning from space were analyzed concluding that the ground anisotropy depends on the nature of the surface, the relative position of the sun's azimuth, the observation wavelength, and the sun's elevation. The atmospheric contribution to the phenomenon is considered to be small. It is shown that bidirectional reflectance of the surfaces, and not only the albedo, must be considered. Applications to determine the sea roughness and the vegetation structure are discussed. Author (ESA)

N79-30665# Academy of Sciences (USSR), Moscow. Inst. of Space Research.
ANALYSIS OF THE INFORMATIVE CHARACTERISTICS OF SCANNER AND PHOTO IMAGES OF THE EARTH'S SURFACE
V. V. Egorov, B. S. Zhukov, and V. A. Kottzov *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 455-464

Avail: NTIS HC A99/MF A01

The analysis of images of the earth obtained from the Soyuz-22 spacecraft by means of the MKF-6 multispectral band camera is described. The analysis of brightness contrast was carried out using the method of pair sampling with frame to frame discretization, while the analysis of spectral contrast was done by central random sampling with frame to frame discretization. The important role played by the recording of the parameters of polarization of the radiation received is discussed, showing that remote indication of water surface oil pollution is one of the most promising applications. It is concluded that the degree of homogeneity of the fragments studied can be estimated.
Author (ESA)

N79-30667# Canada Centre for Remote Sensing, Ottawa (Ontario).
EXPERIMENT ON LANDSAT MSS HIGH GAIN MODE
Thomas T. Alfoeldi, Andrzej Sas-Uhrynowski (Inst. of Geodesy and Cartography, Warsaw), and Irena Majcher *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 475-481 refs

Avail: NTIS HC A99/MF A01

A comparative evaluation was conducted of LANDSAT MSS low and high gain imagery. High gain data has three times greater radiometric resolution for one-third of the radiometric range. While feature classification benefits minimally from the use of high gain data, significant improvements are expected for the identification of 'levels' or degrees of an environmental phenomenon, such as water depths, range of suspended solids concentration, and leaf areal coverage. Advantages in using high gain data also apply to the detection of sub-pixel size features and the analysis of targets under low illumination levels.
Author (ESA)

N79-30673# Centre National d'Etudes Spatiales, Toulouse (France).
SCANNING DEVICES FOR MEDIUM RESOLUTION CAMERAS IN THE VISIBLE AND INFRARED [DISPOSITIFS DE BALAYAGE POUR APPAREIL DE PRISE DE VUES MOYENNE RESOLUTION VISIBLE ET INFRAROUGE]
P. Vermande and G. Thomin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 521-526 In FRENCH

Avail: NTIS HC A99/MF A01

The main characteristics of two kinds of scanning devices for medium resolution infrared video cameras are discussed. One is a wheel combined with a Schmidt telescope for scanning in the image space and the other is an oscillating mirror for scanning in the object space. The main advantage of the oscillating mirror is the reproducibility of the laws of motion. Further studies and experimentation with complete apparatus is recommended.
Author (ESA)

N79-30697# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Nachrichtentechnik.
CLASSIFICATION OF MULTISPECTRAL REMOTE SENSING DATA Ph.D. Thesis - Tech. Univ., Berlin
Peter Haberaecker Jul. 1978 135 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-571) Original contains color illustrations
(DLR-FB-77-72) Avail: NTIS HC A07/MF A01; DFVLR, Cologne DM 108,10

Different concepts pertinent to classification are defined and a mathematical model, subsequently derived, is described. Various classifiers are theoretically considered. A synthetic and a natural scene, taken from a multispectral aerial photograph, are used to test and illustrate the efficiency of the various classifiers. Results are compared and a performance criteria is evolved. Further algorithms are compared and a performance criteria is evolved. Further algorithms are evaluated for feature selection and computation of indices showing the priori quality of classification. Finally, an example within the context of regional planning is examined using the classification of multitemporal image data. Author (ESA)

N79-30842*# Environmental Research and Technology, Inc., Concord, Mass.
EVALUATION OF THE CAPABILITIES OF SATELLITE IMAGERY FOR MONITORING REGIONAL AIR POLLUTION EPISODES
James C. Barnes, Clinton J. Bowley, and Hsiao-hua K. Burke Aug. 1979 97 p refs
(Contract NAS1-15307)
(NASA-CR-159107) Avail: NTIS HC A05/MF A01 CSCL 13B

A comparative analysis of satellite visible channel imagery and ground based aerosol measurements is carried out for three cases representing a significant pollution episodes based on low surface visibility and high sulfate levels. The feasibility of detecting pollution episodes from space is also investigated using a simulation model. The model results are compared to quantitative information derived from digitized satellite data. The results show that when levels are > or = 30 micrograms/cu, a haze pattern that correlates closely with the area of reported low surface visibilities and high micrograms sulfate levels can be detected in satellite visible channel imagery. The model simulation demonstrates the potential of the satellite to monitor the magnitude and areal extent of pollution episodes. Quantitative information on total aerosol amount derived from the satellite digitized data using the atmospheric radiative transfer model agrees well with the results obtained from the ground based measurements. K.L.

N79-31725*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
COLORIMETRIC PRINCIPLES AS APPLIED TO MULTI-CHANNEL IMAGERY M.S. Thesis - Houston Univ. at Clear Lake City
Richard D. Juday, Principal Investigator Jul. 1979 68 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(E79-10266; NASA-TM-58215; JSC-14873) Avail: NTIS HC A04/MF A01 CSCL 05B

N79-31727*# Metrics, Inc., Atlanta, Ga.
DESIGN OF A LOW-COST AUTOMATED LANDSAT DATA ANALYSIS SYSTEM Final Report
G. William Spann, Nancy J. Hooper, and Nickolas L. Faust, Principal Investigators Jul. 1979 47 p refs ERTS
(Contract NAS8-33136)
(E79-10268; NASA-CR-161285) Avail: NTIS HC A03/MF A01 CSCL 05B

N79-31749# Environmental Data Service, Washington, D. C.
ENVIRONMENTAL SATELLITE IMAGERY, MARCH 1978
Apr. 1978 53 p refs
(PB-296057/3; KMRD-5.4-7803; NOAA-S/T-79-89) Avail: NTIS HC A04/MF A01 CSCL 04B

The hemispheric mosaics derived from Scanning Radiometer data, and prepared daily by high speed computer are described. Visible and infrared data swaths obtained while the satellite is southbound on the daylight side of the orbit are used in the 09L mosaics; infrared data swaths obtained during northbound passage are used in the 21L mosaics. The scanline signals are digitized, earth located, and repositioned on a standard polar stereographic map projection. Coastal outlines and latitude/lingitude lines at 10 degree intervals are added by the computer. Overlap between successive swaths is eliminated, with the latest data retained. GRA

N79-32612*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A FAST ROUTINE FOR COMPUTING
Robert R. Jayroe, Jr. Oct. 1977 22 p
(NASA-TM-78133) Avail: NTIS HC A02/MF A01 CSCL 05B

A routine for calculating multidimensional histograms of multivariate data using a combination table look up and search procedure is described. The software was originally developed to computer four-dimensional histograms from LANDSAT multispectral imagery, but the concept can be used on other types of data and the program can be modified for the desired type of output information. Author

N79-32622# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Unit.
ADVANCED TRAINING AND RESEARCH ON SATELLITE REMOTE SENSING TECHNIQUES AND APPLICATIONS IN THE UNITED KINGDOM AND THE UNITED STATES, 1 OCTOBER 1977 TO 30 SEPTEMBER 1978 Final Report
Jelle U. Hielkema 1978 113 p refs Original contains color illustrations
(AGLT/RSU-Series-2/79) Avail: NTIS HC A06/MF A01

Universities and scientific research centers were visited in the U.K. and the United States in order to study different types of satellite remote sensing data for a variety of applications. The development of specific digital data processing and classification techniques for detection, quantifying, and monitoring of desert vegetation using LANDSAT multispectral data was emphasized. It is noted that research and development efforts in the field of satellite remote sensing has become more and more oriented towards computer assisted techniques for data handling, analysis, and interpretation of both environmental and earth resources satellite data. Visual photointerpretation is seen as outmoded and investment in hardware, software, and trained manpower to optimize the use of available data is strongly advised. Author (ESA)

N79-32623# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services Div.
ELECTRONIC PROCESSING OF INFRARED SCANNER SIGNALS USING CCD MEMORY TECHNIQUES
H. A. vanIngenSchenau 6 Oct. 1978 10 p refs Presented at 1978 Inter. Symp. on the Appl. of Charge Coupled Devices, San Diego, Calif., 25-27 Oct. 1978 Original contains color illustrations
(NLR-MP-78031-U) Avail: NTIS HC A02/MF A01

The design of a video quick look which electronically processes signals from an infrared linescanner for a moving-map presentation on TV display is described. The image memory for display is composed of 16-kbit dynamic charged coupled devices (CCD). These CCD memories are line addressable which is attractive in the case of line scan orientation for sensing and display. The video quick look system is described and the design of the CCD image memory is shown. An application of the video quick look is demonstrated for thermal infrared remote sensing. Author (ESA)

N79-33532# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.

