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NASA SP-7041 (19)
October 1978

Earth Resources
A Continuing
Bibliography
with Indexes

National Aeronautics and
Space Administration

Earth Resources
A Continuing Bibliography with Indexes
NASA SP-7041 (19)
Pages 179–228
October 1978

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NASA SP-7041 (19)

EARTH RESOURCES

A Continuing Bibliography
With Indexes
Issue 19

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 July 1, 1978 and September 30, 1978

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

NASA Scientific and Technical Information Branch 1978
National Aeronautics and Space Administration
Washington, DC

This Supplement is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, at the price code E05 ($9.00 domestic; $18.00 foreign).

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 337 reports, articles, and other documents announced between July 1 and September 30, 1978 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 A78-10,000 in ascending accession number order;

STAR entries identified by accession number series N78-10,000 in ascending accession number order.

After the abstract section, there are five indexes:

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

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E11	22.50	45.00
E12	25.00	50.00
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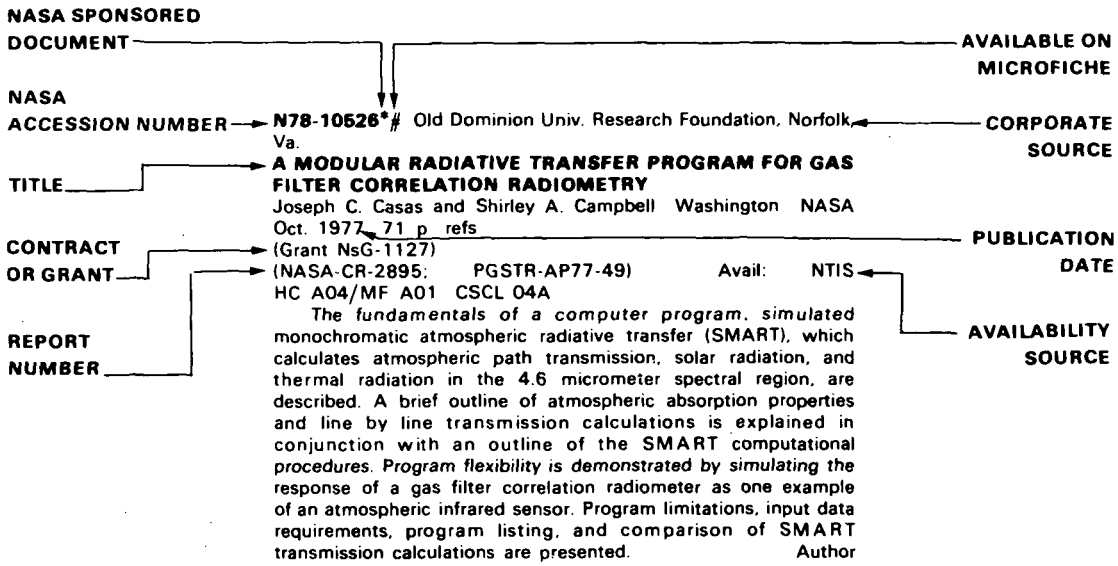

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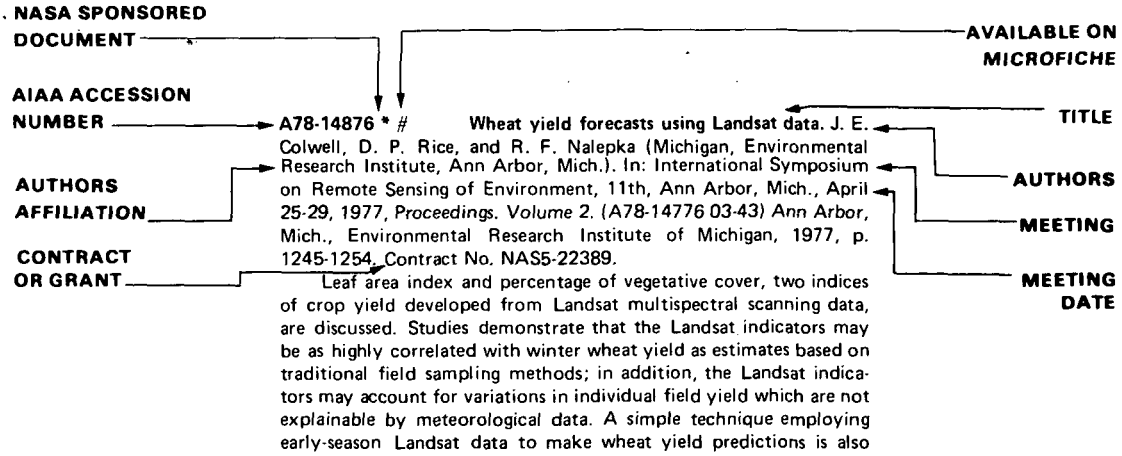

EARTH RESOURCES

A Continuing Bibliography (Issue 19)

OCTOBER 1978

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.

A78-34218 **Perspectives offered by remote sensing in agricultural resources management.** G. Fraysse (EURATOM, Ispra, Italy). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 233-247. 20 refs.

Aerial reconnaissance data and Landsat imagery have been used in the Agreste program, a Franco-Italian study of remote sensing applications to agricultural resources management. The study has focused on rice field inventories, rice yield forecasting, poplar plantation identification, and timber volume assessments. Problems associated with the excessive width of the Landsat multispectral channels caused some difficulties in the timber volume assessments; aerial reconnaissance was needed to supplement Landsat data when high-frequency coverage of phenological states was required. The future use of remote sensing to take crop inventories, perform phytopathological studies and derive yield forecasts for the EEC nations is discussed. J.M.B.

A78-34382 **Evaluation of a Fire Behavior Information Integration System for Southern California Chaparral Wildlands.** S. R. Kessell and P. J. Cattelino (Gradient Modeling, Inc., Missoula, Mont.). *Environmental Management*, vol. 2, Mar. 1978, p. 135-157. 13 refs. Research supported by the U.S. Department of Agriculture.

Cooperation between FIRESCOPE (Fire Resources of Southern California Organized for Potential Emergencies) and Gradient Modelling Inc. has produced a Fire Behavior Information Integration System (FIIBS) designed to store and retrieve data pertinent to the modelling of fire damage parameters on either a single site or wide area basis. The basic concepts of gradient modelling include evaluations of the fire potential of various types of vegetation, site characteristics, e.g., elevation, rainfall, disturbance histories, and computer software links, especially those tied to Landsat imaging. The software package consists of a 140 sq km site inventory and a single (1400 line) FORTRAN IV interactive source program. Remote site inventories are presented to compare previous data bases with the data base obtained through FIIBS. The latter system is considered to be more thorough in every important respect. D.M.W.

A78-34852 **Near real-time monitoring of Iowa corn with Landsat.** R. E. Fries, P. Buchman, and A. C. Aaronson (GE Earth Resources Analysis and Management Center, Beltsville, Md.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 1-8.

A Landsat Agricultural Monitoring Program (LAMP) has been established to monitor Iowa corn in near real-time. The Program utilizes Landsat data in conjunction with collateral data sources to monitor crop development and identify/assess anomalities and crop stress. Throughout the growing season, data are screened manually and by computer for indications of crop condition. Alarms such as abnormal weather phenomena and Landsat imagery abnormalities are identified. These alarms are then assessed as to their extent, severity, and projected impact on Iowa's corn crop. Landsat digital data, coupled with specially gathered collateral data, are used to update this initial alarm impact assessment. During the 1976 growing season, LAMP identified and assessed a variety of alarms affecting corn production in Iowa. Alarms included acute events (e.g., tornadoes, hail, thunderstorms) and chronic conditions (e.g., drought). Response time for initial assessment of these alarms was as short as eight days. (Author)

A78-34854 **Relations between ground truth and airborne measurements of thermal infrared radiation over vegetated surfaces.** F. Bonn and R. Brochu (Sherbrooke, Université, Sherbrooke, Quebec, Canada). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 25-37. 16 refs.

A78-34856 * **Distinguishing saline from nonsaline rangelands with Skylab imagery.** J. H. Everitt, A. H. Gerbermann, and J. A. Cuellar (U.S. Department of Agriculture, Agricultural Research Service, Weslaco, Tex.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 51-65. 19 refs. NASA Order R-09-038-002.

A flight line in Starr County, Texas, was used to test the feasibility of distinguishing saline from nonsaline rangelands using very small scale (1:3,000,000), Skylab satellite imagery. Film optical density readings were made on six different films (four black-and-white, one conventional, and one infrared color) using various film/filter combinations. Differentiating between saline and nonsaline rangelands was possible by using microdensitometry on black-and-white Skylab imagery. (Author)

A78-34869 **Aerial detection of oak wilt in Iowa.** R. R. Anderson (Iowa Geological Survey Remote Sensing Laboratory, Iowa City, Iowa). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 309-319. 9 refs.

A78-34870 * The use of four band multispectral photography to identify forest cover types. S. W. Downs, Jr. (NASA, Marshall Space Flight Center, Data Systems Laboratory, Huntsville, Ala.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers.
Tullahoma, Tenn., University of Tennessee, 1977, p. 329-340. 5 refs.

Four-band multispectral aerial photography and a color additive viewer were employed to identify forest cover types in Northern Alabama. The multispectral photography utilized the blue, green, red and near-infrared spectral regions and was made with black and white infrared film. On the basis of color differences alone, a differentiation between conifers and hardwoods was possible; however, supplementary information related to forest ecology proved necessary for the differentiation of various species of pines and hardwoods. J.M.B.

A78-34871 * Reflectance and photographic characteristics of three citrus varieties for discrimination purposes. H. W. Gausman, D. E. Escobar, and C. L. Wiegand (U.S. Department of Agriculture, Agricultural Research Service, Weslaco, Tex.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 341-355. 11 refs. NASA Order S-70251-AG; NASA Task 3.

A78-34872 Mapping of forest regions from Landsat imagery by computer processing - A case study of East Bastar region. D. S. Kamat, A. K. Kandya, K. L. Majumder, and V. L. Swaminathan (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers.
Tullahoma, Tenn., University of Tennessee, 1977, p. 357-364. 7 refs.

A78-34878 * Determination and error analysis of emittance and spectral emittance measurements by remote sensing. R. Kumar (Conselho Nacional de Desenvolvimento Científico e Tecnológico, Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers.
Tullahoma, Tenn., University of Tennessee, 1977, p. 465-485. 25 refs. Grant No. NGL-15-005-112.

Theoretical and experimental determinations of the emittance of soils and leaves are reviewed, and an error analysis of emittance and spectral emittance measurements is developed as an aid to remote sensing applications. In particular, an equation for the upper bound of the absolute error in an emittance determination is derived. The absolute error is found to decrease with an increase in contact temperature and to increase with an increase in environmental integrated radiant flux density. The difference between temperature and band radiance temperature is plotted as a function of emittance for the wavelength intervals 4.5 to 5.5 microns, 8 to 13.5 microns and 10.2 to 12.5 microns. J.M.B.

A78-34886 * Airborne thermography for crop water stress assessment. J. P. Millard (NASA, Ames Research Center, Moffett Field, Calif.), S. B. Idso, R. J. Reginato, R. D. Jackson, W. L. Ehrler (U.S. Department of Agriculture, Agricultural Research Service, Phoenix, Ariz.), and R. C. Goettelman (LFE Corp., Richmond, Calif.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers.
Tullahoma, Tenn., University of Tennessee, 1977, p. 611-619. 5 refs.

Aircraft overflights to obtain canopy temperatures of six differentially irrigated plots of durum wheat were made at Phoenix, Arizona on 1 and 29 April 1976. The data were acquired by a Texas Instruments model RS-25 infrared line scanner operating in the 8 to 14 micrometer bandpass region. Concurrently, plant water tension was measured on the ground with the Scholander pressure bomb technique. The results indicated that canopy temperatures acquired by aircraft about an hour and a half past solar noon correlated well with presunrise plant water tension - a parameter directly related to plant growth and development. The aircraft data also showed significant within-field canopy temperature variability, indicating the superiority of the synoptic view provided by aircraft over the more spotty view obtained by ground-operated infrared thermometers. (Author)

A78-36647 Image enhancement for vegetative pattern change analysis. G. L. Brothers and E. B. Fish (Texas Tech University, Lubbock, Tex.). *Photogrammetric Engineering and Remote Sensing,* vol. 44, May 1978, p. 607-616. 37 refs.

Aerial photography has been proven to be a valuable technique in the collection of basic data. However, the monitoring of changes through traditional interpretive techniques is an involved, time-consuming process. Photographic enhancement-overlay processing of imagery for change detection, however, appears to offer an effective alternative for detection of changes in resources of concern. In addition to improved results, enhancement-overlay processing provides more thorough information on the specific nature of changes which have occurred. Preprocessing of imagery for employment of this technique represents a limiting factor. As enhancement-overlay processing is developed into a continuous monitoring system, the cost of preprocessing will be reduced because baseline data already will be available for subsequent analyses. G.R.

A78-40125 # Manual for interpreting aerial photographs for soil investigations (Praktikum po deshifrirovaniiu aerofotosnimkov pri pochvennykh issledovaniiakh). T. V. Afanas'eva, Iu. M. Petrusevich, and T. A. Trifonova. Moscow, Izdatel'stvo Moskovskogo Universiteta, 1977. 158 p. 69 refs. In Russian.

Aerial photography is described, and several procedures - including topographic, stereoscopic, and parallax - for interpreting aerial photographs are examined. Morphometric analysis of soil cover is characterized. The interpretation of photographs of forest, marsh, and eroded lands is discussed, and problem examples are presented. Instrument and reception limitations of earth-based interpretation are considered. M.L.

A78-40159 * A first interpretation of East African swidden-ing via computer-assisted analysis of 3 Landsat tapes. F. P. Conant (Hunter College, New York, N.Y.) and T. K. Cary (Columbia University, New York, N.Y.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 36-43. 10 refs. Grant No. NsG-5080.

A preliminary application of the machine processing of Landsat data for the identification of swidden farming in East Africa is discussed. Three sets of Landsat data were analyzed: the 1972 mid-dry season, the 1973 late dry season, and the 1975 early wet season. The analysis procedure consisted of: (1) a preprocessing step to de-skew, rotate, and rescale the data, (2) a geometric correction process, (3) photographic enlargement, and (4) a procedure to obtain spectral response values for training the classification algorithm. S.C.S.

A78-40160 * A Landsat Agricultural Monitoring Program. A. C. Aaronson, P. E. Buchman, T. Wescott, and R. E. Fries (GE Earth Resources Analysis and Management Center, Beltsville, Md.). In: Annual Symposium on Machine Processing of Remotely Sensed

Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 44-51. 7 refs. Contract No. NAS5-23411.

The paper discusses the Landsat Agricultural Monitoring Program which was developed to identify, observe, and evaluate alarm conditions influencing Iowa corn production in 1976. Used in conjunction with climatic and field reports, studies were made of crop development, crop alarms (such as heavy rainfall, hail, tornadoes, and drought) and estimated crop yield. S.C.S.

A78-40162 * The Maximum Likelihood Estimation of Signature Transformation /MLEST/ algorithm. S. G. Thadani (Lockheed Electronics Co., Inc., Houston, Tex.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 66-74. 6 refs. Contract No. NAS9-15200.

The Maximum Likelihood Estimation of Signature Transformation (MLEST) algorithm is used to obtain maximum likelihood estimates (MLE) of affine transformation. The algorithm has been evaluated for three sets of data: simulated (training and recognition segment pairs), consecutive-day (data gathered from Landsat images), and geographical-extension (large-area crop inventory experiment) data sets. For each set, MLEST signature extension runs were made to determine MLE values and the affine-transformed training segment signatures were used to classify the recognition segments. The classification results were used to estimate wheat proportions at 0 and 1% threshold values. S.C.S.

A78-40163 Stratified acreage estimates in the Illinois crop-acreage experiment. R. Sigman, C. P. Gleason, G. A. Hanuschak, and R. R. Starbuck (U.S. Department of Agriculture, Statistical Reporting Service, Washington, D.C.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 80-90. 6 refs.

The article discusses the application of the Statistical Reporting Service to Landsat remote sensor data in order to estimate crop acreages. The method employs a pixel classifier consisting of a series of discriminant functions corresponding to a set of classification categories. The methodology has been evaluated for three Landsat frames taken in 1975 over western Illinois. It was found that several geographic and methodological factors influence the pixel classifier. S.C.S.

A78-40164 * Two phase sampling for wheat acreage estimation. R. W. Thomas and C. M. Hay (California, University, Berkeley, Calif.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 91-101. 6 refs. Contract No. NAS9-14565.

A two phase Landsat-based sample allocation and wheat proportion estimation method was developed. This technique employs manual, Landsat full frame-based wheat or cultivated land proportion estimates from a large number of segments comprising a first sample phase to optimally allocate a smaller phase two sample of computer or manually processed segments. Application to the Kansas Southwest CRD for 1974 produced a wheat acreage estimate for that CRD within 2.42 percent of the USDA SRS-based estimate using a lower CRD inventory budget than for a simulated reference LACIE system. Factor of 2 or greater cost or precision improvements relative to the reference system were obtained. (Author)

A78-40165 * Crop identification and area estimation by computer-aided analysis of Landsat data. M. E. Bauer, M. M. Hixson, B. J. Davis, and J. B. Etheridge (Purdue University, West Lafayette, Ind.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 102-112. 17 refs. Contract No. NAS5-20793.

This report describes the results of a study involving the use of computer-aided analysis techniques applied to Landsat MSS data for identification and area estimation of winter wheat in Kansas and corn and soybeans in Indiana. Key elements of the approach included use of aerial photography for classifier training, stratification of Landsat data and extension of training statistics to areas without training data, and classification of a systematic sample of pixels from each county. Major results and conclusions are: (1) Landsat data was adequate for accurate identification and area estimation of winter wheat in Kansas, but corn and soybean estimates for Indiana were less accurate; (2) computer-aided analysis techniques can be effectively used to extract crop identification information from Landsat MSS data, and (3) systematic sampling of entire counties made possible by computer classification methods resulted in very precise area estimates at county as well as district and state levels. (Author)

A78-40166 An interactive system for agricultural acreage estimates using Landsat data. M. Ozga, W. E. Donovan (Illinois, University, Urbana, Ill.), and C. P. Gleason (U.S. Department of Agriculture, Statistical Reporting Service, Washington, D.C.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 113-123. 18 refs.

This paper describes interactive software systems for making agricultural crop acreage estimates using Landsat MSS data developed jointly by the Center for Advanced Computation of the University of Illinois and the Statistical Reporting Service of the United States Department of Agriculture. These acreage estimation procedures have been incorporated into, and use features previously developed in, EDITOR. EDITOR is an interactive file management and image processing system developed by the Center for Advanced Computation in collaboration with USGS/DI, NASA/AMES, and USDA/SRS. The crop acreage estimation software is implemented as part of the EDITOR system on TENEX, a modified DEC SYSTEM-10. The only hardware necessary to access this acreage estimation subsystem or the whole EDITOR system consists of a KSR (keyboard send-receive) terminal with acoustic coupler and a telephone link to a TENEX system on the ARPA network. A x-y coordinate digitizer and, optionally a terminal graphics plotter, are also needed for digitizing ground-truth samples and interactive registration capabilities. (Author)

A78-40167 Machine processing of aerial data for Agricultural Resources Inventory and Survey Experiment. D. S. Kamat, K. L. Majumder, T. J. Majumdar, I. C. Matieda, C. V. S. Prakash, and V. L. Swaminathan (Indian Space Research Organization, Space Applications Center, Ahmedabad, India). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 124-134. 7 refs.

The multiband aerial data for one flight line, stretching over 38 Kms which covers an area of 6528 hectares, of the Agricultural Resources Inventory and Survey Experiment, Patiala has been analyzed by an unsupervised automatic processing technique. The results are presented in the form of tables and thematic maps. They are verified with the results obtained independently by visual photointerpretation techniques. (Author)

A78-40179 **Computer training procedures for the Western Washington forest productivity study utilizing Landsat data.** J. R. Edwards (U.S. Department of Natural Resources, Div. of Technical Services, Olympia, Wash.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 264-269.

Landsat data and multistage sampling techniques were employed to develop a forest cover inventory for 19 million acres of Western Washington; cover types of the inventory included old growth conifer, second growth conifer, hardwoods, reproduction-stage growth, and nonstocked forest (0 to five years of growth). Mixed stands containing greater than or less than 50% hardwood were found to be spectrally separable. Some classification difficulties resulted from shadows on steep slopes, snow cover and bare ground. J.M.B.

A78-40180 * **Landsat digital data application to forest vegetation and land use classification in Minnesota.** R. A. Mead and M. P. Meyer (Minnesota, University, St. Paul, Minn.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 270-280. Research supported by the University of Minnesota; Contract No. NAS5-20985.

Landsat digital data were used to map eleven categories of land cover in north central Minnesota. The classification accuracy of these maps was found to be very low and they were not adequate for use by field level resource managers. A discussion of the advantages and disadvantages of various processing systems, different algorithms, and the problems in selecting training sets, is included. (Author)

A78-40181 **A table look-up procedure for rapidly mapping vegetation cover and crop development.** A. J. Richardson and C. L. Wiegand (U.S. Department of Agriculture, Agricultural Research Service, Weslaco, Tex.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 284-297. 15 refs.

A table of 10 Landsat data categories has been shown to yield meaningful classifications of vegetation density levels, soil brightness levels, and water without any prior information on local crop and soil conditions. The 10 data categories correspond to water, cloud shadow, low, medium and high reflectivity soil, cloud tops, low, medium and dense plant cover, and a region into which no Landsat data may be expected to fall. The 10 categories, developed through analysis of Landsat data from six overpass dates, should lead to more rapid machine processing of remote sensing data to furnish crop development surveys and crop yield predictions. J.M.B.

A78-41188 **Map intensification from small format camera photography.** R. D. Spencer (Victoria Forests Commission, Melbourne, Australia). *Photogrammetric Engineering and Remote Sensing,* vol. 44, June 1978, p. 697-707. 14 refs.

The use of light, low-performance aircraft and 70 mm or 35 mm cameras with wide-angle lenses provides an economical means of obtaining current photographs for mapping plantation extensions. Increasing the aircraft ceiling to permit photo coverage with narrow-angle lenses or adopting automated camera assemblies, can make the map updating process even more efficient. Mapping 4,000 hectares of plantation extensions was found to involve a budget in which 13% of the expenses were for aircraft hire, 16% for photography, and 71% for map compilation. Photographic intensification of maps through use of small-format cameras may cost less than half the amount required for field surveys, and involve one tenth to one fifth the number of man-days. J.M.B.

A78-41190 **High-altitude versus Landsat imagery for digital crop identification.** J. R. Jensen (Georgia, University, Athens, Ga.), J. E. Estes, and L. R. Tinney (California, University, Santa Barbara, Calif.). *Photogrammetric Engineering and Remote Sensing,* vol. 44, June 1978, p. 723-733. 12 refs.