IMPROVEMENTS IN SOME IMAGE COMPRESSION TECHNIQUES FOR AERIAL RECONNAISSANCE ANALYSIS
Final Technical Report, 1 Jul. - 30 Sep. 1978
O. R. Mitchell, S. C. Bass, E. J. Delp, T. W. Goeddel, and A. Tabatabai May 1979 102 p refs
(Contract F30602-78-C-0102; AF Proj. 2305)
(AD-A071088; RADC-TR-79-99) Avail: NTIS HC A06/MF A01 CSCL 09/4

In this study a number of image coding methods were implemented and applied to aerial reconnaissance photos for relative ranking evaluations by experienced photo-analysts. These coding methods were of three broad types: two-dimensional transform, one-dimensional hybrid, and spatial. The compression rates used were 1.6 and 0.5 bits/pixel. The effects of channel errors at a .001 error rate were also simulated and evaluated.
GRA

N79-33535# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
A LANDSAT DATA COLLECTION PLATFORM AT DEVIL CANYON SITE, UPPER SUSITNA BASIN, ALASKA. PERFORMANCE AND ANALYSIS OF DATA
Richard K. Haugen, Ray L. Tuinstra, and Charles W. Slaughter Feb. 1979 20 p refs
(AD-A068508; CRREL-SR-79-2)' Avail: NTIS HC A02/MF A01 CSCL 13/2

In October 1974, a LANDSAT Data Collection Platform was installed near the prospective Devil Canyon damsite on the Susitna River, south central Alaska. The development of sensor interfaces and characteristics of transmitted data for air and ground surface temperature, windspeed and wind run, water equivalent snow accumulation, and battery voltage are discussed. Temperature data are analyzed statistically and compared with data from surrounding National Weather Service stations. Although some difficulties were encountered in operation during the winter of 1974-75, it was demonstrated that the LANDSAT data collection system could provide useful environmental data from a remote, subarctic location in the winter on a near-real-time basis. GRA

N79-33858*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
PROCEDURE FOR EXTRACTION OF DISPARATE DATA FROM MAPS INTO COMPUTERIZED DATA BASES
Bobby G. Junkin Washington Oct. 1979 23 p refs
(NASA-RP-1048) Avail: NTIS HC A02/MF A01 CSCL 09B

A procedure is presented for extracting disparate sources of data from geographic maps and for the conversion of these data into a suitable format for processing on a computer-oriented information system. Several graphic digitizing considerations are included and related to the NASA Earth Resources Laboratory's Digitizer System. Current operating procedures for the Digitizer System are given in a simplified and logical manner. The report serves as a guide to those organizations interested in converting map-based data by using a comparable map digitizing system.
Author

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08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A79-44706 Estimation of significant wave height and wave height density function using satellite altimeter data. R. W. Priester and L. S. Miller (Applied Science Associates, Inc., Apex, N.C.). *Journal of Geophysical Research*, vol. 84, July 30, 1979, p. 4021-4026. 16 refs.

A technique for estimating the ocean surface roughness probability density function from satellite altimeter data is presented. Results from the application of the technique to Geos 3 altimeter data demonstrate its ability to detect both large-scale and small-scale structural deviations from the Gaussian distribution. Knowledge of the surface roughness probability density enables a direct computation of significant wave height. Significant wave height computations using the estimated quantities have been found to be in general agreement with other approaches. Density function estimation is important to precision altimeter design and has possible implications in oceanographic research. (Author)

A79-44711 A sequential method for filtering satellite altimeter measurements. B. D. Tapley, B. E. Schutz, and P. A. M. Abusali (Texas, University, Austin, Tex.). *Journal of Geophysical Research*, vol. 84, July 30, 1979, p. 4061-4070. 27 refs. Grant No. NOAA-04-7-158-44052.

Recent advances in the area of satellite altimetry have provided a data type which is applicable to the detection and monitoring of transient sea surface phenomena. With the extensive altimeter data set collected by the GEOS 3 spacecraft there is an associated need for accurate and efficient methods for editing and filtering the altimeter data. In this investigation a sequential filter is developed by assuming that the sea surface topography can be approximated by an adaptive Gauss-Markov process. The effect of geoid model errors on the filtered results is illustrated by using both 1 x 1 deg and 5 x 5 min geoid models. Finally, an application of the method to the Gulf Stream current boundary identification problem using GEOS 3 altimeter data is described. (Author)

A79-46581 Snow parameter determination by multichannel microwave radiometry. R. Hofer (Bern, Universität, Berne, Switzerland) and W. Good (Eidgenössisches Institut für Schnee- und Lawinenforschung, Davos, Switzerland). *Remote Sensing of Environment*, vol. 8, Aug. 1979, p. 211-224. 7 refs.

A long-term observational program on the microwave scatter and emission behavior of snow began in 1977 at a high-altitude Alpine test site. The brightness temperatures at 4.9, 10.5, 21, 36, and 94 GHz measured at different incidence and polarization angles during the first season are analyzed with the aid of correlation, factorial, and cluster algorithms. The structure mathematically found within the data is compared with classical parameters of the snow cover. The snow state changed from a high winter state to a late spring state during the measurements. At least three different snow qualities and two grades of moisture for the uppermost 10 cm of the snow layer can clearly be distinguished with a high degree of accuracy. The information content of the measurements is not substantially degraded by a reduction of the data to data as delivered by the NIMBUS-5 and as expected of the NIMBUS-G satellites. Recommendations for optimum frequencies for the remote sensing of snow are given. (Author)

A79-48454 Metric information from aircraft multispectral scanner /MSS/ data. J. C. McGlone, J. R. Baker, and E. M. Mikhail (Purdue University, West Lafayette, Ind.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 1. Falls Church, Va., American Society of Photogrammetry, 1979, p. 274-289. 11 refs. Grant No. NOAA-04-7-158-44128. (ASP 79-132)

The paper investigates the use of first and second order Gauss-Markov processes for the rectification of aircraft digital MSS data. It is shown that the first order method can be made very competitive, in terms of execution time and accuracy, with other methods. The first order method appears to be more useful than the second order one, due to shorter execution time and slightly better results. First results from the restitution of sidelapping strips shows that positional accuracy up to 19.2 meters can be obtained as well as improvement over results of single strip methods. Elevation accuracies of up to 40.6 meters were obtained. B.J.

A79-51265 # Optimality criterion for the assignment of spectral regions in a multispectral television system (Kriterii optimal'nosti rabochikh zon spektrozonal'nykh televizionnykh sistem). Iu. B. Zubarev. *Radiotekhnika*, vol. 34, June 1979, p. 33-37. In Russian.

Consideration is given to a multispectral television system for remote sensing of earth resources. A minimum error probability is devised as the criterion for assignment of spectral regions in this system. B.J.

A79-51448 * Active/passive scanning. J. R. Woodfill (NASA, Johnson Space Center, Houston, Tex.) and F. J. Thomson (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: International Conference on Lasers, Orlando, Fla., December 11-15, 1978, Proceedings. McLean, Va., STS Press, 1979, p. 442-449. Contract No. NAS9-14594.

The paper deals with the design, construction, and applications of an active/passive multispectral scanner combining lasers with conventional passive remote sensors. An application investigation was first undertaken to identify remote sensing applications where active/passive scanners (APS) would provide improvement over current means. Calibration techniques and instrument sensitivity are evaluated to provide predictions of the APS's capability to meet user needs. A preliminary instrument design was developed from the initial conceptual scheme. A design review settled the issues of worthwhile applications, calibration approach, hardware design, and laser complement. Next, a detailed mechanical design was drafted and construction of the APS commenced. The completed APS was tested and calibrated in the laboratory, then installed in a C-47 aircraft and ground tested. Several flight tests completed the test program. V.T.

A79-53371 The modular optoelectronic multispectral scanner system for spaceborne remote sensing. J. Bodechtel (Zentralstelle für Photogrammetrie, Munich, West Germany), O. Hofmann, B. Kunkel, and D. Meissner (Messerschmitt-Bölkow-Blohm GmbH, Unternehmensbereich Raumfahrt, Ottobrunn, West Germany). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-241*. 11 p.

A multispectral scanner system for spaceborne remote sensing of land and coastal/ocean features under development for the German Ministry for Research and Technology is surveyed. The system is based on the use of multilinear detectors arrays for visible, near, medium, and thermal infrared spectral channels. In addition, the electronically scanning image system MOMS (Modular Optoelectronical Multispectral Scanner) is examined, noting that it consists of individual spectral channel modules which can be grouped to dedicated mission tasks, e.g., land surface thematic mapping. Finally, the basic performance data which would allow up to 10,000 pixels per scan line, corresponding to about 20 m resolution at a 200 km swath width, is covered. M.E.P.

A79-53373 **Feature specific spatial- and spectral sensors - Artificial retinas in space.** N. J. Mulder (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-243.* 12 p. 5 refs.

The spectral and spatial correlation techniques which can be easily implemented on-board of satellites are considered. A method which defines a number of spectral filters which cover a large part of the spectrum is described. The transmittance curves of these filters are derived from the reflection spectra of a user defined set of materials and are feature specific. An example is given with three filters derived from the reflectance spectra of water, soil, and grass, and after a linear transform the three correlation signals are coded in three colors. In spatial domain, feature specific filters for contour and line detection are proposed, and correlation operators are defined in a manner analogous to the interconnection patterns on the human eye retina. A coding scheme for printing these spatial features is given, and resolution and data rates of the combined sensor system and the user aspects are discussed. A.T.

A79-53511 **Snow/cloud discrimination staring mode radiometer.** W. J. Stebbins (Westinghouse Electric Corp., Baltimore, Md.). In: Electro-Optics/Laser Conference and Exposition, Boston, Mass., September 19-21, 1978, Proceedings. Chicago, Industrial and Scientific Conference Management, Inc., 1978, p. 289-295.

A new supplementary sensor system has recently been delivered to the USAF/SAMSO for use on the Defense Meteorological Satellite Program. This staring mode radiometer is a snow versus cloud discrimination instrument which senses reflected solar energy in the 1.5 to 1.6 micron band. It has a spectral filter, f/1.7 lens, a custom design long vane 77 Hz tuning fork chopper, and a 4 cm long line array of 48 germanium diode detectors. Each channel has an individual preamplifier, synchronous clamp, and low-pass filter. The multiplexer, 4-bit digital commandable gain control and 6-bit A/D converter are conventional CMOS circuitry. The reasons for the spectrum selected for snow/cloud discrimination, a description of the detailed block diagram, and hardware photographs with emphasis on the tuning fork chopper vanes design, the tuning fork amplitude control loop and the analog signal processing are given. (Author)

N79-28648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EVALUATION AND MODELING OF THE TOPOGRAPHIC EFFECT ON THE SPECTRAL RESPONSE FROM NADIR POINTING SENSORS
Brent N. Holben and Christopher O. Justice Jun. 1979 24 p refs Submitted for publication
(NASA-TM-80305) Avail: NTIS HC A02/MF A01 CSCL 05B

A field experiment, using a hand-held radiometer, was designed and conducted to assess a simple theoretical incidence model for simulating the topographic effect of a uniform sand surface. Seven data sets were taken to compare effects of solar elevation and azimuth encountered at different times of year. Analysis of these data showed considerable variation in radiance values for different slope angles and aspects and that these values varied considerably with changes in solar elevation and azimuth. The field measured variations in spectral response were found to have generally strong correlations with the theoretical model. The reason for the occurrence of lower correlations are given and methods for improving the model are suggested. A model to simulate LANDSAT sensor response was applied to two subsets of the field data to establish the magnitude of the topographic effect on satellite data. Author

N79-28649*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PASSIVE MICROWAVE APPLICATIONS TO SNOWPACK MONITORING USING SATELLITE DATA
Dorothy K. Hall, James L. Foster, Alfred T. C. Chang, and Albert Rango Jun. 1979 15 p refs Submitted for publication
(NASA-TM-80310) Avail: NTIS HC A02/MF A01 CSCL 08L

Nimbus-5 Electrically Scanned Microwave Radiometer data were analyzed for the fall of 1975 and winter and summer of 1976 over the Arctic Coastal Plain of Alaska to determine the applicability of those data to snowpack monitoring. It was found that when the snow depth remained constant at 12.7 cm, the brightness temperatures T sub B varied with air temperature. During April and May the production of ice lenses and layers within the snow, and possibly wet ground beneath the snow contribute to the T sub B variations also. Comparison of March T sub B values of three areas with the same (12.7 cm) snow depth showed that air temperature is the predominant factor controlling the T sub B differences among the three areas, but underlying surface conditions and individual snowpack characteristics are also significant factors. Author

N79-29568*# Environmental Sensing Algorithm Development Co., Sunland, Calif.
EVALUATION AND ANALYSIS OF SEASAT-A SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SSMR) ANTENNA PATTERN CORRECTION (APC) ALGORITHM. SUB-TASK 4: INTERIM MODE T SUB B VERSUS CROSS AND NOMINAL MODE T SUB B Final Report
J. L. Kitzis and S. N. Kitzis 27 Jul. 1979 122 p ref Prepared for JPL
(Contracts NAS7-100; JPL-955368)
(NASA-CR-158865) Avail: NTIS HC A06/MF A01 CSCL 05B

The brightness temperature data produced by the SMMR Antenna Pattern Correction algorithm are evaluated. The evaluation consists of: (1) a direct comparison of the outputs of the interim, cross, and nominal APC modes; (2) a refinement of the previously determined cos beta estimates; and (3) a comparison of the world brightness temperature (T sub B) map with actual SMMR measurements. K.L.

N79-30584# Construcciones Aeronauticas S.A., Madrid (Spain). Space Div.
STUDY OF HIGH STABILITY STRUCTURAL SYSTEMS: PRE-PHASE A Final Report
Paris ESA 29 Sep. 1978 160 p refs
(Contract ESTEC-3398/77/NL-PP(SC))
(DT-HSS-5; ESA-CR(P)-1164) Avail: NTIS HC A08/MF A01

The feasibility of large, high stability, flat, deployable antennas for earth resources observation was studied. A synthetic aperture radar antenna, 10 meters long by 1 meter wide, was taken as a representative structure of this type. Requirement definitions, interface design constraints, and a trade-off analysis of different solutions were considered. Possible design concepts and an analysis of the thermal loads were studied. Due to the different possibilities of the design configurations, strongly depending on some not well defined interfaces during development, the mechanical bahavior of the presented designs are omitted or studied in a simplified manner. Author (ESA)

N79-30634# Academy of Sciences (USSR), Moscow.
REMOTE SENSING IN THE USSR ACADEMY OF SCIENCES STUDIES, EXPERIMENTS, MAIN RESULTS, CURRENT OBJECTIVES
R. Z. Sagdeev, A. P. Kapitza, and Y. L. Ziman *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 203-216 Original contains color illustrations

Avail: NTIS HC A99/MF A01

The earth remote sensing studies carried out in the USSR since 1969 are reviewed. Starting from the Salyut-1 initial experiment, aiming to develop the principles of multiband imagery, the USSR programs to study earth resources from space are detailed, including the INTERCOSMOS multi-national program, the multiband photographic survey carried out from the Soyuz 12

and 13 spacecrafts, the development of the MKF-6 multiband space camera and the MSP-4 multicamera synthesizing projector, the Soyuz-22 synthesized color images, and the RADUGA project among others. The applications, the equipment being used and the data processing are discussed. Several color synthesized photographic examples are shown. Author (ESA)