Multidate crop identification using microdensitometer scanned color infrared high-altitude photography (original scale 1:120,000) and Landsat digital data was conducted for a 140 sq km study area in Kern County, California. The purpose of this analysis was not to achieve maximum crop identification accuracy per se, but to comparatively evaluate the utility of the two image formats for digital crop identification. Preliminary results indicate that the Landsat digital approach is superior to analysis of digitized high-altitude photography. Vignetting in the high-altitude photography dataset caused serious signature extension problems. (Author)

A78-43067 **Modeling the benefits to world agriculture from remote sensing.** P. Kochanowski (Indiana University, South Bend, Ind.). In: Modeling and simulation. Volume 8 - Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa., April 21, 22, 1977. Part 2. Pittsburgh, Pa., Instrument Society of America, 1977, p. 691-695. 11 refs.

Remote sensing of agricultural land permits crop classification and mensuration which can lead to improved forecasts of production. This technique is particularly important for nations which do not already have an accurate agricultural reporting system. Better forecasts have important economic effects. International grain traders can make better decisions about when to store, buy, and sell. Farmers can make better planting decisions by taking advantage of production estimates for areas out of phase with their own agricultural calendar. World economic benefits will accrue to both buyers and sellers because of increased food supply and price stabilization. This paper reviews two world modeling efforts used to empirically establish the above scenario. Dollar estimates, their implications for the United States and the rest of the world, and inherent modeling difficulties are described. (Author)

N78-22438*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

HAND-HELD RADIOMETER RED AND PHOTOGRAPHIC INFRARED SPECTRAL MEASUREMENTS OF AGRICULTURAL CROPS

Compton J. Tucker, Cheng-jin Fan (Morgan State Univ.), James H. Elgin, Jr. (Dept. of Agr., Beltsville, Md.), and James E. McMurtrey (Dept. of Agr., Beltsville, Md.) Feb. 1978 25 p refs Submitted for publication

(NASA-TM-78091) Avail: NTIS HC A02/MF A01 CSCL 02C

Red and photographic infrared radiance data, collected under a variety of conditions at weekly intervals throughout the growing season using a hand-held radiometer, were used to monitor crop growth and development. The vegetation index transformation was used to effectively compensate for the different irradiational conditions encountered during the study period. These data, plotted against time, compared the different crops measured by comparing their green leaf biomass dynamics. This approach, based entirely upon spectral inputs, closely monitors crop growth and development and indicates the promise of ground-based hand-held radiometer measurements of crops. Author

N78-23497*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.

TEN-ECOSYSTEM STUDY (TES) SITE 4, SANDOVAL COUNTY, NEW MEXICO Final Report

W. H. Parkhurst, Principal Investigator Feb. 1978 57 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. EREP

(Contract NAS9-15200)

(E78-10110; NASA-CR-151680; LEC-11284) Avail: NTIS HC A04/MF A01 CSCL 02F

The author has identified the following significant results. Mapping accuracies for level 2 classes were about 95% in the overall probability of correct classification. Dense stands of pinyon-juniper could not be separated from other conifers. Level 3 forest species separation was not possible. The use of a contiguous 10% training area is not practical. The ten-ecosystem study technical analysis procedures proved to be a valid method for completing the study.

N78-23516*# EROS Data Center, Sioux Falls, S. Dak.
USEFULNESS OF LANDSAT DATA FOR MONITORING PLANT DEVELOPMENT AND RANGE CONDITIONS IN CALIFORNIA'S ANNUAL GRASSLAND
David M. Carneggie, Stephen D. DeGloria (Calif. Univ., Berkeley), and Robert N. Colwell (Calif. Univ., Berkeley) *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 77-101 refs
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 02C

A network of sampling sites throughout the annual grassland region was established to correlate plant growth in stages and forage production to climatic and other environmental factors. Plant growth and range conditions were further related to geographic location and seasonal variations. A sequence of LANDSAT data was obtained covering critical periods in the growth cycle. Data were analyzed by both photointerpretation and computer aided techniques. Image characteristics and spectral reflectance data were then related to forage production, range condition, range site, and changing growth conditions. Author

N78-23517*# Kansas Univ., Lawrence. Space Technology Center.
UTILIZATION OF LANDSAT IMAGERY FOR MAPPING VEGETATION ON THE MILLIONTH SCALE
Donald L. Williams and Jerry C. Coiner *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 102-116 refs Presented at the NASA Earth Resources Surv. Symp. Vol. 1A: Agr. and Environ., Houston, Tex., Jun. 1975
(Grant NGL-17-004-024)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08F

To determine if the information content of the imagery is sufficient to permit mapping according to the Unesco classification, a series of test sites were examined. These sites include examples from the humid tropics, arid, and semi-arid subtropics and temperature zones. In every case, the feasibility of this application of LANDSAT imagery was verified. The agricultural significance of several sites is discussed to indicate how the vegetation maps may be interpreted for agricultural evaluation. Author

N78-24593*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Status Report, 1 Jun. - 30 Nov. 1977
R. A. Weismiller and R. P. Mroczynski, Principal Investigators 30 Nov. 1977 78 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGR-15-005-186)
(E78-10129; NASA-CR-157003; LARS-CR-042178) Avail: NTIS HC A05/MF A01 CSCL 05A

N78-24596*# National Aeronautics and Space Administration, Washington, D. C.
PILOT STUDY OF VEGETATION IN THE ALCHICHICA-PEROTE REGION BY REMOTE SENSING
M. Soto, F. Lozano, A. Diez, C. Mejia, and J. Villa Jun. 1978 20 p Transl. into ENGLISH from Biotica (Mex.), v 2, no. 3, 1977 p 19-36 Transl. by Sci. Transl. Serv., Santa Barbara, Calif. Original doc. prep. by Inst. de Invest. Sobre Recursos Bioticos, Flora de Veracruz (Mex.).
(Contract NASw-2791)
(NASA-TM-75101; Contrib-24) Avail: NTIS HC A02/MF A01 CSCL 08F

A study of the application of satellite images to the identification of vegetation in a small area corresponding to the arid zone of Veracruz and part of Puebla is presented. This study is accomplished by means of images from the LANDSAT satellite obtained on January 19 and May 23, 1973. The interpretation of the different maps is made on the basis of information from the data bank of the Flora de Veracruz program, and various surveys made by land and air. Author

N78-25499*# Columbia Univ., New York. Dept. of Geography.
APPLICATION OF DIGITAL ANALYSIS OF MSS DATA TO AGROENVIRONMENTAL STUDIES Semiannual Progress Report
Kempton E. Webb, Colin J. High, and Jerry C. Coiner, Principal Investigators 1 Sep. 1977 111 p refs Original contains imagery.. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NsG-5080)
(E78-10133; NASA-CR-157145) Avail: NTIS HC A06/MF A01 CSCL 02C

N78-25500*# Texas A&M Univ., College Station. Remote Sensing Center.
DRYLAND PASTURE AND CROP CONDITIONS AS SEEN BY HCMM Progress Report, Jan. - Apr. 1978
W. D. Rosenthal, J. C. Harlan, and B. J. Blanchard, Principal Investigators Apr. 1978 20 p refs ERTS
(E78-10134; NASA-CR-157146; RSC-3712-1) Avail: NTIS HC A02/MF A01 CSCL 02C

N78-25503*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
REQUIREMENTS OF A GLOBAL INFORMATION SYSTEM FOR CORN PRODUCTION AND DISTRIBUTION Final Report
D. A. Landgrebe, Principal Investigator, M. F. Baumgardner, M. E. Bauer, M. A. Martin, and R. M. Peart Nov. 1977 120 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-14970)
(E78-10137; NASA-CR-157153; T-1314/4; MA-129TA) Avail: NTIS HC A06/MF A01 CSCL 05B

N78-25504*# 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 1978
D. A. Landgrebe, Principal Investigator 31 May 1978 113 p refs EREP

(Contract NAS9-15466)
(E78-10138; NASA-CR-157154; LARS-053178) Avail: NTIS HC A06/MF A01 CSCL 05B

N78-26509*# Agricultural Research Service, Phoenix, Ariz. Water Conservation Lab.
HEAT CAPACITY MAPPING MISSION Quarterly Progress Report, 1 Feb. - 30 Apr. 1978
Ray D. Jackson, Principal Investigator 30 Apr. 1978 3 p ERTS
(NASA Order S-40255B)
(E78-10139; NASA-CR-157173) Avail: NTIS HC A02/MF A01 CSCL 08H

N78-26527# National Aerospace Lab., Amsterdam (Netherlands). Scientific Services.
IMAGE DATA SECURITY IN THE CONCEPT OF THE AGRICULTURAL REAL TIME IMAGING SATELLITE SYSTEM (ARTISS)
H. A. VanIngenSchenau, L. J. M. Joosten, and J. L. Simons 28 Apr. 1976 117 p refs
(Contract NIVR-1798)
(NLR-TR-76010-U) Avail: NTIS HC A06/MF A01

Under consideration was the requirement for exclusive access to satellite imagery in the concept of ARTISS. Security assessment indicates that user survey requests are handled confidentially and shows the access vulnerability of the transmission of image data to the user groundstation. To ensure the security of this transmission two promising methods are available. Directional transmission using a directive spacecraft antenna, supported by an onboard jamming transmitter which causes deterioration of the picture quality outside a trusted territory; and crypto technique, achieved through onboard enciphering of the image data and deciphering at the user groundstation. Implementation costs for directional transmission and crypto technique are 6% and 3% of the ARTISS costs, respectively. In the case of crypto technique, a 20% cost increase for operations is expected.
Author (ESA)

N78-26530# North Central Forest Experiment Station, St. Paul, Minn.
GROUND WATER DIFFERENCES ON PINE AND HARDWOOD FORESTS OF THE UDELL EXPERIMENTAL FOREST IN MICHIGAN Final Forest Service Research Paper
2 Feb. 1978 15 p refs
(PB-278309/0; FSRP-NC-145) Avail: NTIS HC A02/MF A01 CSCL 08H

Ground water recharge under hardwood and pine forest was measured from 1962 to 1971 on the Udell Experimental Forest in Michigan. Hardwood forests produced more net ground water than pine forests by an average of 50 and 100 mm/year, using two methods of analysis. Shallow water table lands yield 80 to 100 mm/year less water than deep, well drained sands. Water yield decreased the most between drainage classifications of pine plantations.
GRA

N78-27474*# Agricultural Research Service, Weslaco, Tex.
PLANT COVER, SOIL TEMPERATURE, FREEZE, WATER STRESS, AND EVAPOTRANSPIRATION CONDITIONS Quarterly Progress Report, 1 Mar. - 1 Jun. 1978
Craig L. Wiegand, Paul R. Nixon, Harold W. Gausman, L. Neal Namken, Ross W. Leamer, and Arthur J. Richardson, Principal Investigators Jun. 1978 5 p ERTS
(NASA Order S-40198-B)
(E78-10144; NASA-CR-157231) Avail: NTIS HC A02/MF A01 CSCL 08F

N78-27481*# Columbia Univ., New York. Dept. of Geography.
APPLICATION OF DIGITAL ANALYSIS OF MSS DATA TO AGRO-ENVIRONMENTAL STUDIES Semiannual Progress Report, 1 Sep. 1977 - 31 Mar. 1978
Kempton E. Webb, Colin J. High, Jerry C. Coiner, and Leonard Zobler, Principal Investigators 1 Apr. 1978 132 p refs ERTS
(Grant NsG-5080)
(E78-10151; NASA-CR-157245) Avail: NTIS HC A07/MF A01 CSCL 02C

N78-27483*# Colorado State Univ., Fort Collins. Dept. of Earth Resources.
THE POTENTIAL BENEFIT OF IMPROVING THE DISSEMINATION OF AGRICULTURAL WEATHER INFORMATION TO THE MISSISSIPPI COTTON FARMER Final Report
Kenny Thomas Priddy and William E. Marlatt, Principal Investigators Jun. 1978 89 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 571-98 ERTS
(Grant NsG-5073)
(E78-10153; NASA-CR-157246) Avail: NTIS HC A05/MF A01 CSCL 04B

The author has identified the following significant results. The potential benefit of improved dissemination of weather information to the Mississippi cotton farmer was estimated at $36,000 per 1000 acres. This is 16% of production cost of cotton in 1976. On a statewide basis, the total potential savings exceeds 100 million dollars.

N78-27484*# Kansas Univ. Center for Research, Inc., Lawrence.
THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1978 - 31 Mar. 1978
B. G. Barr and E. A. Martinko, Principal Investigators Jul. 1978 90 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 571-98 ERTS
(Grant NGL-17-004-024)
(E78-10154; NASA-CR-157247) Avail: NTIS HC A05/MF A01 CSCL 13B

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.

A78-34204 **Passive infrared sensing of the environment.** A. G. Laird (Royal Radar Establishment, Malvern, Worcs., England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 26-37.

The use of the middle and far infrared (3 to 15 microns) for remote sensing of the terrestrial environment is discussed. The concepts of black body radiation and atmospheric transmission windows are reviewed, and instruments such as the infrared linescanner, thermal imager, radiometer and spectrometer are described. Applications of passive infrared sensing to geological surveys, clear air turbulence monitoring, studies of volcanic activity and hydrological surveys are mentioned. J.M.B.

A78-34210 **Digital analysis of multispectral aerial and Landsat data for land use planning in Britain.** W. E. Gardner, P. Carter (Atomic Energy Research Establishment, Harwell, Berks., England), and T. F. Smith (Department of the Environment, London, England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 96-107. 20 refs.

Over the last 50 years, urban land-use classification at national and regional levels has been developed from a range of data sources, including yearly censuses, local authority maps and ordnance survey maps. Remote sensing by satellite or aircraft is a new tool based on visible, infrared or microwave radiation. However, the amount of data obtained, both analog and digital, is enormous, and the automated interpretation of such data must be considered. The value of remote sensing data has been assessed using a supervised multispectral classification procedure. The general applicability of spectral signatures within a large scene has been tested by comparing class boundaries, determined by these signatures, with ground truth. In addition, the significance of the characteristics of the classes chosen, such as their age and rate of change, is considered. Finally, an attempt is made to assess the future potential for these new methods. (Author)

A78-34666 **Air pollution measurement by Fourier transform spectroscopy.** P. L. Hanst (U.S. Environmental Protection Agency, Research Triangle Park, N.C.). *Applied Optics*, vol. 17, May 1, 1978, p. 1360-1366. 10 refs.

The paper discusses an air-pollution measurement technique based on Fourier transform spectroscopy. The method yields high optical efficiency and the ability to manipulate spectra in order to remove interfering bands. Large absorption cells with long paths are used for measuring reactive pollutants (such as O3, H2O2, HNO3, HNO2, H2CO, HCOOH, PAN, HCl, NH3, NO, and NO2) in the open atmosphere. Small, folded-path cells are used for measuring non-reactive pollutants (such as hydrocarbons and halocarbons). It is suggested that the technique may be improved by removing CO2 when the collected residue is vaporized from the cryocondenser into the infrared absorption cell, and by employing the technique in conjunction with a cryogenic concentration technique and a miniaturized multiple-path cell. S.C.S

A78-34857 * **Effects of detector threshold, location of the sun, and flight altitude upon spectral variations in remote sensing over water.** W. E. Bressette (NASA, Langley Research Center, Marine and Applications Technology Div., Hampton, Va.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 67-88.

Photographic flights with Hasselblad cameras were flown on August 28, 1975, at altitudes from 2.66 and 5.3 kilometers over an ocean acid waste dump site while acid dumping was in progress. Repeated flights resulted in broadband spectral radiance data between the wavelengths of 500 to 900 nanometers for sun elevation angles that varied from 26 to 48 degrees, and at all sun azimuth angles over the range of off-nadir angles from 0 to 35 degrees. From film densitometer data, it is shown that before spectral variations in remotely sensed data can be used to quantify substances in water, the longer wavelength data must be above the detection level of the detector, radiance data between + or - 45 degrees in the direction of the sun must be avoided, and off-nadir camera correction factors must be applied to the observed radiance data. (Author)

A78-34860 * **The remote sensing of algae.** J. F. Thorne (Wisconsin State, Dept. of Natural Resources, Madison, Wis.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 145-160. 18 refs. Grant No. NGL-50-002-127.

State agencies need rapid, synoptic and inexpensive methods for lake assessment to comply with the 1972 Amendments to the Federal Water Pollution Control Act. Low altitude aerial photography may be useful in providing information on algal type and quantity. Photography must be calibrated properly to remove sources of error including airlight, surface reflectance and scene-to-scene illumination differences. A 550-nm narrow wavelength band black and white photographic exposure provided a better correlation to algal biomass than either red or infrared photographic exposure. Of all the biomass parameters tested, depth-integrated chlorophyll a concentration correlated best to remote sensing data. Laboratory-measured reflectance of selected algae indicate that different taxonomic classes of algae may be discriminated on the basis of their reflectance spectra. (Author)

A78-34863 **Monitoring of noxious aquatic plants.** A. R. Benton, Jr. (Texas A & M University, College Station, Tex.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 189-207. 15 refs.

The spread of noxious aquatic plants is an increasing environmental problem in Florida and the other Gulf states. Plant control programs have been hampered by lack of an effective, low-cost procedure for detecting new outbreaks and tracking the spread of known infestations. Aerial photography, using color and color infrared film, was tested extensively during 1974, 1975 and 1976 for its ability to differentiate between aquatic plant species, measure the size of infested areas, and monitor the changes taking place as the growing season progressed. Results were consistent and positive with respect to emersed species, somewhat less so with submersed species. It was discovered that the photography provides particularly valuable insight into the effectiveness of an ongoing aquatic plant control program. (Author)

A78-34864 **Rural landscape assessment - A comparative evaluation of high platform remote sensing.** B. J. Niemann, Jr. and K. N. Kailing (Wisconsin, University, Madison, Wis.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977,

Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 209-223. 15 refs. Research supported by the University of Wisconsin; U.S. Department of the Interior Contract No. 4-14-07-1.

The study area considered in the reported investigation includes the entire 97.28 miles of the Namekagon River, from Lake Namekagon to its confluence with the St. Croix. The Wisconsin portion of the St. Croix and Namekagon Rivers was utilized for the purpose of on-site inspection. The inventory process consisted of ranking the river by segments. Each segment was ranked on the basis of impact (Wild, Scenic, or Recreational) and experience (Exciting, Pleasurable, Interesting, Monotonous, or Distressing). The investigation had the basic objective to test high platform remote sensing systems for assessing wild and scenic rivers. It was found that a clear and perceptible multidimensional organization of the landscape for assessing 'quality' was possible using remote sensing sources. Attention is given to the value of high altitude infrared color photography and Landsat imagery. G.R.

A78-34903 * # Effect of sun elevation upon remote sensing of ocean color over an acid waste dump site. W. E. Bressette (NASA, Langley Research Center, Hampton, Va.). *Annual Remote Sensing of Earth Resources Conference, 7th, University of Tennessee, Tullahoma, Tenn., Mar. 27-29, 1978, Paper.* 16 p. 5 refs.

Photographic flights were made over an ocean acid waste dump site while dumping was in progress. The flights resulted in wide angle, broadband, spectral radiance film exposure data between the wavelengths of 500 to 900 nanometers for sun elevation angles ranging from 26 to 42 degrees. It is shown from densitometer data that the spectral signature of acid waste discharged into ocean water can be observed photographically, the influence of sun elevation upon remotely sensed apparent color can be normalized by using a single spectral band ratioing technique, and photographic quantification and mapping of acid waste through its suspended iron precipitate appears possible. (Author)

A78-35020 Symposium on Application of Remotely Sensed Data to Land Resources Planning, Ann Arbor, Mich., May 20, 1977, Proceedings. Symposium sponsored by the American Institute of Aeronautics and Astronautics and Bendix Corp. Edited by W. J. Pollard. Ann Arbor, Mich., Bendix Corp., 1977. 93 p.

This paper represents a conference on land use planning based on data obtained by remote sensing. Attention is given to the Michigan area, noting local and regional attitudes toward remote sensing applications, as well as legislative implications for the use of remote sensing data, especially mapping. Also discussed are studies of trees and ground cover from color and IR photography. D.M.W.

A78-35684 A study of gaseous pollutants in the Houston, Texas area. S. J. Gordon (Northrop Services, Inc., Research Triangle Park, N.C.) and S. A. Meeks (U.S. Environmental Protection Agency, Chemistry and Physics Laboratory, Research Triangle Park, N.C.). *AIChE Symposium Series,* vol. 73, no. 165, 1977, p. 84-94.

A78-36268 Guidelines for using Landsat data for rural land use surveys in developing countries. J. L. van Genderen, P. A. Vass (Fairey Surveys, Ltd., Maidenhead, Berks., England), and B. F. Lock (Salisbury College of Advanced Education, Adelaide, Australia). *ITC Journal,* no. 1, 1978, p. 30-49. 17 refs. Research supported by the University of Sheffield.

A viable methodology is described which can provide suitable guidelines for the operational production of small-scale rural land use maps of semiarid developing regions from Landsat MSS imagery using inexpensive and unsophisticated techniques. The methodology is divided into two stages: (1) preoperational, involving the careful selection of the appropriate interpretation techniques and imagery; and (2) operational, in which the actual land use map is produced. As the Landsat MSS imagery system permits regular synoptic coverage of the earth's surface, it provides an ideal method for establishing a satisfactory data base and further monitoring of land use changes over large areas. The suggested imagery and interpretation techniques consisting of color composites and monocular magnification are found to be the simplest, fastest and most versatile method. The criteria and hierarchical structure presented in the USGS Circular 671 are found to be acceptable as a general basis for researchers and organizations intending to develop systems for their own regions. S.D.

A78-36303 Airborne monitoring of surface water pollutants by fluorescence spectroscopy. M. P. F. Bristow (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). *Remote Sensing of Environment,* vol. 7, Apr. 1978, p. 105-127. 13 refs.

An airborne laserfluorosensor has been used to record fluorescence profiles of a controlled oil spill and of the river effluent from a pulp and paper mill. A pulsed ultraviolet laser is used as the excitation source in conjunction with a telescope receiver and photomultiplier detector. The complete system, including power supplies and monitoring and recording equipment, was installed and flown on a DC-3 aircraft. The fluorescence profiles exhibited excellent signal-to-noise ratios and ground resolution, thereby providing for good discrimination between targets of different fluorescence quantum efficiency. By making a number of passes over a particular target area, it has been shown that the measured fluorescence profiles demonstrate target changes both in space and time. Information gained from these remote sensing measurements has provided data for use in the design of an advanced laserfluorosensor capable of recording fluorescence spectra and decay time data in addition to fluorescence profiles similar to those presented here. (Author)

A78-36648 * Mapping of chlorophyll a distributions in coastal zones. R. W. Johnson (NASA, Langley Research Center, Hampton, Va.). *Photogrammetric Engineering and Remote Sensing,* vol. 44, May 1978, p. 617-624. 13 refs.