N79-30646# Ecole Polytechnique Federale de Lausanne (Switzerland).
A STUDY OF SOIL HUMIDITY AND ITS VARIATIONS THROUGH REMOTE SENSING [ETUDE DE L'HUMIDITE DU SOL ET DE SA VARIATION PAR TELEDETECTION]
P. Meylan, A. Musy, and C. Morzier (Bern Univ., Switz.) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 305-313 refs In FRENCH

Avail: NTIS HC A99/MF A01

Soil humidity was determined by analysis of grand radiancy and reflectance in the microwave frequency range in order to establish a quantitative evaluation of the upper soil layers. The variations of humidity with time were studied. The usefulness of a sun radiancy model is discussed. Radiometers set at the frequencies of 4.9, 10.5, 21, and 30 GHz along with a scatterometer set at 10.5 GHz were used as well as conventional soil analysis apparatus. The results show that humidity of the upper soil layers can be estimated by single or multiple regression from the emissivity data and that the time functions of radiometric measurements are consistent with those of soil humidity. No clear conclusions were obtained about the usefulness of application of the Burke and Paris sun emission model. Author (ESA)

N79-30650# Centre National d'Etudes Spatiales, Toulouse (France).
UTILIZATION OF MULTISPECTRAL THERMOGRAPHY FOR LANDSCAPE ANALYSIS [UTILISATION DE LA THERMOGRAPHIE MULTISPECTRALE DANS L'ANALYSE DU PAYSAGE]
M. Guy, Y. Patoureaux, M. Supomo, and M. Vieillefosse *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 335-345 refs In FRENCH Original contains color illustrations

Avail: NTIS HC A99/MF A01

An airborne thermographic apparatus was developed to separate the effects of the emissivity and the temperature of the sun. After corrections for atmospheric perturbations, the spectral emissivity of the various ground objects was obtained. Two test flights were done utilizing three spectral bands and the resulting data was processed obtaining color synthesized photographs. The results show that the resultant estimated temperatures are close to the actual values. Suggestions for further improvment and applications are given. Author (ESA)

N79-30653# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Optoelektronike.
MEASUREMENTS OF SPECTRAL CHARACTERISTICS OF NATURAL SCIENCES
R. Staetter and M. Schroeder *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 361-365 refs
Avail: NTIS HC A99/MF A01

The radiometric field measurement technique is presented. The instrumentation and equipment used in a mobil laboratory is described. In particular, the characteristics of the the Barnes 12-550 spectroradiometer and the Bendix scanner for visible/near infrared spectra are detailed. Examples of field measurements are given. The system can be used as a local check of remote sensing measurements as well as to determine reflection characteristics in the band 0.4 to 1.1 micrometers, valuable for interpretation of multispectral images. Author (ESA)

N79-30654# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mirkrowellen.
SEA-STATE MEASUREMENTS AND RADAR IMAGING FROM SPACELAB 1
F. Schlude, M. Kleintz, and M. Werner *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 369-375 refs
Avail: NTIS HC A99/MF A01

A microwave remote sensing experiment (MRSE) to be flown as part of the first Skylab payload is presented. The main experiment objectives are measuring the directional wave height spectrum of the sea surface and radar imaging of land surfaces. The instrumentation of MRSE is described. A survey about data processing on ground is included. Another experiment involving demonstration measurements by the two frequency method from a stationary platform is presented. After an introduction to the theory of the two frequency method, a description of the instrumentation is given. Results of The experiment are discussed. Author (ESA)

N79-30655# Technische Hogeschool, Delft (Netherlands).
RADAR REFLECTOMETRY IN THE NETHERLANDS: MEASUREMENT SYSTEM, DATA HANDLING, AND SOME RESULTS
M. K. Smit *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 377-387 refs
Avail: NTIS HC A99/MF A01

A general discussion of the reflection mechanism is offered to support the argument that it is necessary to average over a number of independent measurements in order to get an accurate measurement result. One way to get a number of independent measurements is to lock at a target at several system-frequencies. With this aim an FM-CW radar was used. The number of independent measurement samples gained in This way, however, is not sufficient, so the method is employed on a number of independent, statistically identical targets. The measurement procedure, which takes this requirement into account and yet allows for quick data collection, is discussed and the method of data storing and data handling is covered. Some measurement results are given to illustrate the method. Author (ESA)

N79-30656# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
A RADIOMETER SYSTEM WITH HIGH ABSOLUTE ACCURACY
Niels Skou *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 389-394 refs
Avail: NTIS HC A99/MF A01

A multifrequency radiometer system including a conically scanning antenna was developed and manufactured. The system is designed for collecting glaciological and oceanographic data and is intended for airborne use. The radiometers, at 5, 17 and 34 GHz, are described with special emphasis on The methods and principles implemented to ensure the high absolute accuracy needed for oceanographic purposes. The noise-injection technique, utilized in radiometer system, yields high absolute accuracy provided that all the front and microwave components are enclosed in a temperature stabilized box kept at a temperature equal to the radiometric reference. A very accurate digital thermometer is used to monitor the temperatures of critical components and corrections to the radiometric data can be performed.
Author (ESA)

N79-30659# Saab-Scania, Linkoping (Sweden).
SURFACE ROUGHNESS MEASUREMENT BY RADAR ALTIMETRY
S. R. J. Axelsson *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 407-416 refs
Avail: NTIS HC A99/MF A01

The basic principles of radar altimetry applied to the measurement of surface roughness height are discussed. Both beam and pulse limited systems are treated. The pulse limited

systems are attractive in spaceborne applications due to the moderate requirements on antenna size and attitude control. However, a much higher transmitted power must be generated than in the beam limited system, which also gives a more well defined sensitivity beam. The low average output power of conventional short-pulse radars can be overcome by using frequency modulated radars. Various types of FM radar altimeters are discussed including pulse compression technique. The possibility for using the range noise level as a measure of the roughness height in beam limited systems is pointed out. It is also shown that the distribution of The roughness height can be estimated by using the information of the fading envelope.
Author (ESA)

N79-30660# Heriott-Watt Univ., Edinburgh (Scotland).
THE REMOTE SENSING OF SURFACE ATMOSPHERIC PRESSURES: AN ACTIVE MICROWAVE SYSTEM
H. W. Lightfoot, D. A. Flower, C. Gatley, and G. E. Peckham *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 417-419

Avail: NTIS HC A99/MF A01

A proposal is made for a microwave pressure sounder to determine surface atmospheric pressure by measurement of the integrated transmission of the atmosphere at several discrete frequencies in the wings of the oxygen absorption band. Pulses of microwave energy are transmitted vertically downwards from a space platform and reflected back from the ocean surface. The ratio of return signal strength to transmitted signal strength is a measure of the atmospheric transmission which is in turn a function of The atmospheric pressure. Measurements at several frequencies are required to eliminate the effects of clouds, changes in ocean surface reflectivity, etc. Since the total absorbing path must be known, the components of the signal reflected from clouds can be rejected. A power rating system operating at two frequencies around 55 GHz was built and is in use on a horizontal ground path as part of the feasibility study for the proposed space flight instruments. Results from this work are discussed.
Author (ESA)

N79-30661# European Space Research and Technology Center, Noordwijk (Netherlands).
SIGNAL PROCESSING ASPECTS OF SPACEBORNE SYNTHETIC APERTURE RADAR SYSTEMS
R. W. Okkes *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 421-428

Avail: NTIS HC A99/MF A01

Signal processing aspects of active microwave systems used for remote sensing of the earth by satellites are discussed. After indicating the general objectives of remote sensing, an outline is given of the radar system concept presently envisaged by the European Space Agnecy to form part of the payload of a European earth resources satellite. The resulting spaceborne radar system is shown to require synthetic aperture techniques. The principle of operation is briefly explained. The speed and complexity of he processing operations are indicated and a challenging alternative option for performing the image generation in real-time using charge coupled devices technology is presented in some detail.
Author (ESA)

N79-30662# Institut Geographique National, Paris (France).
STEREOSCOPY FROM SPACE [STEROSCOPIE SPATIALE]
A. Baudoin *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 431-440 refs In FRENCH
Avail: NTIS HC A99/MF A01