It is pointed out that chlorophyll a is an important environmental parameter for monitoring water quality, nutrient loads, and pollution effects in coastal zones. High chlorophyll a concentrations occur in areas which have high nutrient inflows from sources such as sewage treatment plants and industrial wastes. Low chlorophyll a concentrations may be due to the addition of toxic substances from industrial wastes or other sources. Remote sensing provides an opportunity to assess distributions of water quality parameters, such as chlorophyll a. A description is presented of the chlorophyll a analysis and a quantitative mapping of the James River, Virginia. An approach considered by Johnson (1977) was used in the analysis. An application of the multiple regression analysis technique to a data set collected over the New York Bight, an environmentally different area of the coastal zone, is also discussed. G.R.

A78-36918 Remote pollution probing by laser-induced luminescence techniques. R. E. Grojean, J. A. Sousa, J. F. Roach, E. F. Wyner, and M. Nakashima (U.S. Army, Equipment and Materials Engineering Laboratory, Natick, Mass.). *Optical Engineering,* vol. 17, Mar.-Apr. 1978, p. 139-142. 10 refs.

The general problem of remote detection for laser stimulated luminescent systems is considered. A simple optical model is employed to calculate the maximum practical range of detection for several such luminescent systems. Some experimental verification of

the model is included. Consideration is also given to the practicality of using such a system for the remote detection of casual oil spills. The results of this study indicate that laser-induced fluorescence is a practical technique for the remote detection of pollutants. The ranges calculated from the simplified model are, in general, greater than those reported in the literature, but appear to be realizable.
(Author)

A78-36920 Detection of atmospheric pollutants by quantitative analytical spectroscopy using a continuously scanned tunable dye laser. Y. Fujii and T. Masamura (Tokyo, University, Tokyo, Japan). *Optical Engineering,* vol. 17, Mar.-Apr. 1978, p. 147-152.

A78-36921 Use of the Fast Fourier Transform in evaluation of laser Raman and fluorescence decay times. C. N. Bressel, S. R. Wisotsky (Avco Everett Research Laboratory, Inc., Everett, Mass.), and W. E. Vander Velde (MIT, Cambridge, Mass.). *Optical Engineering,* vol. 17, Mar.-Apr. 1978, p. 153-155. Research supported by the Avco Everett Research Laboratory.

Two methods have been proposed for remote identification of oil slicks on water using an airborne lidar system. Both techniques require estimating the time decay of physical quantities from the measured return signal pulse. The purpose of this paper is to suggest the use of a Fast Fourier Transform technique to deconvolve the oil-fluorescence-on-water Raman decay time from the return pulse. This is a convolution of the required time varying signal with pulse shape, pulse broadening due to surface scattering, and instrument response. It is shown that the method yields results in agreement with those of Measures, Houston and Stephenson. The FFT method is faster and requires little storage and could be implemented in real time on airborne minicomputers or microcomputers. (Author)

A78-37180 * Analytical inversions in remote sensing of particle size distributions. I - Multispectral extinctions in the anomalous diffraction approximation. II - Angular and spectral scattering in diffraction approximations. A. L. Fymat (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Applied Optics,* vol. 17, June 1, 1978, p. 1675-1678. 23 refs.

Consideration is given to analytical inversions in the remote sensing of particle size distributions, noting multispectral extinctions in anomalous diffraction approximation and angular and spectral scattering in diffraction approximation. A closed-form analytical inverse solution is derived in order to reconstruct the size distribution of atmospheric aerosols. The anomalous diffraction approximation to Mie's solution is used to describe the particles. Experimental data yield the geometrical area of aerosol polydispersion. Size distribution is thus found from a set of multispectral extinction measurements. In terms of the angular and spectral scattering of light in a narrow forward cone, it is shown that an analytical inverse solution may also be found for the Fraunhofer approximation to the Kirchhoff diffraction, and for an improved expression of this approximation due to Penndorf (1962) and Shifrin-Punina (1968).
S.C.S.

A78-37304 The net radiation budget of the St. Louis metropolitan area. J. M. White, F. D. Eaton, and A. H. Auer, Jr. (Wyoming, University, Laramie, Wyo.). *Journal of Applied Meteorology,* vol. 17, May 1978, p. 593-599. 9 refs. U.S. Environmental Protection Agency Grant No. R-800875; NSF Grant No. AEN-73-07881.

Ground and aircraft measurements of the shortwave and longwave radiative components were taken to derive the daily evolution of net radiation, and each of its components, during cloudless summer days in the St. Louis metropolitan area (Project METROMEX). Distinct divisional patterns are seen in the reflected solar radiation, emitted radiation and net radiation between the urban and rural land use types. Solar noontime albedo values varied from 15-17% for rural land uses in contrast to 12-13% for most urban land uses. An extreme difference of 15 K in maximum infrared surface temperatures occurred between industrial and undeveloped land uses. These two land uses also exhibited extreme differences in net radiation. Generally, the change in reflected, emitted and net radiative components showed some correlation with the amount of vegetative coverage within each land use. (Author)

A78-37309 Correlation of land use and cover with meteorological anomalies. A. H. Auer, Jr. (Wyoming, University, Laramie, Wyo.). *Journal of Applied Meteorology,* vol. 17, May 1978, p. 636-643. 33 refs. U.S. Environmental Protection Agency Grant No. R-800875; NSF Grant No. AEN-73-07881.

Low-level airborne mapping and photography are used to establish the land use mosaic for metropolitan St. Louis. Attention is focused on identifying certain features of the land use in St. Louis that are unique and may be meteorologically significant in explaining some thermodynamic, kinematic and radiative anomalies associated with the overriding atmosphere of the metropolitan St. Louis. A meteorologically oriented classification of land use and cover is presented which provides as much compatibility as possible with other classification systems currently used by the various federal agencies involved in land use inventory and mapping. The proposed classification system satisfies the three major attributes of the classification process outlined by Grigg (1965): it gives names to categories by simply using accepted terminology, it enables the classification scheme to be transferable, and it allows inductive generalizations to be made. The classification system has the potential of further refinement on the basis of more extended and varied use. S.D.

A78-38873 # Remote monitoring of environmental pollution (Distantsionnyi monitoring zagriazneniia okruzhaiushchei sredy). I. M. Nazarov and Sh. D. Fridman (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Institut Prikladnoi Geofiziki, Moscow, USSR). *Meteorologiia i Gidrologiia,* Apr. 1978, p. 45-57. 26 refs. In Russian.

Several new trends in the use of remote sensing techniques for monitoring environmental pollution are discussed. The method of determining mean concentration of polluting gas on long paths by measuring resonant absorption of laser radiation or radiation from a thermal source is described. The method of differential laser absorption for measuring the spatial distribution of gas and aerosol concentration is also described. The method of single-frequency laser probing of atmospheric aerosols is also considered. The basic principles behind the remote gamma spectral method of monitoring radioactive pollution of soil are recalled. P.T.H.

A78-39631 Planned operation of a multidisciplinary airborne lidar. W. Renger and G. H. Ruppersberg (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, West Germany). In: Laser 77 opto-electronics; Proceedings of the Conference, Munich, West Germany, June 20-24, 1977. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1977, p. 753-755.

The paper describes the planned operation of a combined airborne aerosol-differential absorption lidar. The instrumentation platform is the Meteorological Research Aircraft MYSTERE. Three operation areas within the FRG have been identified for model missions. These missions, which have nearly the same difficulties and solutions as future Spacelab experiments, shall demonstrate the feasibility and to which degree the given objectives can be met.
(Author)

A78-39632 Flight-testing of a continuous laser remote sensing system (Flugerprobung eines kontinuierlichen Laser-Fernmess-Systems). W. Wiesemann (Battelle-Institut, Frankfurt am Main, West Germany). In: Laser 77 opto-electronics; Proceedings of the Conference, Munich, West Germany, June 20-24, 1977. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1977, p. 756-762. In German.

Flight-testing of a lidar system developed for airborne remote sensing of trace gases is described. The flight test involved a CO2 laser; the signal-to-noise ratio of the system and the effects of various reflective surfaces (streets, forests, bodies of water) on the quality of the laser signal were assessed. Quantitative measurement of the specific absorption properties of atmospheric pollutants through use of the airborne lidar is also discussed. J.M.B.

A78-40183 * Tabular data base construction and analysis from thematic classified Landsat imagery of Portland, Oregon. N. A. Bryant (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), A. J. George, Jr. (Oregon State, Dept. of Environmental Quality, Portland, Ore.), and R. Hegdahl (Columbia Region Association of Governments, Portland, Ore.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 313-318. 7 refs. Contract No. NAS7-100.

A systematic verification of Landsat data classifications of the Portland, Oregon metropolitan area has been undertaken on the basis of census tract data. The degree of systematic misclassification due to the Bayesian classifier used to process the Landsat data was noted for the various suburban, industrialized and central business districts of the metropolitan area. The Landsat determinations of residential land use were employed to estimate the number of automobile trips generated in the region and to model air pollution hazards. J.M.B.

A78-41232 Continuous in situ monitoring of ambient particulate sulfur using flame photometry and thermal analysis. W. G. Cobourn, R. B. Husar, and J. D. Husar (Washington University, St. Louis, Mo.). *(International Symposium on Sulfur in the Atmosphere, Dubrovnik, Yugoslavia, Sept. 7-14, 1977.) Atmospheric Environment,* vol. 12, no. 1-3, 1978, p. 89-98. 22 refs. U.S. Environmental Protection Agency Grants No. R-803896; No. R-803115.

A78-41254 Aerosol size distributions and aerosol volume formation for a coal-fired power plant plume. B. K. Cantrell and K. T. Whitby (Minnesota, University, Minneapolis, Minn.). *(International Symposium on Sulfur in the Atmosphere, Dubrovnik, Yugoslavia, Sept. 7-14, 1977.) Atmospheric Environment,* vol. 12, no. 1-3, 1978, p. 323-333. 14 refs. U.S. Environmental Protection Agency Grant No. R-803851-02.

A78-41280 Airborne sampling system for plume monitoring. D. L. Blumenthal, J. A. Ogren, and J. A. Anderson (Meteorology Research, Inc., Altadena, Calif.). *(International Symposium on Sulfur in the Atmosphere, Dubrovnik, Yugoslavia, Sept. 7-14, 1977.) Atmospheric Environment,* vol. 12, no. 1-3, 1978, p. 613-620. 30 refs. Research supported by the U.S. Environmental Protection Agency.

The instrumentation of the single-engine Cessna 206 used for the airborne sampling of plumes for Project MISTT (Midwest Interstate Sulfur Transformation and Transport) is described. On board aerosol instrumentation includes a condensation nuclei monitor, aerosol charge acceptance monitor, integrating nephelometer, electrical aerosol analyzer, optical particle counter, size-segregated filter sampler, and a wing-mounted impactor system. The size distribution sample inlet system is characterized, and a list of continuously monitored chemical compounds and physical parameters is presented. Advantages of the system include the ability to make a large number of simultaneous measurements and the operational procedures which allow rapid feedback of sampling results. M.L.

A78-41301 Experimental results on the SO2 transfer in the Mediterranean obtained with remote sensing devices. P. Zettwoog and R. Haulet (Commissariat à l'Energie Atomique, Département de Protection, Fontenay-aux-Roses, Hauts-de-Seine, France). *(International Symposium on Sulfur in the Atmosphere, Dubrovnik, Yugoslavia, Sept. 7-14, 1977.) Atmospheric Environment,* vol. 12, no. 1-3, 1978, p. 795, 796.

A real-time air quality mapping system has been employed to acquire data on the emission of SO2 from anthropogenic sources and volcanoes in the Mediterranean region. Included in the air quality monitoring system are a Barringer correlation spectrometer to measure overhead burdens of SO2 and a teleanemometer to study plume flows. For the Western Mediterranean region, Mount Etna proves an important SO2 source, exhibiting a mass flow rate from 1100 tons/day during low activity to 12,400 tons/day during eruptions. J.M.B.

A78-41462 *Airborne lidar aerosol measurements during* the ASSESS II mission. Ch. Werner, S. Dietz, H. Herrmann, F. Köpp, H. Löffler (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, West Germany), and F. Bachstein (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen; FB Elektronik, Munich, West Germany). *Review of Scientific Instruments,* vol. 49, July 1978, p. 974-981. 15 refs. Research supported by the Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt.

During May 1977 the Airborne Science Spacelab Experiments System Simulation (ASSESS II) took place, using the NASA CV 990 aircraft. A Nd:glass lidar system, measuring the aerosol mass concentration over large areas, was proxy operated by trained 'Payload Specialists.' The main part of this paper is concerned with the lidar experiment and its results. The participants in the mission viewed it as a tool for judging their spacelab science management and as the final stage of a guide for future planning of experiments. A general result that has emerged is that, for a real spacelab mission, the handling of remote sensing experiments should be fully automatic. (Author)

A78-43161 Remote sensing of air pollutants by correlation spectroscopy Instrumental response characteristics. M. M. Millán and R. M. Hoff (Department of the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada). *Atmospheric Environment,* vol. 12, no. 4, 1978, p. 853-864. 19 refs.

The philosophy behind the development of the correlation spectroscopic techniques now in use for the remote sensing of air pollutants is briefly examined. In order to focus attention on the operational characteristics common to most of these, dispersive as well as non-dispersive, sensors, the authors select one of the commercially available instruments to describe in certain detail how the instrumental design parameters, the available backgrounds or sources, and the geometry of the observation interact to affect the output signal. This work is intended to review the development of the selected instrumental technique, and also to alert the user about some factors which must be considered both with the gathering and during the analysis of the data collected with these types of sensors. (Author)

A78-43162 A kilometer pathlength Fourier-transform infrared system for the study of trace pollutants in ambient and synthetic atmospheres. E. C. Tuazon, R. A. Graham, A. M. Winer, R. R. Easton, J. N. Pitts, Jr. (California, University, Riverside, Calif.), and P. L. Hanst (U.S. Environmental Protection Agency, Research Triangle Park, N.C.). *Atmospheric Environment,* vol. 12, no. 4, 1978, p. 865-875. 37 refs. U.S. Environmental Protection Agency Grant No. 80-45-4601.

N78-23506*# Delaware Univ., Newark. College of Marine Studies.
DETERMINATION OF SPECTRAL SIGNATURES OF SUBSTANCES IN NATURAL WATERS Final Report
V. Klemas, W. Philpot, and G. Davis 1 Mar. 1978 100 p refs
(Grant NsG-1149)
(NASA-CR-156998) Avail: NTIS HC A05/MF A01 CSCL 08H

Optical remote sensing of water pollution offers the possibility of fast, large scale coverage at a relatively low cost. The possibility of using the spectral characteristics of the upwelling light from water for the purpose of ocean water quality monitoring was explained. The work was broken into several broad tasks as follows: (1) definition of a remotely measured spectral signature of water, (2) collection of field data and testing of the signature analysis, and (3) the possibility of using LANDSAT data for the identification of substances in water. An attempt to extract spectral signatures of acid waste and sediment was successful. Author

N78-23523*# California Earth Science Corp., Santa Monica.
ACTIVE AND INACTIVE FAULTS IN SOUTHERN CALIFORNIA VIEWED FROM SKYLAB
P. M. Merifield and D. L. Lamar *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 205-225 refs Presented at the NASA Earth Resources Surv. Symp. Vol. 1B: Geol. and Inform., Houston, Tex., Jun. 1975

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08G

A number of prominent linears in basement terrane of the Peninsular Ranges appeared on Skylab images. In most cases, they were represented by straight or gently curved valleys; however, detailed field investigations have shown that several of these linears mark previously unmapped faults which form two distinct fault sets; one set trends northeast, the other west-northwest. No indications of recent movement were present on these faults which were truncated by seismically active, northwest trending fault zones such as the Elsinore and San Jacinto. Right-lateral separation is demonstrable on the northeast trending set. Author

N78-25498*# Ministry of Tourism and Wildlife, Nairobi (Kenya).
THE KENYA RANGELAND ECOLOGICAL MONITORING UNIT
W. E. Stevens, Principal Investigator 15 Feb. 1978 17 p refs Sponsored by NASA ERTS
(E78-10132; NASA-CR-157011) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. Methodology for aerial surveys and ground truth studies was developed, tested, and revised several times to produce reasonably firm methods of procedure. Computer programs were adapted or developed to analyze, store, and recall data from the ground and air monitoring surveys.

N78-25501*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
APPLICATIONS OF HCMM SATELLITE DATA TO THE STUDY OF URBAN HEATING PATTERNS Quarterly Report
Toby N. Carlson, Principal Investigator 1 Jun. 1978 8 p refs ERTS
(Contract NAS5-24264)
(E78-10135; NASA-CR-157147; QR-2) Avail: NTIS HC A02/MF A01 CSCL 13B

N78-25509# Minnesota Univ., Minneapolis.
ASSESSMENT OF WATER QUALITY STATUS AND TRENDS IN MINNESOTA BY REMOTE SENSING TECHNIQUES
Kenneth N. Brooks, Arnett C. Mace, Jr., and Merle P. Meyer Dec. 1977 66 p refs
(PB-277822; W78-04105) Avail: NTIS HC A04/MF A01 CSCL 08H

Aerial photography, with limited field sampling, was investigated as a practical alternative to estimate the water quality of ten lakes in the Minneapolis and St. Paul metropolitan area of Minnesota. These ten lakes represented a wide diversity of trophic state and were sampled for color, turbidity, suspended sediment, chlorophyll, phytoplankton numbers, and Secchi disk depth. Regression equations for these water quality indicators were based on film transmittance of black and white panchromatic (2402), color (2448) and color infrared (2443) films as measured with a VP-8 image analyzer. Statistically significant prediction equations were developed for Secchi disk depth, turbidity and color. Variability of transmittance readings with time required that a specific set of procedures be followed for practical application. Procedures are outlined which allow film transmittance to be used to estimate Carlson's Trophic State Index. GRA

N78-26439# Technische Universitaet, Munich (West Germany).
REMOTE SENSING USING TUNABLE LASERS
K. W. Rothe and H. Walther 1977 15 p refs
(AED-Conf-77-165-002) Avail: NTIS (US Sales Only) HC A02/MF A01; DoE Depository Libraries

Summarizing the present situation of pollution monitoring by means of LIDAR it can be said that it is proven that the differential absorption method is the most sensitive technique known at present. TEA lasers are suitable light sources for a general application in the infra-red spectral region. The sensitivity which can be expected with those lasers allows to probe the atmosphere in the vicinity of chemical factories or other pollution sources over distances of about 3 km. Further improvements are possible e.g. by the use of heterodyne detection or by the use of frequency up-conversion for signal detection. A considerable step forward can still be expected when continuously tunable lasers as e.g. parametric oscillators of sufficient output are used for the measurements. ERA

N78-27614*# Old Dominion Univ., Norfolk, Va. Dept. of Physics and Geophysical Sciences.
AN EXPERIMENTAL/ANALYTICAL PROGRAM TO ASSESS THE UTILITY OF LIDAR FOR POLLUTION MONITORING Final Report, 1 Sep. 1976 - 31 Oct. 1977
Frank S. Mills, Robert J. Allen, Carolyn F. Butler, and Earl C. Kindle Jun. 1978 46 p refs
(Grant NsG-1343)
(NASA-CR-157302; PGSTR-AP78-9) Avail: NTIS HC A03/MF A01 CSCL 13B

The development and demonstration of lidar techniques for the remote measurement of atmospheric constituents and transport processes in the lower troposphere was carried out. Particular emphasis was given to techniques for monitoring SO2 and particulates, the principal pollutants in power plant and industrial plumes. Data from a plume dispersion study conducted in Maryland during September and October 1976 were reduced, and a data base was assembled which is available to the scientific community for plume model verification. A UV Differential Absorption Lidar (DIAL) was built, and preliminary testing was done. L.S.

N78-27654# Laser Analytics, Inc., Lexington, Mass.
SPECTRAL MEASUREMENTS OF GASEOUS SULFURIC ACID USING TUNABLE DIODE LASERS Final Report, Nov. 1976 - Jul. 1977
Richard S. Eng, Kenneth W. Nill, and Jack F. Butler Feb. 1978 74 p refs
(Contract EPA-68-02-2482)
(PB-278985/7; EPA-600/2-78-019) Avail: NTIS HC A04/MF A01 CSCL 07D

Using a tunable diode laser spectrometer with a spectral resolution of about 10 to the -4 power/cm, the important central portions of the two infrared absorption bands of H2,SO4 at 8:2 micrometers and 11.3 micrometers were scanned at low pressure and at atmospheric nitrogen pressure. Maximum absorption coefficients were measured to be 6.5/cm/atm and 6.9/cm/atm at the 8.2 micrometer and 11.3 micrometer bands, respectively. Interference spectra of SO2, CO2, and H2O near the H2SO4 absorption peaks at 1222/cm and 880/cm were scanned using a 1.1 m cell at 200C to determine interference free regions. A spectroscopic method was used to measure the partial pressures of H2SO4, SO3, and H2O vapors above azeotropes of H2SO4 at 107 C, 150 C and 200 C. The expected performance characteristics of an H2SO4 tunable diode laser stack monitor are considered on the basis of the above results.
GRA

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A78-34217 **Antarctic mapping from satellite imagery.** C. Swithinbank (British Antarctic Survey, Cambridge, England) and C. Lane (Directorate of Overseas Survey, Surbiton, Surrey, England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 212-221.

The mapping of Antarctica has been proceeding too slowly. There is an urgent need for 1:250,000 scale reconnaissance maps to position the results of 30 years of geological, geophysical and glaciological investigation; to give a planimetric base for aeronautical and hydrographic charts; to provide a bench-mark against which to measure future changes in the position of glacier margins; and to yield the first-ever small scale maps almost free from plottable errors. Studies of the value of Landsat imagery as a substitute for conventional mapping led to the publication of seven 1:250,000 scale map sheets. This was probably the first series of maps of any part of the world for which planimetric detail was taken entirely from satellite imagery. Each map was produced in two editions: one a direct half-tone reproduction of Band 7 multispectral scanner imagery, with added graticule, symbols, spotheights, and place names; the other an interpretative line drawing traced from both Band 4 and Band 7 imagery. (Author)

A78-34391 # **Geodetic connection of materials from a nonphotographic aerial survey (Geodezicheskaia priviazka materialov nefotograficheskoi aeros'emki).** V. I. Akovetskii, Iu. N. Korneev, and A. S. Sergeev (Moskovskii Institut Inzhenerov Geodezii, Aerotos'emki i Kartografii, Moscow, USSR). *Geodeziia i Aerofotos'emka,* no. 6, 1977, p. 72-81. In Russian.

Consideration is given to techniques for the geodetic connection of materials from nonphotographic (i.e., radar, television, infrared, laser) aerial surveys. An algorithm is developed for determining the coordinates of place objects. The effects of vertical refraction and the curvature of the earth are taken into account. The technique is discussed with reference to applications in cartography, geology, hydrology, land reclamation, and agriculture. S.C.S.

A78-34393 # **The relation between the point coordinates of a place and its imagery for a pair of radar images (Zavisimost' mezhdu koordinatami tochki mestnosti i ee izobrazhenii na pare radiolokatsionnykh snimkov).** Iu. N. Korneev. *Geodeziia i Aerofotos'emka,* no. 6, 1977, p. 87-91. In Russian.

Two methods for creating stereoscopic radar images are discussed. In the first the radar survey of a single locality or object is made during carrier flights from two sides. In the second the survey is conducted on a single side of the object but at two different heights. A formula, derived for the relation between the point coordinates of the object or locality and its imagery, is applied to the sets of images. It is noted that the coordinates depend solely on the angular elements of the orientation antenna in the right or the upper image. S.C.S.

A78-34868 **A computer processed /Landsat/ land cover map of North Dakota.** R. D. Mower and M. L. Heinrich (North Dakota, University, Grand Forks, N. Dak.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 295-307. 5 refs. Research supported by Bendix Corp. and North Dakota Regional Environmental Assessment Program.

The Bendix Aerospace Systems Division and the University of North Dakota Institute for Remote Sensing (UNDIRS) collaborated with the North Dakota Regional Environmental Assessment Program (REAP) to produce a land cover map at a scale of 1:500,000 for the State of North Dakota. The map was produced from Landsat digital data processed by a Bendix Multispectral Data Analysis System (MDAS). Each pixel (1.12 acres) is classified and portrayed in colors representing either one of ten selected land cover categories or an uncategorized class. The ten land cover categories are as follows: (1) Built-up, (2) Cropland, (3) Fallow, (4) Exposed Subsoil or Saline Seep, (5) Rangeland, (6) Rangeland, Pasture, and Agricultural (Mixed), (7) Forest, (8) Water, (9) Wetland, and (10) Barren. (Author)

A78-34874 **An all-purpose change-detection and recording system.** J. B. Theis (Bausch and Lomb, Inc., Rockville, Md.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 375-406. 68 refs.

A graphical data transfer instrument useful for updating maps on the basis of aerial photographs is described. The change-detection and transfer instrument incorporates a magnification feature to match photograph and map scales, and an anamorphic feature to compensate for geometric anomalies in photographic imagery. The device has been used to process cloud images from the Synchronous Meteorological Satellite, aerial photographs of a coastal zone, and multispectral scanner imagery of forests. J.M.B.

A78-36051 **International Symposium on Geodesy and Physics of the Earth, 3rd, Weimar, East Germany, October 25-31, 1976, Proceedings. Parts 1, 2 & 3.** Edited by H. Kautzleben (Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, Potsdam, East Germany), A. G. Masevich (Akademiia Nauk SSSR, Astronomicheskii Sovet, Moscow, USSR), E. Tengström, and E. Buschmann. Potsdam, Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde (Zentralinstitut für Physik der Erde, Veröffentlichungen, No. 52, pts. 1-3), 1977. Pt. 1, 232 p.; pt. 2, 453 p.; pt. 3, 394 p. In English, German, Russian, and French.

The papers presented contribute new studies on the realization and analysis of space geodesy, monitoring geodetic networks, theory of gravity and the geopotential, and geodynamics. Topics covered include post-Newtonian correction to the dynamics of the earth-moon system and their significance for relativistic gravitational theories, relationships between recent vertical movements of the earth's surface and deep crustal structure, determining the coordinates of geodetic stations by the method of large chords, determination of secular motion of the poles from satellite observations, determination of the free boundary in potential theory, investigations of earth tides, interpolation of deflection of the vertical from horizontal gradients of gravity, and long-period waves and tilts of the earth's surface preceding a strong earthquake. P.T.H.

A78-36078 # **Investigations of earth tides at Tiefenort.** M. M. Schneider and D. Simon (Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, Potsdam, East Germany). In: International Symposium on Geodesy and Physics of the Earth, 3rd, Weimar, East Germany, October 25-31, 1976, Proceedings. Part 2. Potsdam, Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, 1977, p. 499-510. 11 refs.

The Tiefenort earth-tide station is located about 300-m underground and incorporates systems of tilt meters and strain meters for the continuous recording of ground deformations. Photographs are presented of some of the equipment. B.J.

A78-36269 **Transfer functions of interpolation methods.** K. Tempfli and B. Makarovic (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *ITC Journal,* no. 1, 1978, p. 50-80. 9 refs.

The growing impact of digital terrain models in photogrammetry, cartography and civil engineering has significantly enhanced the role of the interpolation methods (IMs). The present study aims primarily at evaluating the performance of IMs in general. No assumption is made in regard to the type of terrain relief, but sampling is assumed to be homogeneous at equal steps. For this purpose, a special analytical numerical approach is formulated and applied to the computation of transfer functions; these functions are particularly suitable for comparative studies of different IMs. The computational effort for the transfer functions is reduced by simplifying the problem to univariate (two-dimensional) data. As input a sinusoid is used which is the elementary unit in the Fourier-transform domain. The interpolation algorithms are classified into piecewise polynomials, moving averages, and linear least-squares methods. It is shown that fidelity depends primarily on the sampling interval while the complexity of the interpolation algorithm is less influential, and that the time efficiency depends mainly on the number of reference points involved in each interpolation cycle. S.D.

A78-37598 # **Constructing locality profiles by a photogrammetric method (Postroenie profilei mestnosti fotogrammetricheskim metodom).** V. I. Pavlov. Leningrad, Izdatel'stvo Nedra, 1977. 96 p. 35 refs. In Russian.

The handbook describes the plotting of locality profiles using data from aerial photographs and digital models. Based on differential formulas, expressions are found for the errors in linear profile points. A theory of constructing profiles according to the surveys of two aerial photographs, a series of aerial photographs, and digital models is outlined. Techniques for constructing locality profiles by analog devices are reviewed, noting that they may be used for planning the location of high-voltage power lines. Attention is also given to the determination of corrections for the relief in gravimetric observations by a stereophotogrammetric method. S.C.S.

A78-37888 # **Aerial phototopography /2nd enlarged edition/ (Aerofototopografiia /2nd enlarged edition/).** A. N. Lobanov. Moscow, Izdatel'stvo Nedra, 1978. 576 p. 23 refs. In Russian.

Topics considered include the analysis of single photographs and stereo pairs, means of measuring photographs, phototransformation of photographs and composition of photographic maps, and analytic and analogic spatial phototriangulation. Phototransformers, monocomparators, stereocomparators, and multipurpose stereophotographic devices are described. The composition of maps and orthophotic maps by use of multipurpose stereo equipment is explained. M.L.

A78-37889 # **Use of earth satellites for the construction of geodetic networks (Ispol'zovanie iskusstvennykh sputnikov zemli dlia postroeniia geodezicheskikh setei).** E. G. Boiko, B. M. Klenitskii, I. M. Landis, and G. A. Ustinov. Moscow, Izdatel'stvo Nedra, 1977. 376 p. 141 refs. In Russian.

The construction of geodetic networks is discussed with attention to the use of data fom geosynchronous and nongeosynchronous satellites. Coordinate systems and their transformations, satellite motion, and the processing of observational data are discussed, and the principles of constructing and smoothing geodetic networks are explained. The optimum conditions for constructing a geodetic network are considered, and procedures for estimating the precision are presented. M.L.

A78-37981 **Design of satellite constellations for optimal continuous coverage.** D. C. Beste (General Research Corp., Santa Barbara, Calif.). *IEEE Transactions on Aerospace and Electronic Systems,* vol. AES-14, May 1978, p. 466-473. 8 refs.

A satellite-borne sensor can view a region at or above the earth's surface. The size of this region depends on the satellite's altitude, the maximum range and scan angle of the sensor, the minimum above-the-horizon viewing angle required, the extent in altitude of the region to be viewed, and the maximum altitude of sensor obscuration by the atmosphere. Except for geosynchronous satellites this region moves relative to the earth, so that constellations of satellites are generally necessary for continuous coverage. Satellite constellations which minimize the number of satellites required for continuous coverage are derived as a function of the angle (psi) subtended at the earth's center by the coverage of a single satellite. This is done for single and triple continuous coverage of the entire earth and of the polar regions extending to abitrary latitude. Simple, cogent approximations for the configurations and numbers of satellites are found. Expressions which relate sensor capabilities and surveillance requirements to psi are presented. Examples are given to illustrate the use and accuracy of the results. (Author)

A78-38064 # **The employment of auxiliary data in the photogrammetric survey of regions without control points (Verwendung von Hilfsdaten bei der photogrammetrischen Vermessung passpunktloser Gebiete).** Y. Erkanli. Darmstadt, Technische Hochschule, Dr.-Ing. Dissertation, 1977. 143 p. 90 refs. In German.

The possibilities of an employment of auxiliary data for aerial photogrammetry are discussed. It is found that a direct determination of the data of external orientation without an employment of geodetic control points is, in principle, feasible. However, such a determination cannot be recommended for economic reasons. Particular attention is given to the employment possibilities for Airborne-Profile-Recorder (APR) data for aerial photogrammetry. In the considered applications, flight altitude data measured above ground are used, in place of geodetic position and altitude control points, as reference lengths for the determination of the model or plotting scale. APR altitudes are also used as altitude control points for the manufacture of maps with a scale of 1:5000. The implementation of the discussed procedures is illustrated with the aid of a practical example involving the photogrammetric survey of regions without control points on the basis of an employment of APR data. The accuracy of laser and radar-APR measurements is compared by taking into account the results of aerotriangulation studies. G.R.

A78-38217 **The definition of the telluroid.** E. W. Grafarend (München, Universität, Neubiberg, West Germany). *Bulletin Géodésique,* vol. 52, no. 1, 1978, p. 25-37. 15 refs.

The three-dimensional mapping of the earth surface onto the best approximative figure, the telluroid, is analyzed by computing the three-dimensional mapping equations and the distortion tensor of Lagrangian and Eulerian type. The angular distortion is given in terms of the distortion tensor. Special emphasis is on the isoparametric mapping called IST. As a by-product the geodetic boundary value problem is formulated in three dimensions. (Author)

A78-40460 # **Current status and developmental trends of satellite geodesy (Stan aktualny oraz kierunki rozwoju geodezji satelitarnej).** W. Baran (Akademia Rolniczo-Techniczna, Olsztyn, Poland). *(Polskie Towarzystwo Astronomiczne, Meeting, 18th, Olsztyn, Poland, Sept. 21, 1977.) Postepy Astronomii,* vol. 26, Jan.-Mar. 1978, p. 3-17. 27 refs. In Polish.

Geometrical and dynamic methods of satellite geodesy are examined, and their principal features are outlined. It is shown how geometrical methods can be used to precisely define a space triangulation net formed by satellite ground stations. Dynamic methods, i.e., analysis of satellite motion, are applied to the determination of the nonuniformities of the earth's gravitational field. It is also shown how higher-order coefficients of an expansion of the gravitational potential in series of spherical functions can be determined from contemporary observations. V.P.

A78-41191 * **Landsat applied to landslide mapping.** D. J. Sauchyn and N. R. Trench (Colorado, University, Boulder, Colo.). *Photogrammetric Engineering and Remote Sensing,* vol. 44, June 1978, p. 735-741. 7 refs. Contract No. NAS5-20914.

A variety of features characteristic of rotational landslides may be identified on Landsat imagery. These include tonal mottling, tonal banding, major and secondary scarps, and ponds. Pseudostereoscopic viewing of 9 by 9 in. transparencies was useful for the detailed identification of landslides, whereas 1:250,000 prints enlarged from 70 mm negatives were most suitable for regional analysis. Band 7 is the most useful band for landslide recognition, due to accentuation of ponds and shadows. Examination of both bands 7 and 5, including vegetation information, was found to be most suitable. Although, given optimum terrain conditions, some landslides in Colorado may be recognized, many smaller landslides are not identifiable. Consequently, Landsat is not recommended for detailed regional mapping, or for use in areas similar to Colorado, where alternative (aircraft) imagery is available. However, Landsat may prove useful for preliminary landslide mapping in relatively unknown areas. (Author)

N78-22456# National Geodetic Survey, Rockville, Md.
ESTABLISHMENT OF CALIBRATION BASE LINES
Joseph F. Dracup Aug. 1977 29 p refs
(PB-277130/1; NOAA-77122102; NOAA-TM-NOS-NSG-8) Avail: NTIS HC A03/MF A01 CSCL 08E

The calibration of electronic distance measuring instruments involves the determination or verification of instrument constants and the assurance that the measured distances meet accuracy specifications. The verification effort is reduced when an accurately measured distance can be used. However, to assure that an instrument is measuring properly, a known distance of high accuracy, or preferably, a sequence of distances forming a calibration range or base line is required. Specifications and recommendations on the establishment of calibration base lines are described in some detail. GRA

N78-23507*# Ohio State Univ. Research Foundation, Columbus.
THE PREDICTION AND MAPPING OF GEOIDAL UNDULATIONS FROM GEOS-3 ALTIMETRY
William Kearsley Wallops Island, Va. NASA. Wallops Flight Center Apr. 1978 52 p refs
(Contract NAS6-2484)
(NASA-CR-141439) Avail: NTIS HC A04/MF A01 CSCL 08B

From the adjusted altimeter data an approximation to the geoid height in ocean areas is obtained. Methods are developed to produce geoid maps in these areas. Geoid heights are obtained for grid points in the region to be mapped, and two of the parameters critical to the production of an accurate map are investigated. These are the spacing of the grid, which must be related to the half-wavelength of the altimeter signal whose amplitude is the desired accuracy of the contour; and the method adopted to predict the grid values. Least squares collocation was used to find geoid undulations on a 1 deg grid in the mapping area. Twenty maps, with their associated precisions, were produced and are included. These maps cover the Indian Ocean, Southwestern and Northeastern portions of the Pacific Ocean, and Southwest Atlantic and the U.S. Calibration Area. Author

N78-23518*# Geological Survey, Washington, D. C.
CHANGE IN LAND USE IN THE PHOENIX (1:250,000) QUANDRANGLE, ARIZONA BETWEEN 1970 AND 1973: ERTS AS AN AID IN A NATIONWIDE PROGRAM FOR MAPPING GENERAL LAND USE
John L. Place *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 117-146 refs Presented at the 3d Earth Resource Technol. Satellite-1 Symp. Vol. 1: Tech. Presentation Sect. A, Washington, D. C., Dec. 1973
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08B

Satellite imagery was used to revise existing land use maps outdated by new residential developments, croplands, and reservoir fill up during a period of dynamic growth in Phoenix, Arizona. Author

N78-23534*# Florida Inst. of Tech., Melbourne. Center for Coastal Zone Research.
LAND USE AND LAND COVER MAPPING: CITY OF PALM BAY, FLORIDA Final Report
Diane D. Barile and Robert Pierce Nov. 1977 58 p Sponsored by NASA. Kennedy Space Center Original contains color illustrations
(NASA-CR-154625) Avail: NTIS HC A04/MF A01 CSCL 08B

Two different computer systems were compared for use in making land use and land cover maps. The Honeywell 635 with the LANDSAT signature development program (LSDP) produced a map depicting general patterns, but themes were difficult to classify as specific land use. Urban areas were unclassified. The General Electric Image 100 produced a map depicting eight land cover categories classifying 68 percent of the total area. Ground truth, LSDP, and Image 100 maps were all made to the same scale for comparison. LSDP agreed with the ground truth 60 percent and 64 percent within the two test areas compared and Image 100 was in agreement 70 percent and 80 percent. Author

N78-24410# Air Force Academy, Colo. Dept. of Economics, Geography and Management.
THE UTILIZATION OF SIDE LOOKING AIRBORNE RADAR (SLAR) IN THE ANALYSIS OF KARST TOPOGRAPHY Final Report
Charles L. Smith and A. Paul Tribble Sep. 1977 37 p refs
(AD-A051330; USAFA-TR-77-13) Avail: NTIS HC A03/MF A01 CSCL 17/9

Characteristics of mechanical and synthetic radar systems are reviewed. Signature elements of Karst topography such as a vertical drainage pattern, knobs, and sinkholes are identified for Side Looking Airborne Radar (SLAR) imagery. SLAR imagery of the Kentucky Pennyroyal and Karst areas in Florida is presented with the signature elements highlighted. Applications of SLAR imagery to the identification and mapping of Karst areas in physically, climatologically, or politically inaccessible areas are addressed. Author (GRA)

N78-24600*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EARTH'S GRAVITY FIELD AND OCEAN DYNAMICS
R. S. Mather May 1978 39 p refs Presented at 7th Symp. on Mathematical Geodesy (4th Hotine Symp.), Assisi, Italy, 8-10 Jun. 1978 Submitted for publication
(NASA-TM-79540) Avail: NTIS HC A03/MF A01 CSCL 08G

An analysis of the signal-to-noise ratio of the best gravity field available shows that a basis exists for the recovery of the dominant parameters of the quasi-stationary sea surface topography. Results obtained from the analysis of GEOS-3 show that it is feasible to recover the quasi-stationary dynamic sea surface topography as a function of wavelength. The gravity field models required for synoptic ocean circulation modeling are less exacting in that constituents affecting radial components of orbital position need not be known through shorter wavelengths. Author

N78-24602# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
USING SYNTHETIC IMAGES TO REGISTER REAL IMAGES WITH SURFACE MODELS
Berthold K. P. Horn and Brett L. Bachman Aug. 1977 53 p refs
(Contract N00014-75-C-0643)
(AD-A052512; AI-M-437) Avail: NTIS HC A04/MF A01 CSCL 09/4

A number of image analysis tasks can benefit from registration of the image with a model of the surface being imaged. Automatic navigation using visible light or radar images requires exact alignment of such images with digital terrain models. In addition, automatic classification of terrain, using satellite imagery, requires such alignment to deal correctly with the effects of varying sun angle and surface slope. Even inspection techniques for certain industrial parts may be improved by this means. The required alignment is achieved by matching the real image with the synthetic image obtained from a surface model and known positions of the light sources. The synthetic image intensity is calculated using the reflectance map, a convenient way of describing surface reflection as a function of surface gradient. The technique is illustrated using LANDSAT images and digital terrain models. GRA

N78-24776*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

GEOS-3 OCEAN GEOID INVESTIGATION

S. M. Yionoulis, A. Eisner, V. L. Pisacane, H. D. Black, and L. L. Pryor May 1978 35 p refs

(NASA Order P-57606-G)

(NASA-CR-141440) Avail: NTIS HC A03/MF A01 CSCL 08J

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 were made. Three major stages of processing were 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. The results obtained compare favorably with gravimetrically determined geoids for this calibration area. Author

N78-27388# *Naval Training Equipment Center, Orlando, Fla.*

HOLOGRAPHIC TERRAIN SIMULATION Interim Report, May - Aug. 1977

Denis R. Breglia, Joseph F. Mulson, and Alfred H. Rodemann Dec. 1977 41 p refs

(AD-A053472; NAVTRAEQUIPC-IH-295) Avail: NTIS HC A03/MF A01 CSCL 08/6

A feasibility analysis of a holographic terrain simulation concept is described. Experimental work in which photographs of terrain are holographically stored and then displayed is evaluated. Advantages of holographic storage of analog images include multiplexing capability of several images stored at one location and the advantage of displayed image stability from a moving hologram array. Future efforts and investigations are outlined. Author (GRA)

N78-27476*# Geological Survey, Denver, Colo.

***GEOLOGIC APPLICATION OF THERMAL-INERTIA MAPPING FROM SATELLITE* Progress Report, 1 Mar. - 31 May 1978**

Terry W. Offield, Principal Investigator, Susanne H. Miller, and Kenneth Watson Jun. 1978 5 p Sponsored by NASA ERTS (E78-10146; NASA-CR-157233) Avail: NTIS HC A02/MF A01 CSCL 08B

The author has identified the following significant results. A theoretical evaluation of the proportional and linear relationship between absolute and relative thermal inertia was performed, and a potentially more accurate expression for absolute thermal inertia mapping was proposed.

N78-27486*# Delaware Univ., Newark. College of Marine Studies.

SKYLAB/ERAP APPLICATION TO ECOLOGICAL, GEOLOGICAL, AND OCEANOGRAPHIC INVESTIGATIONS OF DELAWARE BAY Final Report, Jun. 1973 - Mar. 1976

Vytautas Klemas, D. Bartlett, W. Philpot, R. Rogers (Bendix Aerospace Systems Div., Ann Arbor, Mich.), and L. Reed (Bendix Aerospace Systems Div., Ann Arbor, Mich.) Jun. 1978 68 p refs

(Contract NAS1-12304)

(NASA-CR-144910; CMS-NASA-1-76) Avail: NTIS HC A04/MF A01 CSCL 08C

Skylab/EREP S190A and S190B film products were optically enhanced and visually interpreted to extract data suitable for; (1) mapping coastal land use; (2) inventorying wetlands vegetation; (3) monitoring tidal conditions; (4) observing suspended sediment patterns; (5) charting surface currents; (6) locating coastal fronts and water mass boundaries; (7) monitoring industrial and municipal waste dumps in the ocean; (8) determining the size and flow direction of river, bay and man-made discharge plumes; and (9) observing ship traffic. Film products were visually analyzed to identify and map ten land-use and vegetation categories at a scale of 1:125,000. Digital tapes from the multispectral scanner were used to prepare thematic maps of land use. Classification accuracies obtained by comparison of derived thematic maps of land-use with USGS-CARETS land-use maps in southern Delaware ranged from 44 percent to 100 percent. G.G

N78-27494# Army Engineer Topographic Labs., Fort Belvoir, Va.

INVESTIGATION OF THE APPLICATION OF ARRAY OF ALGEBRA TO TERRAIN MOD

James R. Jancaitis and Ronald L. Magee Apr. 1978 59 p refs

(AD-A054007; ETL-0141) Avail: NTIS HC A04/MF A01 CSCL 08/2

This report investigates the application of array algebra to ETL's terrain modeling procedure in the following manner: analyze array algebra to verify specifically the equivalence of array algebra and the conventional least-squares solutions; analytically and empirically compare the computational efficiency of ETL's terrain modeling algorithm using the current least-squares method and the array algebra technique and investigate the applicability of Rauhala's array algebra to the ETL terrain modeling algorithm. The results showed that the array algebra algorithm is computationally equivalent to the least squares algorithm but has higher implementational overhead. The array algebra algorithm is also less efficient for the ETL terrain modeling problem. GRA

N78-27500# Los Alamos Scientific Lab., N. Mex.