The applications of spatial stereoscopy are reviewed and the experience obtained through the Apollo, Skylab, and LANDSAT missions is described. The technical problems associated with the type of sensor used in photogrammetry are examined. Other possible applications such as stereoradiometry, image interpretation, and pseudostereoscopy are mentioned. Uses of stereoscopy in future satellites are detailed.
Author (ESA)

N79-30664# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
USE OF A METRIC CAMERA IN SPACELAB
M. Schroeder and G. Konecny (Techn. Hochschule, Hannöver) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 449-454 refs

Avail: NTIS HC A99/MF A01

An experiment that will use a high resolution photogrammetric camera, to be included in the first Spacelab mission, to obtain metric quality photographs of the earth's surface is described. Improved satellite imagery is expected from this experiment as well as a demonstration of the use of photographs from space for mapping purpose. Objectives of the experiment, the camera system, the experiment parameters, and image quality are discussed.
Author (ESA)

N79-30666# Battelle Inst., Frankfurt am Main (West Germany).
REMOTE SENSING OF ATMOSPHERIC TRACE GASES BY DIFFERENTIAL ABSORPTION SPECTROSCOPY
W. Englisch and W. Wiesemann *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 465-473 refs Sponsored by DFVLR-BPT

Avail: NTIS HC A99/MF A01

A remote sensing system which is based on differential absorption measurements in the IR spectral region is described. The heart of the system is two tunable continuous wave CO2 lasers with their beams directed to the earth's surface and an optical superheterodyne receiver which detects and analyses the diffusely backscattered laser light. Fundamental spectroscopic data were provided by measuring the pressure-dependent absorption cross sections of relevant molecular gases for a set of discrete laser wavelengths. As a first step towards a spaceborne system, an airborne model was developed and successfully tried at flight altitudes from 300 m to 1200 m. By extrapolating the measured data it is concluded that the measuring range can be extended to Spacelab altitudes.
Author (ESA)

N79-30668# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
FAST INFRARED INTERFERENTIAL SPECTROMETER FOR THE SYSTEMATIC OBSERVATION OF SITES [SPECTROMETRE INTERFERENTIEL INFRAROUGE RAPIDE POUR L'OBSERVATION SYSTEMATIQUE DES SITES]
Georges Gauffre *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 483-488 ref In FRENCH
Avail: NTIS HC A99/MF A01

A Fourier transformation spectrometer, able to gather infrared spectral data on targets with near to ambient temperature, being sensitive to infrared between 3 and 12 micrometers in wavelength is described. Important characteristics of the instrument include a differential operating mode which compares with a reference black body and the feature of scanning the whole spectrum in 0.1 seconds. The interferometer is associated to an steerable telescope for observing distant targets. A minicomputer handles data acquisition and data processing. Results are furnished as the absolute value of spectral luminances.
Author (ESA)

N79-30669# Thomson-CSF, Boulogne-Billancourt (France). Div. Tubes Electroniques.
CHARACTERISTICS AND UTILIZATION OF CHARGE TRANSFER PHOTOSENSITIVE RODS [CARACTERISTIQUES ET UTILISATION DES BARRETTES PHOTOSENSIBLES A TRANSFERT DE CHARGE]
Blamoutier and Descures *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 489-494 refs In FRENCH
Avail: NTIS HC A99/MF A01

Principles and construction of photosensitive rods built on a silicon substrate, capable of light intensity readings through a charge transfer mechanism, is described. The sensitivity spectral response, modulation transfer characteristics, and frequency

response are examined as well as different possible functioning modes. The performance of two rods, having 512 and 1728 elements, respectively, is presented. The potential evolution of the performance of these devices, considering spaceborne applications, is discussed. Author (ESA)

N79-30670# Centre National d'Etudes Spatiales, Toulouse (France).
THE CHARGE TRANSFER DEVICES AND THEIR APPLICATIONS TO THE OBSERVATION OF THE EARTH [LES DISPOSITIFS A TRANSFERT DE CHARGES ET LEURS APPLICATIONS A L'OBSERVATION DE LA TERRE]
Laporte *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 495-508 In FRENCH

Avail: NTIS HC A99/MF A01
Several techniques for the construction of photosensitive charge transfer devices are examined. Data on experimental measurements and performance are given and two instruments of this kind are described. Data on some charge transfer device characteristics are presented in table form. Examples of photographs taken in four spectral bands by the push broom 1728 camera are included. Author (ESA)

N79-30671# Centre National d'Etudes Spatiales, Toulouse (France).
HIGH RESOLUTION MULTISPECTRAL CAMERA [CAMERA MULTISPECTRALE A HAUTE RESOLUTION]
G. Otrio *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 509-515 In FRENCH

Avail: NTIS HC A99/MF A01
The specifications of the high resolution video to be included in the SPOT satellite mission, and the selection of techniques to meet these specifications are discussed. The instrument is composed of a seven lens dioptric telescope, a detector based on photosensitive charge transfer rods, and auxiliary mechanisms. It is concluded that the selection of a push broom type instrument has the greatest potential for this application because of its simplicity and performance. Author (ESA)

N79-30672# Societe Anonyme d'Etudes et Realisations Nucleaires, Limeil-Brevannes (France).
HIGH RESOLUTION CAMERA: INTERRELATION BETWEEN DETECTOR CONFIGURATION AND SPACECRAFT SYSTEMS [PRISE DE VUE A HAUTE RESOLUTION INTERRELATIONS ENTRE CONFIGURATION DES DETECTEURS ET SYSTEME SPATIAL]
A. Alouges, C. Pezant, and A. Semichon *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 517-519 In FRENCH

Avail: NTIS HC A99/MF A01
The interrelation between the detector configuration in the optical focal plane of a spaceborne high resolution camera and the attitude control and stabilization systems of a satellite is examined in order to determine optimization criteria for the detector configuration as a function of system constraints. Push broom scanning and scanning with integration and line charge transfer are studied. The advantages of the system with integration mainly in signal gain and signal to noise ratio due to the increase in exposure time, are pointed out. The constraints that this mode of operation impose on the spacecraft systems are discussed. Author (ESA)

N79-30675# Centre d'Etudes et de Recherches Geodynamiques et Astronomiques, Grasse (France).
CALIBRATION, USING THE MOON, OF SATELLITE-BORNE INFRARED CAMERAS FOR EARTH OBSERVATION [CALIBRATION AU MOYEN DE LA LUNE DES INSTRUMENTS DE PRISE D'IMAGES INFRAROUGES EMBARQUES SUR SATELLITES D'OBSERVATION TERRESTRE]
J. Gay and G. Lebegue (Aerospatiale, Cannes, France) *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 533-540 refs In FRENCH

Avail: NTIS HC A99/MF A01
A feasibility study of calibration by means of the moon was done, for application on METEOSAT satellites, in order to compensate for the insufficiency of the internal calibration systems. Pyrometric calibration, based on pairs of temperature measurements taken on definite points on the moon by the satellite photometers, is discussed. The method will be tested on the first METEOSAT mission. Applications to other infrared earth observation satellites are foreseen. Author (ESA)

N79-31249# Thomson-CSF, Meudon-la-Foret (France).
STUDY OF THE DEFINITION OF A GROUND SAR PROCESSOR FOR SEASAT-A Final Report
Heraud, Schang, Anthouard, Carre, Y. Legal (CIMSA), J. C. Gilbert (CIMSA), and Timsit (Adersa Gerbios) 1978 136 p
(Contract ESA-3350/77-NL-HP(SC))
(ESA-CR(P)-1199) Copyright. Avail: NTIS HC A07/MF A01
A ground processor for the SEASAT A - synthetic aperture radar (SAR) is discussed. The solutions retained for the processing as well as the equipment performance specifications are given. Solutions, such as going from a high throughput rate to low throughput rates with intermediate high density data transmission buffering to bring down the input data rate were considered. All solutions are based on the use of parallel one bit processors which form the basic building block of the PROPAL II processor. Such an architecture was demonstrated to be able to adapt to varied processing requirements and, therefore, its flexibility and growth potential is important. The processor configuration retained was optimized for cost at the expense of throughput performance. Author (ESA)