MAPPING OFFSHORE OIL LEASES

J. L. Sibert 1978 8 p refs Presented at a Joint Meeting of Am. Congr. on Surveying and Mapping and Am. Soc. for Photogrammetry, Washington, D.C., 26 Feb. 1978

(Contract W-7405-eng-36)

(LA-UR-77-2892; Conf-780209-1) Avail: NTIS HC A02/MF A01

A data base query system developed as a tool for regulatory decision making is described. The legal description of each lease, based on the public and survey, is stored in the data base to provide the coordinates necessary for map production. Maps are produced interactively during a query session on a Tektronix 4014 graphics terminal. Hardcopy color maps are obtained by using a color-equipped FR-80 computer output microfilm recorder. The procedure is totally automated and is completely handled from a remote terminal. Several examples of queries and the maps they produce are presented. Other aspects of the data base retrieval system discussed include a network structure based on the CODASYL standard and a query language that allows complex retrievals to be specified in simple english phrases. ERA

04
GEOLOGY AND MINERAL RESOURCES

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

A78-33123 * Aerospace technology can be applied to exploration 'back on earth'. L. D. Jaffe (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Oil and Gas Journal*, Aug. 15, 1977, p. 92-97. Contract No. NAS7-100.

Applications of aerospace technology to petroleum exploration are described. Attention is given to seismic reflection techniques, sea-floor mapping, remote geochemical sensing, improved drilling methods and down-hole acoustic concepts, such as down-hole seismic tomography. The seismic reflection techniques include monitoring of swept-frequency explosive or solid-propellant seismic sources, as well as aerial seismic surveys. Telemetry and processing of seismic data may also be performed through use of aerospace technology. Sea-floor sonor imaging and a computer-aided system of geologic analogies for petroleum exploration are also considered. J.M.B.

A78-34214 Analog and digital processing of multispectral data for geologic application. J. Bodechtel (Zentralstelle für Geophotogrammetrie und Fernerkundung, Munich, West Germany) and R. Haydn. In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 159-168. 7 refs.

An automatic analog and digital classification for the interpretation of geological information in remote sensing imagery is described. An electronic analog processor for single or multiple images (multispectral or multitemporal) is considered; the processor accepts photographic transparencies fed into a disk memory and performs such functions as density slicing and logarithmic density stretching. Attention is also given to hybrid analog-digital processing to achieve statistical enhancement of class separability and combination of transformed data by operation in color space. Descriptive statistics, data manipulation and classification-periodicity analyses may be obtained through digital processing. J.M.B.

A78-34215 Applications of satellite studies for structural geology in Italy. R. Cassinis (Milano, Università, Milan, Italy). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 169-181. 7 refs.

The Italian national program for geodynamics requires updated and comprehensive tectonic maps to be used as a base for further larger-scale studies on seismicity, mineral resources and energy supply. As a first step in these studies, several groups of geologists started a revision of geologic lineaments using Landsat and Skylab imagery, comparing the results obtained with the known geological data. Common criteria of classification and identification have been established and the significance and potential of enhancement techniques evaluated. Two areas will be discussed as examples of regional studies by satellite imagery: Northern Sardinia and Central Sicily. The former is a good training field to study the relationship between linears and faults, fractured areas and mineral occurrences on a crystalline shield; special attention was given to the intersections and to the regional significance of linears. In the second area, the synoptic potential of space imagery is largely responsible for the extraction from the 'noise' of a very confused geology of some regional features of geodynamic importance. (Author)

A78-34877 Significance of the space imagery for studies of the petroleum platform areas. P. V. Florenskii (Akademiia Nauk SSSR, Geologicheskii Institut, Moscow, USSR) and A. S. Petrenko (Moskovskii Institut Neftekhimicheskoi i Gazovoi Promyshlennosti, Moscow, USSR). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 441-464. 13 refs.

Scanner imagery from Landsat-1 and from the Soviet Meteor series satellites was used as an aid in clarifying the plutonic structure of the Lower Volga region of the Soviet Union. The space imagery provided useful information on the geological lineaments of the area and served to define boundaries of deep-seated Precambrian blocks and to locate anticlines containing petroleum and natural gas. The relationship between the space imagery and the internal structure of the region was elucidated by reference to neotectonic formations, gravimetric geodesy and magnetic field measurements. J.M.B.

A78-34880 * The application of satellite data in monitoring strip mines. L. A. Sharber and F. Shahrokhi (Tennessee, University, Space Institute, Tullahoma, Tenn.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 499-514. 7 refs. Research supported by the Tennessee State Planning Office; Contract No. NAS8-31980.

Strip mines in the New River Drainage Basin of Tennessee were studied through use of Landsat-1 imagery and aircraft photography. A multilevel analysis, involving conventional photo interpretation techniques, densitometric methods, multispectral analysis and statistical testing was applied to the data. The Landsat imagery proved adequate for monitoring large-scale change resulting from active mining and land-reclamation projects. However, the spatial resolution of the satellite imagery rendered it inadequate for assessment of many smaller strip mines, in the region which may be as small as a few hectares. J.M.B.

A78-35497 # Tectonics of the Central European plate and surrounding area on the basis of data from interpretation of space imagery (K tektonike sredne-Evropeiskoi plity i ee obramlenii po dannym deshifrirovaniia kosmicheskikh snimkov). V. A. Bush, R. G. Garetskii, and L. G. Kiriukhin. *Akademiia Nauk SSSR, Doklady*, vol. 239, Mar. 1, 1978, p. 146-149. In Russian.

Four-spectral-band optical scanning imagery of the Central European plate and adjoining territory obtained by the Meteor-25 satellite was evaluated. The general features of the imagery suggest a division of the territory into two principal regions, the boundary of which runs approximately from Bremen through Dresden down to Lvov. North of this line the image is marked by a light tone without clear details, while to the south and southwest the image has large dark spots corresponding to outcrops of the variscite basement. Nine basic features were identified, including Baltic paleozoic folded systems, precambrian soils of the Czech massif, the prealpine boundary dip, the alpine folded belt, and annular anomalies. P.T.H.

A78-35822 Time-resolved laser fluorosensors - A laboratory study of their potential in the remote characterization of oil. D. M. Rayner and A. G. Szabo (National Research Council, Div. of Biological Sciences, Ottawa, Canada). *Applied Optics*, vol. 17, May 15, 1978, p. 1624-1630. 11 refs. Research supported by the Department of Energy, Mines and Resources of Canada.

The fluorescence decay profiles have been determined for a number of light, crude, and heavy oils under ideal laboratory conditions to assess their utility in the remote characterization and

identification of oil spills using remote laser fluorosensors. The fluorescence decay of light and crude oils can best be described by double exponential kinetics with the former having longer decay constants. The heavy oils are described by only a single exponential decay function with a lifetime less than 1 nsec. (Author)

A78-36054 # **Monitoring geodetic networks by space techniques.** B. H. Chovitz (NOAA, Rockville, Md.). In: International Symposium on Geodesy and Physics of the Earth, 3rd, Weimar, East Germany, October 25-31, 1976, Proceedings. Part 1. Potsdam, Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, 1977, p. 43-58.

The present capabilities of three space techniques for observing positional variations with time are summarized: laser ranging to satellites, laser ranging to the moon, and radio interferometry. Applications of space techniques are proposed for monitoring the network of the North American Datum, monitoring polar motion, and for providing an independent measurement of the slope of mean sea level in order to solve the discrepancy between geodetic and oceanographic determinations of the height of the mean sea surface in the north-south direction. P.T.H.

A78-36081 # **The Upper Bavaria network for earth tides - First measurement of 1970-1975 (Das Oberbayerische Testnetz für Erdgezeiten - Erstvermessung von 1970-1975).** H. Schmitz-Hübsch (Deutsches Geodätisches Forschungsinstitut, Munich, West Germany). In: International Symposium on Geodesy and Physics of the Earth, 3rd, Weimar, East Germany, October 25-31, 1976, Proceedings. Part 2. Potsdam, Deutsche Akademie der Wissenschaften, Zentralinstitut für Physik der Erde, 1977, p. 529-539. 7 refs. In German.

A network of 30-m deep boreholes running north to south in the Alpine foothills is used to measure the components of horizontal acceleration due to gravitation for the geological layers of the unfolded and folded molasse as well as of 'kalkalpin' (calcareous alpine). The results are analyzed by the Venedikov procedure and are determined by the arrangement of the measurements. The derived inclination vectors are invariant with respect to pendulum rotation but are correlated with borehole slope. M.L.

A78-36304 Use of Landsat-1 imagery in exploration for Keweenawan-type copper deposits. R. E. Smith, A. A. Green (Commonwealth Scientific and Industrial Research Organization, Div. of Mineralogy, Wembley, Australia), G. Robinson (Commonwealth Scientific and Industrial Research Organization, Div. of Mineral Physics, North Ryde, New South Wales, Australia), and F. R. Honey (Commonwealth Scientific and Industrial Research Organization, Div. of Land Resources Management, Wembley, Australia). *(International Geological Congress, 25th, Symposium on Exploration Remote Sensing, Sydney, Australia, Aug. 1976.) Remote Sensing of Environment,* vol. 7, Apr. 1978, p. 129-144. 14 refs.

Hydrothermally altered lava was distinguished from unaltered lava by analysis of Landsat imagery for a region of Western Australia with Keweenawan-type copper deposits. Color composites on the 1:500,000 scale proved adequate for general determinations of the one- to two-km wide altered flow tops, which may extend for 50 km or more. First-generation contrast stretched prints of the multispectral scanning bands 4, 5 and 7 enlarged to a 1:250,000 scale provided additional fineness in the discrimination. The first-generation imagery was particularly useful in distinguishing individual layers of hydrothermal alteration within a pile of lavas. J.M.B.

A78-36305 A multi-attribute method for comparing geological lineament interpretations. J. F. Huntington and A. P. Raiche (Commonwealth Scientific and Industrial Research Organization, Div. of Mineral Physics, North Ryde, New South Wales, Australia). *(International Geological Congress, 25th, Symposium on Exploration Remote Sensing, Sydney, Australia, Aug. 1976.) Remote Sensing of Environment,* vol. 7, Apr. 1978, p. 145-161. 8 refs.

A quantitative technique for analyzing the differences in geological lineament interpretations is presented. The vector association method may be of use in standardizing the often widely divergent lineament interpretations developed from satellite and aircraft reconnaissance imagery. Through classification of the location, direction and length of the lineaments, the vector association method yields similarity coefficients which provide local as well as overall comparisons of lineament interpretations. J.M.B.

A78-36306 The human perception of geological lineaments and other discrete features in remote sensing imagery - Signal strengths, noise levels and quality. K. L. Burns (Commonwealth Scientific and Industrial Research Organization, Div. of Mineral Physics, North Ryde, New South Wales, Australia) and G. H. Brown (Commonwealth Scientific and Industrial Research Organization, Div. of Mathematics and Statistics, Lindfield, New South Wales, Australia). *(International Geological Congress, 25th, Symposium on Exploration Remote Sensing, Sydney, Australia, Aug. 1976.) Remote Sensing of Environment,* vol. 7, Apr. 1978, p. 163-176.

A78-40176 Application of image principal component technique to the geological study of a structural basin in Central Spain. A. Santisteban (Madrid, Universidad Autónoma, Madrid, Spain) and L. Munoz (Madrid, Universidad Complutense, Madrid, Spain). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 228-236. 8 refs.

A method is described for obtaining the principal components of a multispectral image. It allows a simultaneous radiometric enhancement by means of a suitable finer level quantization that does not introduce artifacts. Using this method we are able to produce good photographic prints of the principal components of Landsat MSS images. The first two components alone contain nearly all the information existing on the original image while the others contain only noise. This technique was applied to the geological study of Campo Arañuelo Basin, in Central Spain, with the aim of confirming the hypothesis of different geological histories since Miocene times of this area and the remainder of Tajo Basin. (Author)

A78-40534 Summary of 1977 geothermal drilling - Western United States. J. L. Smith, C. F. Isselhardt, and J. S. Matlick (Republic Geothermal, Inc., Santa Fe Springs, Calif.). *Geothermal Energy,* vol. 6, May 1978, p. 11-19.

A survey of geothermal drilling projects conducted in 1977 is presented. Geothermal field development in California is discussed with reference to the seven new wells in the Imperial Valley, the 32 wells drilled in the geyser region, and the Coso Hot Springs area. Drilling projects in Nevada, Idaho, Utah, and New Mexico are also reviewed. It is noted that in 1977 the primary concentration was on development drilling for new dry steam plants and flow testing to determine design characteristics for hot water resource power plants. S.C.S.

A78-40535 Geothermal energy resources map of the western United States. P. J. Grim (NOAA, National Geophysical and Solar Terrestrial Data Center, Boulder, Colo.). *Geothermal Energy,* vol. 6, May 1978, p. 37-43. 10 refs. ERDA-supported research.

N78-22510 Colorado School of Mines, Golden.
REMOTE SENSING APPLIED TO EXPLORATION FOR VEIN-TYPE URANIUM DEPOSITS, FRONT RANGE, COLORADO Ph.D. Thesis
James Carryl Fisher 1976 170 p
Avail: Univ. Microfilms Order No. 78-02796

A remote sensing program consisting of two main sensors, medium altitude black and white photography and low altitude color photography, adequately mapped most of the important geologic features and ore controls. Medium altitude black and white photography was useful to map major throughgoing fracture

trends, major metamorphic foliation trends major rock types, and areas of intense fault branching. Low altitude color photography was useful to map and differentiate limonitic and hematitic color anomalies, details of fault and foliation intersections, lithologies, and breccia-zone indications. Together, these two sensors could be used effectively to outline target areas which would lead to a more successful ground based uranium exploration program. Dissert. Abstr.

N78-23520*# Itek Corp., Alexandria, Va. Data Analysis Center.

PHOTOARCHAEOLOGY. RECONNAISSANCE TESTS USING COLOR, AS WELL AS OTHER FILMS, INDICATE THAT EXPLORATION STUDIES MAY BE REDUCED FROM MONTHS TO HOURS

Carl H. Strandberg *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 172-180 Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 05B

Various types of films were used to detect pre-Columbian archaeological sites in South Dakota. Natural color and color IR films (scale 1/10,000) provided the best interpretation medium. Author

N78-23522*# General Electric Co., Philadelphia, Pa. Space Div.

LANDSAT DATA: A NEW PERSPECTIVE FOR GEOLOGY. A REVIEW OF THE UTILIZATION OF LANDSAT IMAGERY FOR GEOLOGICAL INTERPRETATION

Ralph N. Baker *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 194-204 refs Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08G

Areas in which LANDSAT satellite imagery were found most useful include regional interpretations of geological structure, updating verifying of geologic maps, mineral and petroleum exploration, and the monitoring of natural hazards such as large-scale erosion and seismicity. Investigations in these areas of application demonstrated the wide variety of uses presently undertaken or envisioned for the future. Author

N78-25044# Joint Publications Research Service, Arlington, Va.

ANNULAR STRUCTURES ON THE EARTH

V. N. Bryukhanov, M. Z. Glukhovskiy, and A. L. Stavtsev *In its* Transl. on USSR Sci. and Technol.: Phys. Sci. and Technol., No. 30 (JPRS-707141), 2 Mar. 1978 p 78-93 refs Transl. into ENGLISH from Priroda (Moscow), no. 10, 1977 p 54-65 Copyright. Avail: NTIS HC A06/MF A01

A study of space photographs has shown that annular structures are a characteristic element of the structure of the planets of the earth group, regardless of the stage of their development. The annular structures developed in the process of formation of the primary basalt crust of the planets and persisted in their primordial form in those places where endogenous and exogenous processes after crustal formation were manifested to an insignificant degree. This information leads to the assumption that the planets of the earth group developed identically in the early stages Author

N78-25233*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

APPLICATIONS OF AEROSPACE TECHNOLOGY TO PETROLEUM EXTRACTION AND RESERVOIR ENGINEERING

Leonard D. Jaffe, Lloyd H. Back, C. Martin Berdahl, Earl E. Collins, Jr., Paul G. Gordon, John Houseman, Marshall F. Humphrey, George C. Hsu, John D. Ham, Jack E. Marte et al 30 Oct. 1977 343 p refs (Contract NAS7-100)
(NASA-CR-157167; JPL-Pub-78-22) Avail: NTIS HC A15/MF A01 CSCL 21D

Through contacts with the petroleum industry, the petroleum service industry, universities and government agencies, important petroleum extraction problems were identified. For each problem, areas of aerospace technology that might aid in its solution were also identified, where possible. Some of the problems were selected for further consideration. Work on these problems led to the formulation of specific concepts as candidate for development. Each concept is addressed to the solution of specific extraction problems and makes use of specific areas of aerospace technology. Author

N78-25505*# Georgia Southwestern Coll., Americus.

REMOTE SENSING OF GEOBOTANICAL RELATIONS IN GEORGIA Final Technical Report

Daniel D. Arden, Jr. and Raymond N. Westra Jan. 1977 103 p refs
(Contract NAS8-30884)
(NASA-CR-150709) Avail: NTIS HC A06/MF A01 CSCL 08F

The application of remote sensing to geological investigations, with special attention to geobotanical factors, was evaluated. The general areas of investigation included: (1) recognition of mineral deposits; (2) geological mapping; (3) delineation of geological structure, including areas of complex tectonics; and (4) limestone areas where ground withdrawal had intensified surface collapse. Author

N78-26499# Sandia Labs., Albuquerque, N. Mex.

INITIAL RESPONSE OF A ROCK PENETRATOR

Donald B. Longcope and D. E. Grady Dec. 1977 30 p refs (Contract EY-76-C-04-0789)
(SAND-77-1712) Avail: NTIS HC A03/MF A01

An analysis based on elastic rod theory is given for the earlytime axisymmetric response of pointed penetrators. Results of measurements by laser interferometry of the back surface particle velocity of laboratory scale penetrators impacted by sandstone targets are presented. Values of the initial pressure on the penetrator tip are determined which give agreement between the analytical and experimental results. These initial tip pressures are found to be approximated by the stress particle velocity Hugoniot for the target material. ERA

N78-27478*# Department of Industry, London (England).

THE USE OF LANDSAT IMAGERY IN RELATION TO AIR SURVEY IMAGERY FOR TERRAIN ANALYSIS IN NORTH-WEST QUEENSLAND, AUSTRALIA, VOLUME 1 Final Report

Monica M. Cole and E. Stuart Owen-Jones, Principal Investigators 15 Dec. 1977 161 p refs Sponsored by NASA ERTS 3 Vol.
(E78-10148; NASA-CR-157242) Avail: NTIS HC A08/MF A01 CSCL 08B

The author has identified the following significant results. Distinctive spectral signatures discriminated areas underlain by distinctive lithological/stratigraphical units where bedrock either outcrops or is relatively near to surface in the Lady Annie-Mt. Gordon fault zone, the Mary Kathleen, and Dugald River-Naraku areas. Spectral signatures associated with discrete plant communities distinguished different types of superficial deposits over the Cloncurry Plains. Distinctive spectral signatures also revealed the presence and nature of concealed bedrock beneath cover of residuum and superficial deposits where this is relatively thin in the Cloncurry Plains. Major faults were clearly displayed in areas of outcropping and near surface bedrock. Sets of lineaments with preferred orientations were identified in the Lady Annie and Dugald River areas. Known base metal deposits occur along these features.

N78-27479*# Department of Industry, London (England).

THE USE OF LANDSAT IMAGERY IN RELATION TO AIR SURVEY IMAGERY FOR TERRAIN ANALYSIS IN NORTH-WEST QUEENSLAND, AUSTRALIA, VOLUME 2 Final Report

Monica M. Cole and E. Stuart Owen-Jones, Principal Investigators
15 Dec. 1977 135 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS 3 Vol.
(E78-10149; NASA-CR-157243) Avail: NTIS HC A07/MF A01 CSCL 08B

N78-27480*# Department of Industry, London (England).
THE USE OF LANDSAT IMAGERY IN RELATION TO AIR SURVEY IMAGERY FOR TERRAIN ANALYSIS IN NORTH-WEST QUEENSLAND, AUSTRALIA, VOLUME 3 Final Report
Monica M. Cole and E. Stuart Owen-Jones, Principal Investigators
15 Dec. 1977 73 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS 3 Vol.
(E78-10150; NASA-CR-157244) Avail: NTIS HC A04/MF A01 CSCL 08B

N78-27482*# Georgia Southwestern Coll., Americus.
INTRODUCTORY WORKSHOPS ON REMOTE SENSING AS RELATED TO GEOLOGICAL PROBLEMS IN GEORGIA Final Report
Barry F. Beck and Jack C. Carter, Principal Investigators Mar. 1978 23 p refs Workshop held at Americus, Ga., 24-25 May 1977 ERTS
(Contract NAS8-30884)
(E78-10152; NASA-CR-150710) Avail: NTIS HC A02/MF A01 CSCL 08G

N78-27681 *Texas Univ. at Austin.*
RECONNAISSANCE GEOLOGY OF THE TOMOCHIC-OCAMPO AREA SIERRA MADRE OCCIDENTAL, CHIHAUHUA, MEXICO Ph.D. Thesis
Eric Rice Swanson 1977 154 p
Avail: Univ. Microfilms Order No. 7807393

The volcanic strata of two large remote areas near Tomochic and Ocampo in the Sierra Madre Occidental of western Chihuahua were mapped in a reconnaissance fashion utilizing remote sensing and a genetic approach to mapping which emphasizes caldera recognition. Most of the major units in the Sierran areas were sampled for chemical analysis and K-Ar dating as were some mafic lavas in the volcanic Basin and Range country to the east of the Sierra. Chemical data confirm that silicic volcanic rocks of the Sierra exhibit geographically related chemical variations. Volcanic rocks of inland Mexico tend to be higher in silicon and potassium but lower in sodium, calcium, and aluminum than are similar volcanic rocks closer to the coast. Volcanism in the Sierra is probably related to convergent motion and subduction of the Farallow plate 34 to 23 m.y. ago.

Dissert. Abstr.

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OCEANOGRAPHY AND MARINE RESOURCES

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

A78-34216 **Remote sensing in glaciology and the physics of echoes.** J. F. Nye (Bristol, University, Bristol, England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 189-197. 24 refs. Research supported by the Natural Environment Research Council.

The many applications of remote sensing that are now being used in glaciology are reviewed. The most highly developed application is the echo sounding of polar ice masses by radio pulses. A radio echo has a detailed structure both of amplitude and of phase; it is a pattern in three dimensions, moving upwards and changing with time as it goes. It can be observed with the aid of a laboratory analog machine that uses ultrasonic pulses in place of radio pulses. A conspicuous feature of the pattern is a complicated array of looped lines, called dislocations, along which the amplitude is zero and the phase is indeterminate. They are analogous to the dislocations found in crystals. A comprehensive theory of the scattering of pulses by a rough wavy surface, or other scattering object, which seems essential to a full understanding of active remote sensing, does not yet exist. One of the features the theory must account for is the imperfect focusing of the echoes on caustic surfaces and the relation between these surfaces and the dislocation lines. (Author)

A78-34381 **Remote sensing of coastal food resources.** V. Klemas and D. S. Bartlett (Delaware, University, Newark, Del.). *Environmental Management*, vol. 2, Mar. 1978, p. 119-126. 24 refs.

The food web of numerous estuaries and coastal waters is based on the primary productivity of coastal marshes that constitute centers of solar energy fixation and an important link in the mineral cycles. The fixed carbon and minerals enter the water primarily as detritus where a complex food web makes them accessible to commercially important fish and benthic communities. With the launch of Landsat, NOAA-2, and Skylab, relatively high resolution spacecraft data became available for mapping and inventorying tidal marshes and their productivity on a global scale. Using multispectral analysis techniques, classification accuracies greater than 80 percent have been obtained for most marsh plant species, and greater than 90 percent for key types such as Spartina alterniflora, which is the primary producer in large tide marshes of the coastal eastern USA. The capacity of remote sensors on spacecraft such as NOAA-2, Landsat, and Skylab to assess coastal food resources on a global scale is discussed from the point of view of resolution, classification accuracy, and cost effectiveness. (Author)

A78-34862 **Thermal infrared studies - Forteau Bay, Labrador.** R. D. Worsfold and D. Strong (Newfoundland, Memorial University, St. John's, Canada). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 171-187. 12 refs.

Remotely sensed data collected during the 1976 winter field season over a ground truth site located at Forteau Bay, Newfoundland, are considered. Ground measured verification data included meteorological information, snow cover and ice thickness, and thermal measurements. The infrared line scanner used to collect the thermal infrared data was flown in an aircraft of the Canada Centre for Remote Sensing. Microwave scattermeter data and photographic data were also collected. Correlation between the infrared imagery and density sliced data allowed the classification of the data into five ranges. The ranges were: (1) open water and frazil ice, (2) new ice, frozen frazil, frozen slush, (3) floe boundaries, (4) shorefast ice without snow cover, rafting detail, and (5) snow cover. The study demonstrates the power of density slicing as an interpretive tool. G.R.

A78-34929 # **Side looking radar for ice reconnaissance.** C. Ramplee-Smith (Department of Fisheries, Ottawa, Canada) and H. G. Hengeveld (Department of the Environment, Ottawa, Canada). *(Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb. 21-23, 1977.) Canadian Journal of Remote Sensing*, vol. 4, Apr. 1978, p. 44-50. 9 refs.

The use of side-looking airborne radar (SLAR) to monitor sea and river ice in Canadian waters is discussed. Initial SLAR ice reconnaissance missions in the St. Lawrence River and Gulf during 1969 provided a test of the technique; ice reconnaissance in the Northwest Passage has also been undertaken to meet the needs of Arctic shipping. Wide-swath coverage, digital airborne processing and resolution of the SLAR systems are considered. For best performance in detecting new and old ice, and in distinguishing such features as ridges, leads and puddles, equipment operating in the X-band has been adopted. J.M.B.

A78-35328 **HF radio oceanography - A review.** D. E. Barrick (NOAA, Wave Propagation Laboratory, Boulder, Colo.). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology*, vol. 13, Jan. 1978, p. 23-43. 42 refs.

The paper reviews the state of the art of oceanography conducted with the aid of radar echoes from the sea at high frequency. The basic methods and problems of HF remote sensing are examined. The progress achieved over a number of experiments in measuring sea state by first- and second-order scatter is outlined. Attention is given to both surface wave and skywave experiments. Efforts in deducing surface wind velocity components from HF echoes from sea waves are described. P.T.H.

A78-35337 * **Radar imaging of the ocean surface.** C. Elachi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology*, vol. 13, Jan. 1978, p. 165-179. 26 refs. Contract No. NAS7-100.

Techniques for obtaining radar images of the ocean surface are briefly described, and examples of radar images of a variety of ocean surface wave types obtained by synthetic-aperture radar are presented and discussed. Observations described include deep-ocean waves, discrete wave trains, internal waves as surface manifestations, slicks, and eddies. P.T.H.

A78-35344 * **Computed and observed ocean topography - A comparison.** F. O. Vonbun, J. G. Marsh, and F. J. Lerch (NASA, Goddard Space Flight Center, Greenbelt, Md.). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology*, vol. 13, Jan. 1978, p. 253-262. 16 refs.

The Goddard Space Flight Center's latest Gravity Earth Model, GEM-8, was used to construct a static sea surface. Such a surface corresponds to the surface of an ocean without the time-varying effects of atmospheric pressure, surface wind friction, tides, and currents. It conforms to a surface dictated by the earth's gravitational and rotational forces. The sea surface model is the result of analyzing more than 500,000 satellite observations together with about 1600 5 deg x 5 deg and about 38,000 1 deg x 1 deg surface

gravity anomalies. Preliminary comparisons between the computed and measured sea surface topography indicate that they agree quite well and differ by less than 1 m in many places including the Atlantic test area. Sea-surface features such as undulations caused by trenches and ridges are clearly and accurately detectable. The use of altimeter data for orbit computation reduces the uncertainty of the spacecraft height and thus the errors of the sea-surface topography. G.R.

A78-35345 * Ocean wave heights measured by a high resolution pulse-limited radar altimeter. E. J. Walsh (NASA, Wallops Flight Center, Wallops Island, Va.), E. A. Uliana, and B. S. Yaplee (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 263-276. 12 refs.

Data on significant wave height (SWH) taken with an airborne (2-3.5 km altitude) X-band 1-ns pulse-limited radar altimeter under various wind and sea conditions are interpreted. A heuristic discussion of the return pulse shape and the method of extracting the SWH is followed by a demonstration that the mean of the resulting SWH values is in agreement with other, independent measurements. The scatter of the SWH values is large compared to the estimates based on the statistical fluctuations in the radar signal. The discrepancy is resolved by showing that the radar is actually observing small-scale variations in the sea-surface standard deviation caused by the small number of ocean wavelengths illuminated. S.D.

A78-35346 * A review of applications of microwave radiometry to oceanography. T. T. Wilheit, Jr. (NASA, Goddard Space Flight Center, Greenbelt, Md.). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 277-293. 17 refs.

Following a review of the essential physics of microwave radiative transfer, oceanographic applications of this background physics are discussed using data from electrically scanning microwave radiometers on the Nimbus 5 and 6 satellites operating at 1.55-cm and 8-mm wavelengths, respectively. These data are interpreted in terms of rain rate, ice coverage, and first-year versus multiyear ice determination. It is shown that multifrequency radiometer measurements make it possible to separate the surface and atmospheric effects and to obtain useful measurements of sea surface temperature, surface wind speed, and atmospheric parameters along with improved measurements of rain and ice. S.D.

A78-35347 * Measurement of ocean temperature and salinity via microwave radiometry. H.-J. C. Blume, B. M. Kendall, and J. C. Fedors (NASA, Langley Research Center, Hampton, Va.). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 295-308. 13 refs.

Sea-surface temperature with an accuracy of 1 C and salinity with an accuracy of 1% were measured with a 1.43 and 2.65 GHz radiometer system after correcting for the influence of cosmic radiation, intervening atmosphere, sea-surface roughness, and antenna beamwidth. The radiometers are a third-generation system using null-balancing and feedback noise injection. Flight measurements from aircraft over bay regions and coastal areas of the Atlantic resulted in contour maps with spatial resolution of 0.5 km. (Author)

A78-35348 * Microwave remote sensing of sea ice in the AIDJEX Main Experiment. W. J. Campbell, J. Wayenberg, J. B. Ramseyer (U.S. Geological Survey, Tacoma, Wash.), R. O. Ramseier, M. R. Vant, R. Weaver, A. Redmond, L. Arsenault (Department of the Environment, Ottawa, Canada), P. Gloersen, and H. J. Zwally (NASA, Goddard Space Flight Center, Greenbelt, Md.). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 309-337. 41 refs.

A microwave remote sensing program of sea ice in the Beaufort Sea was conducted during the Arctic Ice Dynamics Joint Experiment (AIDJEX). Several types of both passive and active sensors were used to perform surface and aircraft measurements during all seasons of the year. In situ observations were made of physical properties (salinity, temperature, density, surface roughness), dielectric properties, and passive microwave measurements were made of first-year, multiyear, and first-year/multiyear mixtures. Airborne passive microwave measurements were performed with the electronically scanning microwave radiometer while airborne active microwave measurements were performed by synthetic aperture radar, X- and L-band radar, and a scatterometer. S.C.S.

A78-35349 * Time-dependence of sea-ice concentration and multiyear ice fraction in the Arctic Basin. P. Gloersen, H. J. Zwally, A. T. C. Chang, D. K. Hall (NASA, Goddard Space Flight Center, Greenbelt, Md.), W. J. Campbell (U.S. Geological Survey, Tacoma, Wash.), and R. O. Ramseier (Department of Fisheries and Environment, Ottawa, Canada). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 339-359. 21 refs.

Microwave images of sea ice obtained by Nimbus-5 and the NASA CV-990 airborne laboratory are used to determine the time variation of the sea-ice concentration and multiyear ice fraction within the pack ice in the Arctic Basin. The images, constructed from data acquired from the electrically scanned microwave radiometer, are analyzed for four seasons during 1973-1975. Observations indicate significant variations in the sea-ice concentration in the spring, late fall, and early winter. Sea-ice concentrations as low as 50% were detected in large areas in the interior of the Arctic polar sea-ice pack. The applicability of passive-microwave remote sensing for monitoring the time dependence of sea-ice concentration is considered. M.L.

A78-35351 Evaluation of Multi-Frequency-Microwave-Radiometer-System performance for oceanography. L. Thrane (Danmarks Tekniske Hojskole, Lyngby, Denmark). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 373-392. 18 refs. European Space Agency Contract No. SC/129/HQ.

A technique is presented for constructing a mathematical model of a Multi-Frequency Microwave Radiometer System. The technique combines the different responses of microwave radiometers with models of the sea surface, the effects of the earth's atmosphere and of the sky emission. A linear perturbation method and a more accurate nonlinear method are outlined for processing of data simultaneously collected by the radiometers. The mathematical model of the Radiometer System combined with the linear data-processing method is useful for predicting in-flight sensor performance. Based on a chosen performance function, an evaluation of a spaceborne Multi-Frequency Microwave Radiometer System is given. (Author)

A78-35352 * The experimental oceanographic satellite Seasat-A. J. A. Dunne (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 393-404. 25 refs. Contract No. NAS7-100.

The experimental Seasat-A satellite, scheduled for launch in 1978, is designed to provide measurements of sea-surface temperature, surface wind speed and direction, sea state and directional wave

spectra. The instrument package of the satellite includes a highly precise radar altimeter, a wind-field scatterometer, a synthetic-aperture imaging radar, a scanning multifrequency microwave radiometer and a radiometer operating in the visual and infrared. Tides, currents and storm surges on the marine geoid may be monitored through analysis of range information from the radar altimeter and a satellite ephemeris; sea-ice reconnaissance is also planned. J.M.B.

A78-35353 **Radar measurements of wind and waves.** *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 405-412.

The capabilities of two-frequency radar, side-looking airborne radar, synthetic aperture radar and CW Doppler radar in oceanographic sensing are discussed. Determination of surface windspeed from measurements of the microwave cross-section of the sea is a principal application of the radar systems, though calibration programs and a better understanding of the physics of wavelet modulation by long waves are needed. Oceanography employing HF radio signals is also considered; attention is given to the use of shore-based antenna arrays to derive wave spectral data from Doppler spectrum sidebands. J.M.B.

A78-35355 **Contributions to large-scale oceanography by radio techniques.** *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 417-426.

The use of satellite-borne radar altimeters and microwave radiometers to perform large-scale oceanographic surveys is discussed. Ice-sheet topographic assessments with an accuracy of one meter and investigations of oceanic eddies and the variation in the location of western boundary currents are among the present applications of radar altimeters. Satellite altimeter calibration programs based on short-arc orbits over the Northwest Atlantic are also suggested. In the field of microwave radiometry, measurements of sea-surface temperature with a one deg C accuracy, salinity to one part per thousand, wind speed to three m/sec and rain rate within a factor of two are possible. J.M.B.

A78-37058 **A resolution limitation on sea-echo radar spectra inferred from point to point ionospheric Doppler broadening.** M. L. Heron and R. J. Rose (North Queensland, James Cook University, Townsville, Australia). *Geophysical Research Letters,* vol. 5, May 1978, p. 379-381. 13 refs. Research supported by the Radio Research Board and Telecom Australia.

A78-38523 * # **Seasat-A opens new phase in earth observations.** E. Cutting and W. Pounder (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Astronautics and Aeronautics,* vol. 16, June 1978, p. 42-50. 9 refs.

The data output of the Seasat-A, the first satellite designed specifically for oceanographic observation, is described. Wave height and direction, ice distribution, surface wind speed and direction, ocean-surface temperature, and atmospheric water content will be monitored by the satellite. Imaging radar, microwave scatterometer, microwave radiometer and visual and infrared radiometer experiments are included in the Seasat-A observing program. Two types of orbits have been developed: a near-repeat cycle of three days, and a near-repeat cycle of 25 days. Both orbit types offer fine coverage (18.5 km crossing separations) of the earth. Synthetic aperture radar data on computer-compatible tapes and geophysical data records available through the Seasat-A mission are described. J.M.B.

A78-39638 * **Remote sensing of optical properties in continuously stratified waters.** H. R. Gordon (Miami, University, Coral Gables, Fla.). *Applied Optics,* vol. 17, June 15, 1978, p. 1893-1897. 6 refs. Contract No. NAS5-22963.

The radiative transfer equation is solved by Monte Carlo methods for natural waters in which the optical properties are distributed with depth. It is demonstrated that interpreting the reflectance of a continuously stratified ocean in terms of an equivalent homogeneous ocean yields the average of a particular combination of the water's optical properties over the dimensionless penetration depth. Although in general the dimensionless penetration depth cannot be remotely measured, a method is presented for estimating the actual penetration depth from the remote observations if the medium's absorption coefficient is known, independent of depth, and sufficiently large. The application of this to the remote measurement of the vertical distribution of suspended sediments is discussed in detail. (Author)

A78-40474 **Lateral oscillations of the Pacific Equatorial Countercurrent.** K. Wyrtki (Hawaii, University, Honolulu, Hawaii). *Journal of Physical Oceanography,* vol. 8, May 1978, p. 530-532. NSF-supported research.

Long equatorial waves recently discovered in the Pacific Ocean on satellite photographs are being linked to oscillations in sea level at Fanning Island and to the oscillatory trajectory of a drifting buoy. The drift pattern of the buoy suggests that lateral oscillations of the Equatorial Countercurrent with a period of about 34 days are responsible for the observed variations of sea level. (Author)

N78-22453# Alaska Univ., Fairbanks.
SUSPENDED SEDIMENTS AND RELATED LIMNOLOGY OF AN ALPINE LAKE SYSTEM Year End Report, 1 Jun. 1976 - 31 Jan. 1977
V. Alexander, J. Mellor, and R. J. Barsdate 31 Jan. 1977 16 p
(Contract EY-76-S-06-2229-010)
(RLO/2229/T10-2; AR-2) Avail: NTIS HC A02/MF A01

This project has the aim of first assessing the potential of remote sensing to determine changes in sediment load in arctic lakes, and then to use this technique to assess the effects of road construction on arctic freshwater aquatic habitats. The first part of the work has centered on the use of Peters and Schraeder Lakes as a natural laboratory since these lakes have a strong sediment gradient for methodology evaluation. The next stage is to expand this work to other lakes and finally to actually look at the impact of changes in sediment load due to construction activities and utilization of arctic road systems. The results of the first two years' work suggest that the method has value, and the project is now ready to approach the terminal phase in looking at the real effects of road construction in the arctic. VP-8 density slicing and densitometry of the films are the two analysis techniques in use, with Plus-X Aerographic film in an aerial mapping camera format the film of choice. Ground truth data were collected in conjunction with the aerial mapping data, and some information on the effects of sediment load on primary production regimes was also included. ERA

N78-23529*# Earth Satellite Corp., Washington, D. C.
A FEASIBILITY DEMONSTRATION OF AERIAL PHOTOGRAPHIC SUPPORT FOR MARINE ARCHAEOLOGICAL SURVEYS
A. D. Marmelstein *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 341-350

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 14E

The use of recutting remote sensing was demonstrated for location of shipwrecks in the Florida Keys, using selected films and filters for improved water penetration. Author

N78-23541# Swedish Meteorological and Hydrological Inst., Norkoeping.
SEA ICE-75. GROUND TRUTH REPORT
Ingemar Udin Stockholm Winter Navigation Research Board 1976 77 p refs
(Rept-16-2) Avail: NTIS HC A05/MF A01

A remote sensing project over sea ice in the Bay of Bothnia was carried out during March 1975. Several sensors - microwave, visual and infrared, were tested. Following background information of ice conditions and weather general ice parameters are presented. Satellite information and air photos are analyzed. At the same time as the remote sensing experiment an extensive ground truth program was carried out. Various ice parameters within three different ground truth areas, one inside the other, were studied. These small scale ice observations and measurements and the ground truth program in general are discussed. ESA

N78-23542# Swedish Meteorological and Hydrological Inst., Norkoeping.
SEA ICE-75. ICE DETECTION BY SLAR
R. H. J. Morra and G. P. deLoor Stockholm Winter Navigation Research Board 1976 33 p refs
(Rept-16-3) Avail: NTIS HC A03/MF A01

A sea ice remote sensing experiment was carried out in the Bay of Bothnia during March 1975 using, among other sensors, a real aperture X-band side-looking airborne radar (SLAR). The properties, possibilities, and limitations of SLAR are discussed in detail and an analysis is made of SLAR imagery in comparison with aerial photography. ESA

N78-23543# Swedish Meteorological and Hydrological Inst., Norkoeping.
SEA ICE-75. ANALYSIS OF SLAR DATA
Surendra Parashar Winter Navigation Research Board 1976 56 p refs Partly sponsored by Swed. Board for Space Activities
(Rept-16-4) Avail: NTIS HC A04/MF A01

Results obtained from an analysis of SLAR data collected during a sea ice remote sensing experiment in the Bay of Bothnia during March 1975 are presented. The data gathered included SLAR images of sea ice obtained by utilizing EMI X-band real-aperture radar. The formation of sea ice and its relevant characteristics and the nature of radar returns from sea ice are included for background. A brief historical note on the use of radar for mapping ice is also given. ESA

N78-23544# Winter Navigation Research Board, Stockholm (Sweden).
SEA ICE-75. FLAR, ODAR, SHIP'S RADAR
Ture Hagman (Res. Inst. of Natl. Defence), Jerry Nilsson (Res. Inst. of Natl. Defence), and Yngve Nilsson 1976 35 p refs
(Rept-16-5) Avail: NTIS HC A03/MF A01

Results from a field test on sea ice mapping by radar carried out in the Gulf of Bothnia, March 1975, are presented. Three different types of radar were used: forward looking airborne search radar (FLAR), omnidirectional helicopterborne search radar (ODAR), and shipborne radars of the icebreaker Tor. It is shown that conventional radars can map the large scale ice structure of extensive areas in sufficient detail to assist navigation and ice forecasting. The radars of an icebreaker give short range navigational information on the ice situation with high resolution in real time. Different ways of recording radar information are discussed and some recommendations on further measurements of radar signatures of sea ice are given. Author (ESA)

N78-23545# Research Inst. of National Defence, Stockholm (Sweden).
SEA ICE-75. IR-SCANNER RESULTS
Erik Fagerlund and Gunnar Lundholm Winter Navigation Research Board 1976 22 p refs
(Rept-16-6) Avail: NTIS HC A02/MF A01

During a field experiment over an ice covered area of the Gulf of Bothnia in March 1975, several different types of remote sensing equipment were tested, including infrared thermography performed with the airborne single line scanner TEKLA in the 8 to 14 microm region. The thermal recordings were concentrated to a 5 X 5 square km test area, which was described in great detail by ground truth measurements and photography. During 14 runs at 300 to 2000 m altitude, the thermal radiation from the sea surface was recorded on photographic film and magnetic tape. The film recordings give a general survey of the apparent temperature variations within various parts of the mapped area. By processing the tape recorded information, a more detailed analysis of some interesting objects was accomplished. The results are compared with the available ground truth and aerial photographs. Author (ESA)

N78-23546# Winter Navigation Research Board, Stockholm (Sweden).
SEA ICE-75. RADAR ALTIMETER RESULTS
Sune Axelsson (Saab-Scania AB, Linkoeping) 1976 30 p refs
(Rept-16-7) Avail: NTIS HC A03/MF A01

The results obtained at a field experiment with radar altimetry above sea-ice, carried out in the Gulf of Bothnia, March 1975, are presented. The results indicate that the envelope detected noise of the altimetry output signal can be used for measurements on ice ridges and other large-scale surface roughnesses. The spectral characteristics of the signal also give some information about the surface roughness. The AGC-signal, which is a measure of the reflectivity of the ground surface, may be used to distinguish ice from water as well as snow-covered ice from non-covered ice. As the weather was mild during the whole test period further measurements should be carried out during a period of cold weather. Some modifications of the altimetry equipment are also recommended. Author (ESA)

N78-23547# Swedish Meteorological and Hydrological Inst., Norkoeping.
SEA ICE-75. DYNAMICAL REPORT
Ingemar Udin and Anders Omstedt Stockholm Winter Navigation Research Board 1976 66 p refs
(Rept-16-8) Avail: NTIS HC A04/MF A01

Field measurements on sea ice were carried out in the Bay of Bothnia during March 10-20, 1975. The forces and parameters in the equation of motion for sea ice have been studied on the mesoscale. Winds and currents were measured to calculate the wind and water stress, the ice mass distribution was studied, the tilting of the sea surface computed, temperatures at different ice types measured. From the data obtained and with classical boundary layer theory the forces in the equation of motion have been calculated and their balance studied. The results support the assumption made in a numerical ice forecasting model under development at the Swedish Meteorological and Hydrological Institute and the data obtained will be used for further development and improvements. Author (ESA)

N78-23548# Winter Navigation Research Board, Stockholm (Sweden).
SEA ICE-75 Summary Report
Aake Blomquist (Natl. Defence Res. Inst.), Claes Pilo (Swed. Space Corp.), and Thomas Thompson (Swed. Meteorol. and Hydrol. Inst., Norkoeping) 1976 33 p refs
(Rept-16-9) Avail: NTIS HC A03/MF A01

The results of a sea ice remote sensing experiment carried out in the Bay of Bothnia during March 1975 are reported. The experimental program is outlined and the sensors used - including SLAR, FLAR, microwave and IR sensors - are described. The various ice parameters studied such as thickness, roughness, concentration, and dynamics are also discussed. ESA

N78-23695 National Technical Information Service, Springfield, Va.
ICE AND FOG: DETECTION AND WARNING SYSTEMS. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Feb. 1978
Guy E. Habercom, Jr. Mar. 1978 155 p Supersedes NTIS/PS-77/0188; NTIS/PS-76/0096; NTIS/PS-75/231 (NTIS/PS-78/0181/4; NTIS/PS-77/0188; NTIS/PS-76/0096; NTIS/PS-75/231) Copyright. Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Sea ice, aircraft ice, bridge ice, and fog formation detecting methods are reviewed in government-sponsored research reports. Remote aerial sensing and ground based detection systems are among the methods investigated. (This updated bibliography contains 150 abstracts, 32 of which are new entries to the previous edition.) GRA

N78-24254* National Aeronautics and Space Administration, Washington, D. C.