N79-31704# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
AN ATTITUDE SENSING TECHNIQUE FOR SOUNDING ROCKETS, USING RF-INTERFEROMETRY
G. Mayer and G. E. Todd *In* ESA European Sounding Rocket, Balloon and Related Res., with Emphasis on Expt. at High Latitudes Jun. 1978 p 483-486 refs

Avail: NTIS HC A23/MF A01
A simple attitude sensing system which was primarily designed for use on earth survey rockets, but is also of use for the attitude stabilization of all types of space vehicles is presented. The system uses an airborne radio direction finder or interferometer to control the payload in the propagation direction of the incident wave from UHF transmitter beacons located at the points of interest in an earth resources survey. Author (ESA)

N79-31747# Thomson-CSF, Meudon-la-Foret (France). Dept. Espace-Satellites.
STUDY OF SAR FOR THE EUROPEAN REMOTE SENSING PROGRAM: EXECUTIVE SUMMARY Final Report
11 Dec. 1978 114 p refs Prepared in cooperation with Dornier-Werje G.m.b.H., Friedrichshafen and Selenia S.p.A., Rome Original contains color illustrations
(Contract ESA-3523/78-F-CG(SC))
(ESA-CR(P)-1174) Avail: NTIS HC A06/MF A01
A detailed analysis of system specification, spacecraft interfaces, the influence of system geometry, image quality requirements, and processing tasks is presented followed by a trade-off study leading to the choice of orbit altitude, look angle, pulse duration, pulse repetition frequency, antenna dimensions, radar resolution, RF power, onboard/onground interface, and downlink modulation technique. The main critera directing the trade-off study were the reduction of the RF power and the compatibility with present platform design. A baseline configuration scheme is given, showing a resulting 310 W average RF power or an orbit altitude of 822 km. Author (ESA)

N79-31748# Eurosat S.A., Geneva (Switzerland).
STUDY ON THE IDENTIFICATION OF SERVICES AND ORGANIZATIONS INTERESTED IN THE USE OF THE SPACELAB METRIC CAMERA Final Report
C. L. P. Miller 15 Dec. 1978 89 p
(Contract ESA-3537/78-F-HC(SC))
(CLP/PR/3278; ESA-CR(P)-1184) Avail: NTIS HC A05/MF A01

Nine countries in Africa were visited and 40 organizations contacted. Results show that there is a great interest in the use of the Spacelab metric camera. The main cartographic interest involves the revision of existing maps, particularly on the 1:200,000 and 1:250,000 scale and the making of new topographic maps primarily scaled at 1:50,000 which presently exist for only about 18 percent of Africa. For thematic applications the camera technical characteristics are appreciated. Certain limitations in the performance of the camera, and the capability of various African organizations to use the product are discussed. Author (ESA)

N79-31850# Sandia Labs., Albuquerque, N. Mex.
IN SITU ENVIRONMENTAL SAMPLER (IES): DESCRIPTIVE ANALYSIS AND OPERATING PROCEDURES
F. R. Gustke Mar. 1979 109 p
(Contract EY-76-C-04-0789)
(SAND-78-1342) Avail: NTIS HC A06/MF A01

A self-contained, portable, analog tape-recording system was designed to record sample data on environments encountered during transportation. This highly versatile, rugged instrument will record in situ up to 14 channels of data, along with IRIG time and voice, with a maximum frequency response of dc to 5 kHz at tape speeds from 3-3/4 to 15 inches per second. The system and operating procedures for its use are described. DOE

N79-33529*# Environmental Sensing Algorithm Development Co., Sunland, Calif.
EVALUATION AND ANALYSIS OF SEASAT-A SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) ANTENNA PATTERN CORRECTION (APC) ALGORITHM
Final Report
J. L. Kitzis and S. N. Kitzis 28 Sep. 1979 148 p Prepared for JPL
(Contracts NAS7-100; JPL-955368)
(NASA-CR-162346) Avail: NTIS HC A07/MF A01 CSCL 14B

An evaluation of the versions of the SEASAT-A SMMR antenna pattern correction (APC) algorithm is presented. Two efforts are focused upon in the APC evaluation: the intercomparison of the interim, box, cross, and nominal APC modes; and the development of software to facilitate the creation of matched spacecraft and surface truth data sets which are located together in time and space. The problems discovered in earlier versions of the APC, now corrected, are discussed. A.W.H.

N79-33531*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN IMPROVED SCHEME FOR THE REMOTE SENSING OF SEA SURFACE TEMPERATURE
G. Dalu (CNR, Ist. di Fisica della Atmosfera, Rome), C. Prabhakara, R. C. Lo (Computer Sci. Corp., Silver Spring, Md.), and M. J. Mack (Computer Sci. Corp., Silver Spring, Md.) Jul. 1979 29 p refs
(NASA-TM-80332) Avail: NTIS HC A03/MF A01 CSCL 08J

A radiometer which possesses two channels in the 11 to 13 micrometer window region is discussed. The radiometer is used to estimate the sea surface temperature within an accuracy of 1 C. A mathematical model is presented to show that the accuracy is improved to within 0.3 C with an independent estimate of total precipitable water vapor. A broadband channel in the 18 micrometer water vapor band is introduced in addition to the two former channels to remotely sense the total precipitable water vapor. The effect of the surface emissivity is taken into account in the scheme. A.W.H.

09
GENERAL

Includes economic analysis.

A79-45423 * # **A Microwave Radiometer Spacecraft, some control requirements and concepts.** U. M. Lovelace (NASA, Langley Research Center, Hampton, Va.). In: Guidance and Control Conference, Boulder, Colo., August 6-8, 1979, Collection of Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1979. 8 p. (AIAA 79-1777)

A general overview of a conceptual design for a Microwave Radiometer Spacecraft using a large passive reflector, microwave radiometers, and advanced control concepts is presented. The mission requirements, developed around high resolution, large area mapping of soil moisture for global crop forecasting, are reviewed. These mission requirements, along with system design requirements, dictate the need for a reflector in excess of 700 meters in diameter. Conceptual designs for supporting structures and subsystems, including attitude and surface control, are summarized. (Author)

A79-45649 # **Satellite Remote Monitoring Systems - General requirements and a proposed new approach.** K. Singh and G.-P. Forcina (COMSAT General Corp., Washington, D.C.). In: International Conference on Digital Satellite Communications, 4th, Montreal, Canada, October 23-25, 1978, Proceedings.
Montreal, Teleglobe Canada, 1979, p. 16-22.

This paper briefly analyzes the general requirements for the design of a Remote Monitoring System for the collection of data, via satellite, from land based monitoring sites. The existing systems are discussed, then the concept of 4/6 GHz Remote Monitoring Systems is introduced and the rationale for an experimental RMS at 4/6 GHz explained. The experimental system implemented by COMSAT General for the U.S. Geological Survey (USGS) is described and the technical characteristics of its components illustrated. Finally, the results of the experimental program are described and their impact on the design of an operational system discussed. (Author)

A79-47260 **Space technology spinoffs.** G. Gurney (U.S. Department of Defense, Washington, D.C.). New York, Franklin Watts, Inc., 1979. 94 p. 10 refs. $5.90.

This popular work discusses the benefits derived from the NASA space program in areas including medicine, environmental protection, energy conservation and transportation. It examines the ability of space technology to meet the needs of society and its transfer into everyday life. Various contemporary and future space missions, including Landsat, Nimbus and GEOS are examined with reference to future possibilities of technology transfer. C.F.W.

A79-48464 **Proposal for a national high-altitude photography data base.** P. A. Antill (U.S. Geological Survey, Reston, Va.) and J. A. Gockowski (U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C.). In: American Society of Photogrammetry, Annual Meeting, 45th, Washington, D.C., March 18-24, 1979, Proceedings. Volume 2. Falls Church, Va., American Society of Photogrammetry, 1979, p. 551-555. (ASP 79-197)

The paper is concerned with the development of a proposal for a national high-altitude photography data base. The proposal is limited to the conterminous United States, an area of about three million square miles. The proposal is discussed relative to coverage and schedule, aircraft, cameras and film types, cycle, season, and storage and dissemination of products. This proposal has many advantages, the most important being a cost reduction from present federal agency operating costs, with no increase in staffing, to obtain national photographic coverage. The two cameras used will provide B/W mapping photographs at 1:80,000 scale and higher resolution CIR resource photographs at 1:58,000 scale to meet many of the user agencies' requirements. By pooling funds and coordinating priorities, national high-altitude photographic coverage could be completed in 3 to 4 years. S.D.