NASA SATELLITE TO STUDY EARTH'S OCEANS FROM SPACE

26 May 1978 56 p

(NASA-News-Release-78-77; P78-10081) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 22A

The feasibility of using microwave instruments to scan the world's oceans from space in order to obtain scientific data for oceanographers, meteorologists, and commercial users of the seas will be demonstrated during the mission of the Seasat A satellite which will be launched into an 800 kilometer high near circular orbit by an Agena Atlas-Agena launch vehicle. The satellite configuration, its payload, and data collection and processing capabilities are described as well as the launch vehicle system.

A.R.H.

N78-24603# Kansas Univ., Lawrence. Lawrence Remote Sensing Lab.

BACKSCATTER PROPERTIES OF SEA ICE WITH RADAR: ARCTIC OPERATIONS DESCRIPTION AND PRELIMINARY DATA SUMMARY

R. G. Unstott, G. J. Dome, R. A. Hand, James Hague, J. Pape, and R. K. Moore Oct. 1977 161 p

(Contract N00014-76-C-1105)

(AD-A052711; RSL-TM-331-1) Avail: NTIS HC A08/MF A01 CSCL 17/9

Active microwave responses of sea ice and lake ice were investigated at sites located off the North Alaskan Coast in the Arctic Ocean. The experimenters were ground-based at the Naval Arctic Research Laboratory, NARL, located outside of Barrow, Alaska, during May 1977, an early spring month in the Arctic. Microwave equipment was mounted and assembled on a portable A-frame type support system which was transported to test sites via sled and snowmobile. Data were acquired at numerous microwave frequencies, receive-transmit polarizations, and angles of incidence for 5 sea ice and 2 lake ice types. This memo documents the experiment and the experimental procedure; and lists the raw experimental data. Author (GRA)

N78-25502*# Alaska Univ., Fairbanks.

LANDSAT SURVEY OF NEAR-SHORE ICE CONDITIONS ALONG THE ARCTIC COAST OF ALASKA ***Final Report***

William J. Stringer, Principal Investigator and Stephen A. Barrett 31 May 1978 211 p refs Sponsored by NASA ERTS

(E78-10136; NASA-CR-157148) Avail: NTIS HC A10/MF A01 CSCL 08L

The author has identified the following significant results. Winter and spring near-shore ice conditions were analyzed for the Beaufort Sea 1973-77, and the Chukchi Sea 1973-76. LANDSAT imagery was utilized to map major ice features related to regional ice morphology. Significant features from individual LANDSAT image maps were combined to yield regional maps of major ice ridge systems for each year of study and maps of flaw lead systems for representative seasons during each year. These regional maps were, in turn, used to prepare seasonal ice morphology maps. These maps showed, in terms of a zonal analysis, regions of statistically uniform ice behavior. The behavorial characteristics of each zone were described in terms of coastal processes and bathymetric configuration.

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.

A78-34212 **Applications of satellite data in mapping rainfall for the solution of associated problems in regions of sparse conventional observations.** E. C. Barrett (Bristol, University, Bristol, England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 126-142. 21 refs.

A78-34213 **Remote sensing of soil moisture - User requirements and present prospects.** L. F. Curtis (Bristol, University, Bristol, England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 143-158. 27 refs.

Remote sensing techniques applicable to the assessment of soil moisture are discussed, with emphasis on active and passive microwave systems, which may provide quantitative information on moisture states. The masking effects of vegetation, land cultivation and soil type on the microwave sensing results are considered; an FM-CW ground-based radar providing a reference library of correlations between microwave responses and soil moisture states under various conditions may be employed to solve some calibration problems. Remote sensing in the visible and near-infrared wavelengths is suggested for repetitive observations of rainstorm effects in dry areas or waterlogging in wetter regions. J.M.B.

A78-34853 **Vegetation mapping from color aerial photography of Lake Champlain wetlands.** W. G. Howland (Vermont, University, Burlington, Vt.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 9-23. 16 refs. U.S. Department of the Interior Grant No. A-022.

Vegetation in the Missisquoi and Lamoille River Deltas of the Lake Champlain Basin (Vermont) was mapped from available medium-high altitude color aerial photography. This study has established the present distribution of vegetation in view of expected ecological modifications resulting from future artificial lake level regulation. Photointerpretation was visual through the use of a Bausch and Lomb zoom stereoscope and a Hilger and Watts stereometer. Signatures were established for thirteen canopy types. Species composition, relative dominance, canopy height, and physical site affinities of plant associations were determined. The resulting canopy association maps show patterns distinctly correlative to deltaic surface morphology. Evidence of the impact of recent years of abnormally high lake levels on the distribution of wetland vegetation is presented, along with associated symptoms of stress. Ground control was achieved during the summers of 1975 and 1976. (Author)

A78-34861 **Multilevel analysis of ecosystem alteration due to water regime changes in a south Louisiana swamp.** W. A. Blanchard (Louisiana State University, Baton Rouge, La.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 161-169. 7 refs.

A78-37924 **Problems in hydrology (Problemy gidrologii).** Edited by V. D. Bykov, M. I. L'vovich, N. V. Somov, and R. K. Klige. Moscow, Izdatel'stvo Nauka, 1978. 240 p. In Russian.

The handbook considers various aspects of hydrology, including water-exchange and water resources. Methods for performing hydrological calculations are discussed, noting those applicable to studying rainfall drainage, the probability distribution of maximal water flow rates, and the spatial regularities of the annual flow of rivers. Several topics in space hydrology are discussed, including the modeling of water flows by remote sensing. The formation of water resources is reviewed along with data concerning the water balance. The interaction between industry and water resources is outlined. S.C.S.

A78-37925 # **Space methods in hydrology (Kosmicheskie metody v gidrologii).** G. P. Kalinin, Iu. V. Kurilova, and P. A. Kolosov. Leningrad, Gidrometeoizdat, 1977. 184 p. 233 refs. In Russian.

The handbook outlines remote sensing methods for monitoring earth resources including regional and global water exchange. The application of aerial photography for determining water reserves, snow and ice covers, and ground water is reviewed. Procedures for predicting hydrological processes on the basis of aerial-photography data are indicated. The use of satellite information in studies of global hydrology is considered, noting the interaction of the atmosphere and the hydrosphere, and the statistical structure of the spatial-time fields of hydrometeorological characteristics. S.C.S.

A78-40175 * **Use of Landsat multispectral imagery in estimating snow areal extent and snow water content cost-effectively.** S. Khorram (California, University, Berkeley, Calif.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 218-227. 13 refs. Grant No. NGL-05-003-404.

Landsat color composites are used in conjunction with a limited amount of aerial survey data and ground-truth measurements in order to estimate snow areal extent and snow water content. The snow water content estimations are based on the inexpensive Landsat data and the much more expensively obtained information on ground snow courses. A cost-effectiveness analysis of the procedures showed the expenses involved in obtaining confidence intervals of 80, 90, 95 and 99% for the estimates. J.M.B.

N78-22454*# Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
ASSESSMENT OF AQUATIC VEGETATION WITH SATELLITE-DERIVED DATA Technical Completion Report, Jun. - Sep. 1977
B. L. Markham, W. R. Philipson, J. Ng, and T. Liang Nov. 1977 24 p refs
(Grant NGL-33-010-171; Contract DI-14-34-0001-7068; OWRT Proj. A-082-NY(1))
(NASA-CR-156295; PB-275768/0; W78-02401) Avail: NTIS HC A02/MF A01 CSCL 08H

LANDSAT satellite data were analyzed manually and digitally to determine whether they can provide any useful information concerning freshwater, aquatic vegetation. The study focused on central New York State, where aerial photographic coverage and field data for three lakes were available for comparison. GRA

N78-23501*# NUS Corp., Rockville, Md.
REMOTE SENSING APPLICATIONS TO A PARTIAL AREA MODEL Final Report, Apr. 1970 - Jul. 1977
Edwin T. Engman and John R. Annett, Principal Investigators Jul. 1977 94 p refs ERTS
(Contract NAS5-23399)
(E78-10125; NASA-CR-156741; NUS-3048) Avail: NTIS HC A05/MF A01 CSCL 08B

The author has identified the following significant results. Storm volumes simulated with geometry delineated from

LANDSAT and aircraft infrared imagery were compared with calibration volumes simulated with geometry delineated by hand from soils maps. Results show that where land use is indicative of the soils in a watershed, remotely sensed data can provide good results in a partial area model. Contributing areas were not identifiable by any criteria other than land use. Good results can not be expected in areas with uniform land use with this approach.

N78-23502*# California Univ., Santa Barbara. Dept. of Geography.
REMOTE SENSING APPLICATIONS TO HYDROLOGIC MODELING IN THE SOUTHERN SIERRA NEVADA AND PORTIONS OF THE SAN JOAQUIN VALLEY, VOLUME 1
Final Report, 17 Jan. 1977 - 16 Mar. 1978
Jeff Dozier, John E. Estes, David S. Simonett, Principal Investigators, Robert Davis, James Frew, Caryn Gold, Sandra Keith, and Danny Marks May 1978 126 p refs ERTS 2 Vol.
(Grant NsG-5155)
(E78-10126; NASA-CR-156977) Avail: NTIS HC A07/MF A01 CSCL 08H

The author has identified the following significant results. Characteristics of LANDSAT MSS imagery present problems in using satellite radiation measurements to estimate the shortwave albedo of an alpine snow cover. Every 15 minute USGS quadrangle contains over 100,000 pixels which poses a computation problem if each pixel is to be evaluated individually. The sampling interval may be sufficiently great to mask some effects of terrain and vegetation on reflectance. Three frames of LANDSAT imagery are needed for complete coverage of the study area, yet less than one third of the area coverage from each frame covers an area of interest. Because of distortions inherent in the imagery, information regarding spacecraft altitude, attitude, and position must be statistically derived with respect to ground control points in the image whose geodetic locations are known. An inspection of shade points indicates that up to one third of the most heavily snow covered areas may saturate in bands 4 through 6. LANDSAT's 9 day repeat cycle is not optimum for snow cover reflectance modeling because the most pronounced changes in albedo occur most nearly following a new snowfall. Such a snowfall, occurring between overpasses, is inadequately represented by extrapolation from the previous overpasses.

N78-23503*# California Univ., Santa Barbara. Dept. of Geography.
REMOTE SENSING APPLICATIONS TO HYDROLOGIC MODELING IN THE SOUTHERN SIERRA NEVADA AND PORTIONS OF THE SAN JOAQUIN VALLEY, VOLUME 2
Final Report, 17 Jan. 1977 - 16 Mar. 1978
Jeff Dozier, John E. Estes, David S. Simonett, Principal Investigators, Robert Davis, James Frew, Caryn Gold, Sandra Keith, and Danny Marks May 1978 354 p ERTS 2 Vol.
(Grant NsG-5155)
(E78-10127; NASA-CR-156978) Avail: NTIS HC A16/MF A01 CSCL 08H

N78-23508*# Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
CORNELL UNIVERSITY REMOTE SENSING PROGRAM
Semiannual Status Report, 1 Jun. - 30 Nov. 1977
Ta Liang, Arthur J. McNair, and Warren R. Philipson Dec. 1977 118 p refs
(Grant NGL-33-010-171)
(NASA-CR-156993; SASR-11) Avail: NTIS HC A06/MF A01 CSCL 05B

Aircraft and satellite remote sensing technology were applied in the following areas: (1) evaluation of proposed fly ash disposal sites; (2) development of priorities for drainage improvements; (3) state park analysis for rehabilitation and development; (4) watershed study for water quality planning; and (5) assistance project-landfill site selection. Results are briefly summarized. Other projects conducted include: (1) assessment of vineyard-related problems; (2) LANDSAT analysis for pheasant range management; (3) photo-historic evaluation of Revolutionary War sites; and (4) thermal analysis of building insulation. The objectives, expected benefits and actions, and status of these projects are described.
J.M.S.

N78-23521*# *Geological Survey, Washington, D. C.*
APPLICATION OF COMPUTER PROCESSED MULTISPECTRAL DATA TO THE DISCRIMINATION OF LAND COLLAPSE (SINKHOLE) PRONE AREAS IN FLORIDA
A. E. Coker, R. Marshall (Mich. Univ., Ann Arbor), and N. S. Thomson (Mich. Univ., Ann Arbor) *In* NASA John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 181-193 refs Presented at the 6th Intern. Symp. on Remote Sensing of Environ., Oct. 1969 Sponsored in cooperation with Army and AF
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08G

Data were collected near Bartow, Florida, for the purpose of studying land collapse phenomena using remote sensing techniques. Data obtained using the multispectral scanner system consisted of various combinations of 18 spectral bands ranging from 0.4-14.0 microns and several types of photography. The multispectral data were processed on a special-purpose analog computer in order to detect moisture-stressed vegetation and to enhance terrain surface temperatures. The processed results were printed on film to show the patterns of distribution of the proposed hydrogeologic indicators. Author

N78-23524*# Geological Survey, Washington, D. C.
OPTICAL DATA PROCESSING AND PROJECTED APPLICATIONS OF THE ERTS-1 IMAGERY COVERING THE 1973 MISSISSIPPI RIVER VALLEY FLOODS
Morris Deutsch (EROS Program) and Fred Ruggles *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 226-244 refs Prepared in cooperation with NASA. Goddard Space Flight Center

(Contract DI-14-08-0001-13185)
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08H

Flooding was detected along the Mississippi River and some of its tributaries by the multispectral scanner (MSS) on the ERTS-1 on at least three orbits during the spring of 1973. The ERTS data provided the first opportunity for mapping the regional extent of flooding. Special optical data processing techniques were used to produce a variety of multispectral color composites enhancing flood-plain details. One of these, a 2-color composite of near infrared bands 6 and 7, was enlarged and registered to 1:250,000-scale topographic maps and used as the basis for preparation of flood image maps. Two specifically filtered 3-color composites of MSS bands 5,6, and 7 and 4, 5, and 7 were prepared. Author

N78-23525*# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
APPLICATIONS OF ERTS-1 IMAGERY TO TERRESTRIAL AND MARINE ENVIRONMENTAL ANALYSES IN ALASKA
D. M. Anderson, H. L. McKim, W. K. Crowder, R. K. Haugen, L. W. Gatto, and T. L. Marlar *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 245-272 refs Presented at the 3d Earth Resources Technol. Satellite-1 Symp. Vol. 1: Tech. Presentations, Sect. B, Washington, D. C., Dec. 1973
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08B

A method is considered for identifying and monitoring estuare in surface water, circulation patterns, and changes at different Alaskan sites. Author

N78-23526*# Geological Survey, Washington, D. C.
WATER-MANAGEMENT MODELS IN FLORIDA FROM LANDSAT-1 DATA
A. L. Higer, E. H. Cordes, A. E. Coker, and R. H. Rogers (Bendix Aerospace Systems Div.) *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 273-304 refs Presented at the NASA Earth Resources Surv. Symp Vol. 1D: Water, Houston, Tex., Jun. 1975

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 05A

ERTS-1 is described as a near real time, data relay system for south Florida water quantity and quality monitoring. An ecological model of the Shark River Slough in Everglades National Park is also presented. Author

N78-23528*# Delaware Univ., Newark.
MONITORING COASTAL WATER PROPERTIES AND CURRENT CIRCULATION WITH ERTS-1
V. Klemas, M. Otley, C. Wethe, and R. H. Rogers (Bendix Aerospace Systems Div.) *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 315-340 refs Presented at the 3d Earth Reosurces Technol Satellite-1 Symp. Vol. 1: Tech. Presentation, Sect. B, Washington, D. C., Dec. 1973
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08C

Imagery and digital tapes from nine successful ERTS-1 passes over Delaware Bay during different portions of the tidal cycle were analyzed with special emphasis on turbidity, current circulation, waste disposal plumes, and convergent boundaries between different water masses. ERTS-1 image radiance correlated well with Secchi depth and suspended sediment concentration. Circulation patterns observed by ERTS-1 during different parts of the tidal cycle, agreed well with predicted and measured currents throughout Delaware Bay. Author

N78-23530*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE MAPPING OF MARSH VEGETATION USING AIRCRAFT MULTISPECTRAL SCANNER DATA
M. Kristine Butera *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 351-371 refs Presented at the Earth Resources Surv. Symp. Vol. 1A: Agr. and Environ., Houston, Tex., Jun. 1975

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 CSCL 08B

Aircraft multispectral scanner data were applied to the identification and mapping of Louisiana marsh vegetation species for salinity ozone determination. Author

N78-23532*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
KOREAN COASTAL WATER DEPTH/SEDIMENT AND LAND COVER MAPPING (1:25,000) BY COMPUTER ANALYSIS OF LANDSAT IMAGERY
K. Y. Park (Colorado State Univ., Fort Collins) and Lee D. Miller May 1978 23 p refs Presented at 7th Ann. Remote Sensing of Earth Resources Conf., Tullahoma, Tenn., 27-28 Mar. 1978 Submitted for publication
(NASA-TM-79546) Avail: NTIS HC A02/MF A01 CSCL 08B

Computer analysis was applied to single date LANDSAT MSS imagery of a sample coastal area near Seoul, Korea equivalent to a 1:50,000 topographic map. Supervised image processing yielded a test classification map from this sample image containing 12 classes: 5 water depth/sediment classes, 2 shoreline/tidal classes, and 5 coastal land cover classes at a scale of 1:25,000 and with a training set accuracy of 76%. Unsupervised image classification was applied to a subportion in two case studies. One focuses on the impact of groundwater development on the Papago Indians in Arizona; the second, through a discussion of groundwater development in Pakistan, demonstrates the role groundwater development can play in the economic development process in developing arid countries. GRA

N78-23537*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APPLICATION OF REMOTE SENSING TO THE CHESAPEAKE BAY REGION. VOLUME 1: EXECUTIVE SUMMARY
W. T. Chen, G. W. Freas, Jr., G. D. Hickman (Maryland Univ., College Park), D. A. Pemberton (Maryland Univ., College Park), T. D. Wilkerson (Maryland Univ., College Park), I. Adler (Maryland Univ., College Park), and V. J. Laurie (EPA, Washington, D. C.) 1978 47 p Conf. held at Berkeley Springs, W. Va., 12-15 Apr. 1977; sponsored by NASA, EPA, and Maryland Univ., College Park
(NASA-CP-6; G-7719) Avail: NTIS HC A03/MF A01 CSCL 08C

The proceedings are presented of a conference, jointly sponsored by the National Aeronautics and Space Administration, the U.S. Environmental Protection Agency, and the University of Maryland. The purpose of the Conference was to assemble representatives of federal and state government agencies engaged in research on the condition and evolution of the Chesapeake Bay to compose a status report, to present current activities and future plans, and to recommend a long-range future course of policies and programs. Author

N78-23538*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIELECTRIC CONSTANTS OF SOILS AT MICROWAVE FREQUENCIES-2
J. Wang, T. Schmugge, and D. Williams May 1978 34 p refs
(NASA-TP-1238; G-7802-13) Avail: NTIS HC A03/MF A01 CSCL 20N

The dielectric constants of several soil samples were measured at frequencies of 5 and 19 GHz using the infinite transmission line method. The results of these measurements are presented and discussed with respect to soil types and texture structures. A comparison is made with other measurements at 1.4 GHz. At all three frequencies, the dependence of dielectric constant on soil moisture can be approximated by two straight lines. At low moisture, the slope is less than at high moisture level. The intersection of the two lines is believed to be a function of soil texture. Author

N78-23550# Arkansas Univ., Fayetteville. Water Resources Research Center.
LANDSAT LINEAR TREND ANALYSIS: A TOOL FOR GROUNDWATER EXPLORATION IN NORTHERN ARKANSAS Project Completion Report, May 1975 - 30 Jun. 1977
Harold C. MacDonald, Kenneth F. Steele, and Elizabeth Gaines Jun. 1977 118 p refs
(Contract DI-14-34-0001-6004; OWRT Proj. A-034-ARK(1)) (PB-277121/0; PUB-49; W78-03752) Avail: NTIS HC A06/MF A01 CSCL 08H

In northern Arkansas, knowledge of deep aquifers is fairly limited. The development of these deeper aquifers to their fullest potential as reliable water sources depends upon the delineation of high yield areas, a process that may be facilitated by linear trend analysis. Satellite and photolineament maps of the 13 counties were prepared by use of LANDSAT images and agricultural stabilization and conservation service photo indexes. The lineaments and fracture traces on aerial photographs and LANDSAT images are natural linear features such as aligned stream segments, soil tonal and vegetal alignments, and topographic sags. GRA

N78-23551# Arizona Univ., Tucson. Office of Arid Lands Studies.
THE IMPACT OF GROUNDWATER DEVELOPMENT IN ARID LANDS: A LITERATURE REVIEW AND ANNOTATED BIBLIOGRAPHY
Susan Jo Keith 1977 153 p

(Contract DI-14-31-0001-5254)
(PB-276908/1; OWRT-W-197(5254)(2);
ARID-LANDS-RESOURCE-IP-10; W78-03757) Avail: NTIS HC A08/MF A01 CSCL 13B

The importance of anticipating the physical and socioeconomic effects of groundwater development in arid lands is discussed *of the site analyzed and produced classification maps comparable* in results in a spatial sense. The results of this test indicated that it is feasible to produce such quantitative maps for detailed study of dynamic coastal processes given a LANDSAT image data base at sufficiently frequent time intervals. Author

N78-23700*# Florida Univ., Gainesville. Coastal and Oceanographic Engineering Lab.
SATELLITE APPLICATIONS TO A COASTAL INLET STUDY, CLEARWATER BEACH, FLORIDA
Y. H. Wang, M. Smutz, B. E. Ruth, and H. K. Brooks Dec. 1977 25 p refs
(Grant NsG-7236)
(NASA-CR-156994; UFL/COEL-77/026) Avail: NTIS HC A02/MF A01 CSCL 08C

Two sets of LANDSAT magnetic tapes were obtained and displayed on the screen of an IMAGE 100 computer. Spectral analysis was performed to produce various signatures, their extent and location. Subsequent ground truth observations and measurements were gathered by means of hydrographic surveys and low-altitude aerial photography for interpretation and calibration of the LANDSAT data. Finally, a coastal engineering assessment based on the LANDSAT data was made. Recommendations to the City of Clearwater regarding the navigational channel alignment and dredging practice are presented in the light of *the inlet stability.* Author

N78-25497*# Department of the Environment, Ottawa (Ontario).
RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Jan. - Mar. 1978
R. A. Halliday, Principal Investigator and I. A. Reid May 1978 9 p ref Sponsored by NASA ERTS
(E78-10131; NASA-CR-157144) Avail: NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results. The project continues to demonstrate the feasibility of transmitting hydrometric data in the LANDSAT and GOES mode and using these data operationally. All elements except for the GOES downlink at PASS are functioning well.