A79-53372 **The remote sensing programme of the European Space Agency /ESA/.** C. Honvault (ESA, Earth Observation Programme Dept., Toulouse, France). *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 17-22, 1979, Paper 79-242.* 14 p.

The paper presents a brief survey of previous studies and developments, work presently underway, and future plans of the Remote Sensing Programme of the European Space Agency. The discussion covers the following: the earthnet program, first Spacelab payload experiments (metric camera and microwave remote sensing experiment), microwave experiment for first Spacelab payload, preparation of a European remote sensing satellite program proposal (mission objectives and requirements, feasibility studies, SAR studies, and Phase A studies on satellite systems). Attention is given to the remote sensing preparatory program. Experimental programs based on extensive ground and airborne measurements are required to develop applications and familiarize future users with remote sensing data. The overall plan of the program is tabulated. S.D.

A79-53443 **Legal aspects of remote sensing.** R. H. Coljee. *International Astronautical Federation, International Astronautical Congress, 30th, Munich, West Germany, Sept. 12-22, 1979, Paper 79-ST-01.* 5 p.

Art. II of the Outer Space Treaty foresees absolute freedom in outer space, while, in accordance with Art. III, states are permitted to carry out activities that comply with the international law. The present paper addresses the question whether remote sensing from satellites complies with the treaty. The USA is advocating total freedom both for acquisition and dissimination of remotely sensed data, while the USSR advocates the introduction of certain constraints both on acquisition and dissimination. It is suggested that the danger of misuse could be avoided by informing any country whenever data on this country are provided to another country or institution, and identifying the data. V.P.

A79-53527 * **Remote sensing of earth from space: Role of 'smart sensors'; Proceedings of the Conference, Hampton, Va., November 14-16, 1978.** Conference sponsored by the American Institute of Aeronautics and Astronautics and NASA. Edited by R. A. Breckenridge (NASA, Langley Research Center, Hampton, Va.). New York, American Institute of Aeronautics and Astronautics, Inc. (Progress in Astronautics and Aeronautics. Volume 67), 1979. 520 p. $42.50.

The papers in this volume cover a wide range of topics, from user requirements for 'smart' sensors to the development of innovative solid-state devices. By definition, a 'smart' sensor can, by means of its data/information processing capability, extract much more information than a simple sensor from the received physical signals, disregard or discard data with little or no information content, and handle efficiently the large volumes of data to be generated in future spacecraft. User concepts for 'smart' sensors are considered, and the topic of data processing systems is addressed. Attention is given to advanced device technology which brings forth unique device concepts applicable to 'smart' sensors. Also discussed are data preprocessing techniques. S.D.

N79-28191# Committee on Science and Technology (U. S. House).
OVERSIGHT: PRESIDENT'S CIVILIAN SPACE POLICY

Washington GPO 1979 69 p Hearing before the Comm. on Sci. and Technol., 96th Congr., 1st Sess., 14 Feb. 1979
(GPO-44-319) Avail: Comm. on Sci. and Technol.

Testimony was given on the contents of the president's view on the future of space programs. A clarification on the nature and scope of the administraton's space policy was reported. Some of the space programs discussed were: space shuttles, LANDSAT satellites, earth resource allocations, and environmental monitoring. M.M.M.

N79-28207# New Mexico Univ., Albuquerque. Technology Application Center.
THE SKYLAB PROGRAM, VOLUME 1. CITATIONS FROM THE INTERNATIONAL AEROSPACE ABSTRACTS DATA BASE Progress Report, 1972 - Dec. 1974
Gerald F. Zollars Apr. 1979 46 p Sponsored in part by NTIS
(NTIS/PS-79/0335/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 22A

Articles concerning Skylab mission planning, the Earth Resources Program, development of the Apollo telescope mount, remote sensing, orbital workshops, aerospace medicine, the SKYLAB Student science program, and early research results of of experiments performed aboard SKYLAB are reported. GRA

N79-28643*# Humboldt State Univ., Arcata, Calif. Center for Community Development.
DEVELOPING AND DEMONSTRATING AN INSTITUTIONAL MECHANISM FOR TRANSFERRING REMOTE SENSING TECHNOLOGY TO 14 WESTERN STATES USING NORTHERN CALIFORNIA AS THE TEST SITE Final Report, 1 Jun. 1977 - 31 Dec. 1978
Donna Hankins, Principal Investigator 31 Dec. 1978 622 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-2244)
(E79-10229; NASA-CR-158758; Rept-3) Avail: NTIS HC A99/MF A01 CSCL 05B

N79-29591# Hawaii State Dept. of Planning and Economic Development, Honolulu. Land Use Div.
HAWAII'S RESOURCES: INVENTORY AND POLICIES. A PROTOTYPE DEMONSTRATION FOR THE ISLAND OF KAUAI Final Report
1978 155 p
(PB-294504/6) Avail: NTIS HC A08/MF A01 CSCL 13B

The State and Land Resources Policy Project had the objectives to develop: (1) policies for the preservation and management of Hawaii's resources; and (2) a resource base inventory (RBI) system to assist decision makers in implementing those policies. The RBI, in both its bibliographic and cartographic (resource map) demonstration versions for Kauai, should prove to be a valuable tool for resource planners, managers, and decision makers. GRA

N79-30613# European Space Agency, Paris (France).
EARTH OBSERVATION FROM SPACE AND MANAGEMENT OF PLANETARY RESOURCES
J. Plevin, ed, V. Hood, ed, T. D. Guyene, ed, and S. Adamy May 1978 671 p refs Partly in FRENCH and ENGLISH Proc. of ESA/CNES Intern. Conf., Toulouse, 6-11 Mar. 1978; co-sponsored by Council of Europe, CEC, European Assoc. of Remote Sensing Labs. Original contains color illustrations
(ESA-SP-134) Avail: NTIS HC A99/MF A01

The state of the art of satellite observation technology and considerations on the management and economic aspects are reviewed.

N79-30630# European Space Research and Technology Center, Toulouse (France).
THE EARTH OBSERVATION PROGRAM OF THE EUROPEAN SPACE AGENCY
D. Lennertz and I. Pryke *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 163-176

Avail: NTIS HC A99/MF A01

The earth observation program of the European Space Agency is reviewed. Activities in the fields of meteorology, climatology, geodesy, and remote sensing are covered. Several projects are described, including METEOSAT, SEOCS, BIRAMIS, SLALOM, LASSO, SONG and SPACELAB. Applications of spaceborne radar and microwaves for remote sensing are explained. A proposal for an European remote sensing satellite is discussed. Author (ESA)

N79-30631# Centre National d'Etudes Spatiales, Toulouse (France).
THE SPOT PROGRAM [LE PROGRAMME SPOT]
M. Cazenave *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 177-185 In FRENCH
Avail: NTIS HC A99/MF A01

The earth satellite observation program 'SPOT' is a polyvalent system mounted on a multifunction platform which is adaptable to various payloads. The first mission is related to territory utilization, and will be implemented by a payload operating in the viable spectrum, consisting of two identical high resolution instruments. This first payload offers the possibility of observing any zone with an average delay of 2.5 days of latitudes higher than 45 deg and the possibility of obtaining stereoscopic images with an angle of about 30 deg with a delay of one day between both images. Author (ESA)

N79-30632*# National Aeronautics and Space Administration, Washington, D. C.
THE LANDSAT PROGRAM: THE PRESENT AND PROSPECTS
Ruth I. Whitman *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 187-195 refs
Avail: NTIS HC A99/MF A01 CSCL 08B

The LANDSAT program is described and the benefits derived from it are pointed out. The successive LANDSAT launchings and its respective equipment are discussed. The earth's surface covering, the techniques of relaying the information to the ground, a description of the LANDSAT D system, a comparison between the multispectral scanner on LANDSAT C and the MSS on LANDSAT D, and information about the regions of the electromagnetic spectrum covered by LANDSAT C and LANDSAT D are discussed. Author (ESA)

N79-30633# Canada Centre for Remote Sensing, Ottawa (Ontario).
CANADA'S SURSAT PROGRAM
E. Shaw *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 197-201 refs

Avail: NTIS HC A99/MF A01

The Canadian Sursat program, its origins, purpose, and expected benefits are explained. The program seeks an experimental assessment of the feasibility of satellite surveillance to meet the civilian regulatory and monitoring requirements in the time frame 1980 to 2000. Preparations are under way to receive U. S. SEASAT-A satellite data at Shoe Cove, develop optical and digital radar processing equipment and to equip two aircraft with radar. A series of application experiments will be done from mid 1978 to late 1979. If there is sufficient merit in the satellite information system, a recommendation would then be made for participation in a joint international satellite program that would be operational in the late 1980's. Author (ESA)

N79-30676# United Nations. General Assembly. Committee on the Peaceful Uses of Outer Space.
GLOBAL POLITICS: THE IMPACT OF SATELLITE TECHNOLOGY
Peter Jankowitsch *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 543-548 refs
Avail: NTIS HC A99/MF A01

The historical and organizational framework within which the international community has been attempting to cooperate in the peaceful uses of outer space is presented. The impact of satellite technology on global politics during the last two decades is stressed, in particular the rapid and widespread growth of remote sensing activities. A global remote sensing system is suggested, to be coordinated by the United Nations.
Author (ESA)

N79-30678# ECON, Inc., Princeton, N. J.
BENEFITS TO THE UNITED STATES FROM IMPROVED WORLDWIDE WHEAT CROP INFORMATION BASED ON LANDSAT SYSTEM OVERVIEW
Klaus P. Heiss *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 563-574 refs
Avail: NTIS HC A99/MF A01

The Earth Resources Survey and the LANDSAT Program of NASA, in particular, were the subject of an economic evaluation in 1974. Two case studies on the application of LANDSAT data to agriculture were conducted. The value of worldwide information improvements on wheat crops is measured in the context of world wheat markets. The benefits to the United States of public LANDSAT information on wheat crops are, on the average, 235 million dollars a year. Most of these benefits accrue directly to United States consumers in the form of lower average wheat prices; at the same time production efficiency gains accrue in providing for domestic and foreign demand. These benefits are those of a system with possibly as many as three operating spacecraft of the LANDSAT-D type. The benefits compare favorably with the annual system's cost of about 80 million dollars.
Author (ESA)

N79-30679# United Nations, New York, N. Y. Outer Space Affairs Div.
THE ECONOMIC IMPLICATIONS OF REMOTE SENSING FROM SPACE FOR THE DEVELOPING COUNTRIES
Adigun AdeAbiodun *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 575-583 refs
Avail: NTIS HC A99/MF A01

The prospects for the operational stutus of space programs and the impact of future space vehicles and sensors on the economy of the developing countries are examined. Many developing countries have been satisfied and encouraged with the results obtained to date from the analysis of the data (acquired by LANDSAT satellite) of their resources. Consequently, these countries are now actively seeking training opportunities for their nationals in the interpretation and utilization of space-acquired information on their land. Such an investment carries an added advantage of introducing new technology into their planning and development processes. However, the required scale of investment in a full development of the ground segment of this technology might be too taxing on the resourced of most of the developing countries: regional co-operation provides an alternative solution.
Author (ESA)

N79-30681# London Univ. (England). Faculty of Laws.
LEGAL IMPLICATIONS OF REMOTE SENSING FROM SPACE
B. Cheng *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 597-612 refs
Avail: NTIS HC A99/MF A01

The applicable principles of general international law and the relevant provisions in the four multilateral treaties relating to outer space drawn up through the United Nations are examined. It is found that the existing law allows free sensing from outer space, but this conclusion is qualified by pointing to three ways whereby states might be able to contain its consequences. An analysis of the proposals currently before the United Nations, which is working on a new international instrument to govern remote sensing from outer space, and a critical examination of the progress so far made are included.
Author (ESA)

N79-30682# Zentralstelle fuer Geo-Photogrammetrie und Fernerkundung, Munich (West Germany).
KEY EUROPEAN APPLICATIONS FOR SATELLITE REMOTE SENSING EXPERIMENTS WITH PRESENT SYSTEMS: REQUIREMENTS FOR OPERATIONAL APPLICATION
J. Bodechtel *In* ESA Earth Observation from Space and Management of Planetary Resources May 1978 p 613-626 refs
Avail: NTIS HC A99/MF A01

The application of earth observation satellites for obtaining accurate and up-to-date information for survey, planning, and monitoring on a regional as well as worldwide level is discussed. Based on European user requirements, operational monitoring from space and sensor specifications are examined. Examples are drawn from LANDSAT and Skylab data. Results show that three optical payload configurations are sufficient to meet the requirements cited. These include an optical payload for medium and high ground resolution to be used in evaluating land use, extractive resources, and agricultural needs. Another optical configuration, having medium ground resolution with high spectral resolution, is needed for monitoring coastal zones and water resources. Finally, an optical payload for coarse ground resolution can be used in oceanography and the observation of polar zones.
Author (ESA)

N79-31715*# Cornell Univ., Ithaca, N. Y.
CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1978 - 31 May 1979
Ta Liang, Arthur J. McNair, and Warren R. Philipson, Principal Investigators Jun. 1979 221 p refs ERTS
(Grant NGL-33-010-171)
(E79-10255; NASA-CR-158861) Avail: NTIS HC A10/MF A01 CSCL 05B

N79-31723*# Battelle Columbus Labs., Ohio.
REVIEW OF PRICING POLICY ALTERNATIVES FOR THE OPERATIONAL LANDSAT SYSTEM Final Report
R. W. Earhart, Principal Investigator, J. A. Madigan, W. F. Moore, and R. F. Porter Nov. 1977 97 p refs ERTS
(Contract NASw-2800)
(E79-10263; NASA-CR-158878; BCL-OA-TFR-77-6) Avail: NTIS HC A05/MF A01 CSCL 12A

N79-33115# Executive Office of the President, Washington, D. C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT, 1978 ACTIVITIES
Jimmy Carter NASA Jul. 1979 109 p
Avail: NTIS MF A01; SOD HC as NAS1.52:978

Highlights of national aeronautics and space programs for the year are described for the following areas: communications, Earth resources, space science, transportation, and space energy. Activities of NASA and five other Federal agencies with the largest programs in these areas are discussed. The national space policy statement is included in the appendixes along with records of U. S. spacecraft launchings, the history of U. S. and Soviet manned space flights; and data related to applications satellites, scientific payloads, and space probes. Budgetary summaries are included.
A.R.H.

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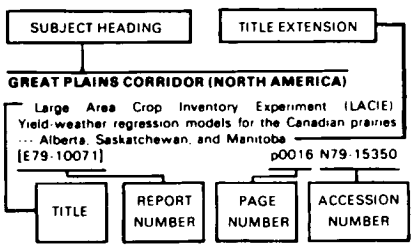

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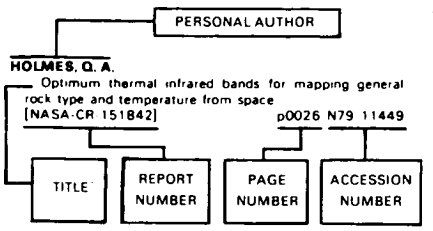

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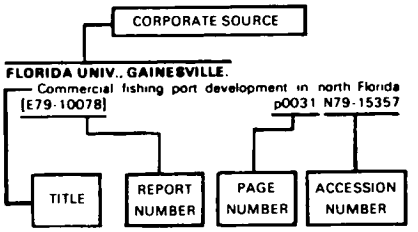

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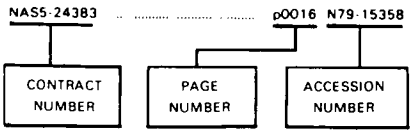

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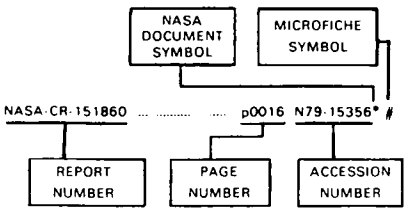

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