N78-25507*# Washington Univ., St. Louis, Mo. Center for Development Technology.
PROGRAM ON STATE AGENCY REMOTE SENSING DATA MANAGEMENT (SARSDM) Final Report
Lester F. Eastwood, Jr. and Edward O. Gotway 19 May 1978 208 p refs
(Contract NAS8-32354)
(NASA-CR-150715) Avail: NTIS HC A10/MF A01 CSCL 05B

A planning study for developing a Missouri natural resources information system (NRIS) that combines satellite-derived data and other information to assist in carrying out key state tasks was conducted. Four *focal applications -- dam safety, ground* water supply monitoring, municipal water supply monitoring, and Missouri River basin modeling were identified. Major contributions of the study are: (1) a systematic choice and analysis of a high priority application (water resources) for a Missouri, LANDSAT-based information system; (2) a system design and implementation plan, based on Missouri, but useful for many other states; (3) an analysis of system costs, component and personnel requirements, and scheduling; and (4) an assessment of deterrents to successful technological innovation of this type in state government, and a system management plan, based on this assessment, for overcoming these obstacles in Missouri. Author

N78-25508*# Tennessee Univ., Knoxville. Dept. of Geography.
THE VERIFICATION OF LANDSAT DATA IN THE GEOGRAPHICAL ANALYSIS OF WETLANDS IN WEST TENNESSEE Final Report, 31 Oct. 1974 - 31 Mar. 1978
John Rehder and Dale Quattrochi Jun. 1978 144 p refs
(Contract NAS8-31143)
(NASA-CR-3012) Avail: NTIS HC A07/MF A01 CSCL 08F

The reliability of LANDSAT imagery as a medium for identifying, delimiting, monitoring, measuring, and mapping wetlands in west Tennessee was assessed to verify LANDSAT *as an accurate, efficient cartographic tool that could be* employed by a wide range of users to study wetland dynamics. The verification procedure was based on the visual interpretation and measurement of multispectral imagery. The accuracy testing procedure was predicated on surrogate ground truth data gleaned from medium altitude imagery of the wetlands. Fourteen sites or case study areas were selected from individual 9 x 9 inch photo frames on the aerial photography. These sites were then used as data control calibration parameters for assessing the cartography accuracy of the LANDSAT imagery. An analysis of results obtained from the verification tests indicated that 1:250,000 scale LANDSAT data were the most reliable scale of imagery for visually mapping and measuring wetlands using the area grid technique. The mean areal percentage of accuracy was 93.54 percent (real) and 96.93 percent (absolute). As a test of accuracy, the LANDSAT 1:250,000 scale overall wetland measurements were compared with an area cell mensuration of the swamplands from 1:130,000 scale color infrared U-2 aircraft imagery. The comparative totals substantiated the results from the LANDSAT verification procedure. Author

N78-26510*# National Oceanic and Atmospheric Administration, Washington, D. C.
APPLICATIONS OF HCMM DATA TO SOIL MOISTURE SNOW AND ESTUARINE CURRENT STUDIES Quarterly Report
Donald R. Wiesnet, Principal Investigator, David F. McGinnis, and Michael Matson 8 Jun. 1978 5 p Sponsored by NASA ERTS
(E78-10140; NASA-CR-157174; HCM-045; QR-3) Avail: NTIS HC A02/MF A01 CSCL 08C

N78-26511*# College for Civil Engineering, Bucharest (Romania). *Lab. for Remote Sensing.*
USE OF LANDSAT DATA FOR NATURAL RESOURCES INVESTIGATION IN THE LOWER BASIN OF DANUBE AND DANUBE DELTA Final Report, May 1975 - Nov. 1976
Nicolaie OPrescu, Principal Investigator Sep. 1977 87 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
(E78-10141; NASA-CR-157175; DaDelta-1/6) Avail: NTIS HC A05/MF A01 CSCL 08F

The author has identified the following significant results. Monitoring of excess humidity was possible at the Baragan test site. Qualitative improvements of 20-50% were obtained in regards to soil inventory in the eastern Danube Delta, comparing data with conventional maps. The pedological situation was observed after drainage in impounded enclosures. The appearance of *stagnate water was surveyed due to difference in color shades* on LANDSAT imagery. Areas with gluey soils, such as lake bottoms rich in CaCO3 and shell grist, were clearly represented. Sediment discharges into the sea at the Danube mouth and plumes over *100 km at sea could be easily distinguished on LANDSAT* MSS 4 and 5.

N78-26513*# Minnesota Univ., Minneapolis. Space Science Center.
A STUDY OF MINNESOTA LAND AND WATER RESOURCES USING REMOTE SENSING Progress Report, 1 Jan. 1977 - 1 Jan. 1978
William G. Shepherd, Principal Investigator 31 Dec. 1977 269 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-24-005-263)
(E78-10143; NASA-CR-157177) Avail: NTIS HC A12/MF A01 CSCL 05B

The author has identified the following significant results. Both LANDSAT imagery and digital data were studied for usefulness in surveying water conditions of Minnesota lakes. Initial consideration was given to analysis of LANDSAT image densities because of the low technologic and cost requirements. The techniques employed, however, yield inconsistent and unreliable results. A set of criteria is given for using LANDSAT data in identification of three categories of particulate contaminants in Lake Superior. A linear transformation giving the relationship between the residual LANDSAT intensities and concentrations of three contaminants was obtained from correlation of remote sensing data with insitu measurements. LANDSAT imagery was found useful in placing peat bogs and fens in their respective geologic settings. Artificial disturbances and drainageways in peatlands could be recognized and classified.

N78-26514*# Mitre Corp., McLean, Va. Metrek Div.
SIMPLIFIED MULTIPLE SCATTERING MODEL FOR RADIATIVE TRANSFER IN TURBID WATER
A. H. Ghovanlou and G. N. Gupta May 1978 72 p refs Sponsored by NASA
(Contract F19628-77-C-0001)
(NASA-CR-145365) Avail: NTIS HC A04/MF A01 CSCL 20N

Quantitative analytical procedures for relating selected water quality parameters to the characteristics of the backscattered signals, measured by remote sensors, require the solution of the radiative transport equation in turbid media. Presented is an approximate closed form solution of this equation and based on this solution, the remote sensing of sediments is discussed. The results are compared with other standard closed form solutions such as quasi-single scattering approximations. G.G.

N78-26677*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ESTIMATION OF SNOW TEMPERATURE AND MEAN CRYSTAL RADIUS FROM REMOTE MULTISPECTRAL PASSIVE MICROWAVE MEASUREMENTS
A. T. C. Chang Jun. 1978 15 p refs
(NASA-TP-1251) Avail: NTIS HC A02/MF A01 CSCL 08L

Variation in crystal size and physical temperature of snowfield observations from space give large variations in the microwave brightness temperature. Since the brightness temperature is a function of wavelength, the microwave brightness temperature can be used to extract the snow temperature and mean crystal radius profiles. The Scanning Multichannel Microwave Radiometer (SMMR), to be launched on board the Nimbus-G and Seasat-A spacecraft, will make observations in wavelengths of 0.8, 1.4, 1.7, 2.8, and 4.6 cm. A statistical retrieval method was developed to determine the snowfield temperature profile and mean crystal size by using the scanning multifrequency microwave radiometer on board a spacecraft. The estimated errors for retrieval are approximately 1.5 K for temperature and 0.001 for crystal radius in the presence of 1 K rms noise for each SMMR channel.
Author

N78-27472*# South Carolina Univ., Columbia. Dept. of Geology.
AERIAL FIELD GUIDE
Dag Nummedal *In* Texas Univ. at Austin The Channeled Scabland 1978 p 169-177 refs

Avail: NTIS HC A09/MF A01 CSCL 08G

There are two overflights planned for the field conference; one for the Cheney-Palouse tract of the eastern channeled scabland, the other covering the coulees and basins of the western region. The approximate flight lines are indicated on the accompanying LANDSAT images. The first flight will follow the eastern margin of this large scabland tract, passing a series of loess remnants, gravel bars and excavated rock basins. The western scablands overflight will provide a review of the structurally controlled complex pattern of large-scale erosion and deposition characteristic of the region between the upper Grand Coulee (Banks Lake) and the Pasco Basin. G.G.

N78-27475*# South Dakota State Univ., Brookings. Remote Sensing Inst.
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Apr. - Jun. 1978
Donald G. Moore, Principal Investigator, J. Heilman, J. Tunheim, and V. Baumberger Jun. 1978 14 p ERTS
(Contract NAS5-2406)
(E78-10145; NASA-CR-157232) Avail: NTIS HC A02/MF A01 CSCL 13B

The author has identified the following significant results. To investigate the general relationship between surface temperature and soil moisture profiles, a series of model calculations were carried out. Soil temperature profiles were calculated during a complete diurnal cycle for a variety of moisture profiles. Preliminary results indicate the surface temperature difference between two sites measured at about 1400 hours is related to the difference in soil moisture within the diurnal damping depth (about 50 cm). The model shows this temperature difference to vary considerably throughout the diurnal cycle.

N78-27477*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Quarterly Progress Report, 1 Apr. - 30 Jun. 1978
James C. Barnes, Principal Investigator 30 Jun. 1978 4 p ERTS
(Contract NAS5-24316)
(E78-10147; NASA-CR-157234; QPR-3) Avail: NTIS HC A02/MF A01 CSCL 08L

N78-27720 South Carolina Univ., Columbia.
VARIATIONS IN TIDAL INLET PROCESSES AND MORPHOLOGY IN THE GEORGIA EMBAYMENT Ph.D. Thesis
Dennis Keith Hubbard 1977 90 p
Avail: Univ. Microfilms Order No. 7807907

Large scale sand body distributions were determined by aerial reconnaissance and inspection of oblique and vertical aerial photographs. The distribution of surface bedforms and internal sedimentary structures were determined through low tide ground reconnaissance, SCUBA observations, fathometer profiles, trenches and box cores. Based on these studies, three types of inlets were identified: tide dominated, wave dominated, and transitional. Dissert. Abstr.

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A78-33595 # Holographic pattern recognition (Gologra-ficheskoe opoznavanie obrazov). G. I. Vasilenko. Moscow, Izdatel'stvo Sovetskoe Radio, 1977. 328 p. 122 refs. In Russian.

A unified treatment of the theories, techniques, and applications of automated identification devices used for the holographic pattern recognition is presented. Topics include the optical processing of information during pattern recognition, the basic theories of holographic identification of images, methods of holographic filtration of pictures, and the use of holographic image devices. Reading machines, information search systems, and methods of automating scientific research are considered. M.L.

A78-34201 Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, University of Bristol, Bristol, England, April 5-9, 1976. Symposium sponsored by the Colston Research Society. Edited by R. F. Peel, L. F. Curtis, and E. C. Barrett (Bristol, University, Bristol, England). London, Butterworth and Co. (Publishers), Ltd. (Colston Papers. Volume 28), 1977. 286 p. $22.

Remote sensing of the earth, the associated data processing and display, and applications of remote sensing to such subjects as structural geology, glaciology, hydrology and upper atmospheric studies are discussed. Topics of the papers include development of a multiband photographic system, passive infrared sensing of clear air turbulence, two-frequency radar applied to surface wave pattern studies, a proposed ESA satellite using passive microwave radiometry, interactive image processing, urban land-use classification, rainfall mapping, soil moisture assessments, remote sensing data as an aid to mapping Antarctica, and a European program of crop inventories and yield forecasts developed through analysis of Landsat and aerial reconnaissance data. J.M.B.

A78-34208 An interactive image processing system. D. M. Balston (Plessey Radar, Havant, Hants., England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 80-90.

This paper describes an interactive image processing system which is now being developed. The major application areas for machine-aided image interpretation are discussed and broken down into two distinct but related techniques. The design principles underlying the system are discussed and the facilities which it will initially provide are described in detail. The system will be capable of accommodating additional facilities as the need arises and the associated technology becomes available. The final sections discuss the planned enhancements and close with a description of the approach to texture analysis and other spatial processing techniques. (Author)

A78-34209 Data processing facilities of the TERRA experiment. S. Gizzi (Telespazio S.p.A., Rome, Italy). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 91-95.

The data processing facility operating at the Telespazio station at Conca del Fucino, Italy, is described in this chapter. It is seen as a complete system presenting different aspects and offering a set of capabilities ranging from data acquisition to pre-processing to information management. The hardware configuration is briefly described and the main functions of the system are indicated as well as the general philosophy used in designing it. (Author)

A78-34777 # Simplified graphoanalytic means for determining adjusting elements during the transformation of spaceborne photographs (Uproshchennye grafo-analiticheskie sposoby opredeleniia ustanovochnykh elementov pri transformirovanii kosmicheskikh fotosnimkov). G. B. Gonin and A. P. Boldyreva. *Geodeziia i Kartografiia,* Feb. 1978, p. 44-50. 5 refs. In Russian.

Two mathematically rigorous optical-analytic methods are developed for transferring the results of the decoding of spaceborne photographs onto cartographic bases. The first consists of transforming the images without converting the components specifying corrections for inclination angles and then reducing the transformations to given scales. The second consists of constructing photomaps of arbitrary components and scales directly on the basis of the spaceborne photographs. Both methods may be used in conjunction with simplified measurement and calculation techniques. S.C.S.

A78-34865 Machine processing of Landsat multispectral data for low cost development of regional land cover information in Indiana. P. W. Mausel and L. Guernsey (Indiana State University, Terre Haute, Ind.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 239-258. 5 refs.

A78-34866 Computer enhancement techniques of Landsat MSS digital images for land use/land cover assessments. P. S. Chavez, Jr., G. L. Berlin (U.S. Geological Survey, Flagstaff, Ariz.), and W. B. Mitchell (U.S. Geological Survey, Reston, Va.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 259-275. 7 refs.

A description is presented of the design and the implementation of computer techniques which were developed to process standard Landsat Multispectral Scanner (MSS) data for the potential enhancement of land use/land cover information. Two scenes of the Phoenix, Arizona metropolitan region were selected for demonstration tests. The test site is centered at 33 deg 12 min N and 112 deg 09 min W and covers approximately 6,000 sq km. The MSS data were acquired on May 15, 1974 and November 29, 1974. The two employed stages of computer processing are related to image correction and image enhancement. Simulated natural color images were found to be helpful in providing a general overview of the test area in colors anomalous to normal vision. Attention is given to sun elevation variance, atmospheric haze, a striping noise pattern, dropped lines, geometric distortions, false color, natural color, color ratios, dependent processing, temporal processing, and thematic mapping. G.R.

A78-34867 Delineation of land features in Egypt by Landsat satellite images. E. M. El Shazly, I. A. El Kassas (Atomic Energy Establishment; Remote Sensing Center, Cairo, Egypt), and M. A. Abdel Hady (Remote Sensing Center, Cairo, Egypt; Oklahoma State University, Stillwater, Okla.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 277-294. 6 refs.

The present paper gives conspicuous examples studied by Landsat satellite imagery of major land features in Egypt, and their implication on the environment and natural resources exploration and management. The land features concerned include the River Nile Basin, the depressions in the Western Desert and the drainage systems. (Author)

A78-34875 **A theoretical model for the evaluation of the interactions between Landsat MSS data and UTM maps in geometric transformations.** M. E. Kirby (Intera Environmental Consultants, Ltd., Ottawa, Canada) and D. Steiner (Waterloo, University, Waterloo, Ontario, Canada; Eidgenössische Technische Hochschule, Zurich, Switzerland). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 407-421. 7 refs. National Research Council Grant No. A-7501.

Geometrical distortions in Landsat multispectral scanning data constitute a hindrance to direct referencing of imaged data to a coordinate grid system (i.e., map projection). For referencing of Landsat data to a Universal Transverse Mercator (UTM) projection, a technique involving an affine transformation and the method of least squares has generally been adopted. A model is developed here to map the distortions found in various parts of a UTM zone when multispectral scanning data are referenced to the projection through this commonly employed technique. The errors associated with the referencing appear to be insignificant. J.M.B.

A78-34876 **Video processing - An effective tool for image analysis.** R. A. Levinson and R. W. Marrs (Wyoming, University, Laramie, Wyo.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 423-440. 14 refs.

The efficient utilization of the full potential of multispectral remote-sensor data requires an employment of specialized image enhancement and analysis techniques. A description is presented of a video image analysis system which can rapidly process large amounts of image data from many sensor systems. Critical enhancement procedures which can be easily performed are related to gain and level adjustment, image mixing and differencing, ratioing, contrast-stretch, atmospheric correction, scale matching, density contouring, density areal measurement, edge enhancement, color separation, color combination functions, and false-color compositing. The video system compares quite favorably to optical and digital equipment which performs similar functions. Complex mathematical manipulation of data cannot be performed with the video image analysis system, but those functions which can be performed are accomplished very rapidly and at modest cost. G.R.

A78-34931 # **EROS Data Center Landsat digital enhancement techniques and imagery availability, 1977.** W. G. Rohde, J. K. Lo, and R. A. Pohl (Technicolor Graphic Services, Inc.; U.S. Geological Survey, EROS Data Center, Sioux Falls, S. Dak.). *(Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb. 21-23, 1977.) Canadian Journal of Remote Sensing,* vol. 4, Apr. 1978, p. 63-76.

Digital enhancement techniques which have been adopted for processing Landsat data are discussed, with attention given to radiometric restoration, geometric correction, contrast enhancement and edge enhancement. Correction algorithms for such radiometric anomalies as striping, poor data lines and atmospheric scattering effects are described; systematic correction of geometric distortions due to earth rotation and variable line lengths are also mentioned. In addition, enhancement of boundaries between features exhibiting subtle brightness differences at their edges (edge enhancement) and contrast enhancement to extend the distribution of brightness values on computer compatible tapes receive consideration. J.M.B.

A78-36270 **Solar stereo Landsat imagery.** V. C. Miller (Indiana State University, Terre Haute, Ind.). *ITC Journal,* no. 1, 1978, p. 158-166.

Unlike conventional stereophotography in which the same shadows photograph differently because of different camera positions, differences in Landsat shadows are caused by different positions of the sun. Although simultaneous viewing of the two halfs of the Landsat solar stereogram of a portion of south-central Pennsylvania recorded on two different dates and at two different solar elevations is rendered somewhat difficult by the differences in overall image tone and in vegetation, the differences in the illumination intensities on east- and west-facing slopes, and particularly differences in the shadows, create a definite stereoscopic effect called solar stereo. Three examples of Landsat stereopairs are presented, where both images of each pair are taken from the same position but on different dates. It is shown that the resulting differences in the shadows cast produces the stereoscopic impression. S.D.

A78-36271 **Current status and perspectives of active microwave imaging for geoscience application.** F. Leberl (Graz, Technische Universität, Graz, Austria). *ITC Journal,* no. 1, 1978, p. 167-190. 39 refs.

The future of the side-looking radar (SLR) for remote-sensing geoscience applications is examined. The evidence presented leads to the conclusion that SLR will have continued applications for surveillance and in the geosciences, possibly even to a greater extent than at present. This conclusion is reached by reviewing the history of imaging radar, a description of the work of major research centers in the field, and an analysis of the advantages and limitations of SLR. The latter may just be at the beginning, and requirements may emerge for more information and training opportunities relating to radar imaging and interpretation. S.D.

A78-36456 **Digital analysis of Landsat images and applications.** H. Ochiai (Toba Merchant Marine College, Toba, Japan), S. Takeuchi, and K. Ohi (Fujitsu Laboratories, Ltd., Kawasaki, Japan). *Fujitsu Scientific and Technical Journal,* vol. 14, Mar. 1978, p. 1-18. 8 refs.

Digital image analysis techniques for remote sensing applications are discussed. New techniques for image enhancement in false color display and for thematic analysis are outlined along with some illustrative examples using actual Landsat imagery. The false color display allows images to be readily interpreted by enhancing their spectral characteristics through digital processing, while the thematic analysis adopts simple techniques without limiting the statistical distribution form of the data. The discussed thematic analysis techniques include classification per pixel, classification per area, and similarity analysis. The effectiveness of the thematic analysis is demonstrated by applying it to the extraction of yearly variation in land use and to the survey of ocean environment. S.D.

A78-36643 **Reflexive prediction and digital terrain modelling.** V. Kratky (National Research Council, Ottawa, Canada). *Photogrammetric Engineering and Remote Sensing,* vol. 44, May 1978, p. 569-574. 5 refs.

An estimation process, called reflexive prediction, which was formulated by Bjerhammar (1975) is considered. Bjerhammar presents four versions of the procedure. Two of these, including pure prediction without filtering and prediction with least squares filtering, can be conveniently applied to grid-structured sets of data points. The least squares condition of minimizing the sum of squares of corrections is used to obtain an expression in array algebra formulation which is an equivalent to a well-known condition in the conventional matrix-vector formulation considered by Kratky (1976). The employment of the considered approach in the case of an application of Bjerhammar's reflexible prediction method to data sets of a grid pattern makes it possible to reduce drastically computer time and memory requirements for solutions in large models. G.R.

A78-37973 **An Adcock system with active antennas for mobile applications (Ein Adcocksystem mit aktiven Antennen für den mobilen Einsatz).** G. Bodemann (Telefunken AG, Ulm, West Germany) and H. Lindenmeier (München, Technische Universität, Munich, West Germany). *Wissenschaftliche Berichte AEG-Telefunken,* vol. 50, no. 4-5, 1977, p. 158-165. 13 refs. In German.

For certain tasks of radio reconnaissance in the RF region, an Adcock system which can be conveniently transported is needed. An ideal mobile Adcock system should consist of small field probes

which receive only the primary field and which are completely independent of the environment and the soil characteristics. This ideal can be closely approached by making use of active antennas with special characteristics. A description is presented of an active antenna which was especially developed for this application, taking into account also a compound 8-Adcock. The Adcock with a height of 2 m for the active antennas has the same sensitivity as the passive antennas with a height of 10 m. G.R.

A78-40161 Comparing soil boundaries delineated by digital analysis of multispectral scanner data from high and low spatial resolution systems. S. J. Kristof, M. F. Baumgardner, A. L. Zachary, and E. R. Stoner (Purdue University, West Lafayette, Ind.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 52-63. 5 refs.

A78-40172 Correlation of intensity variations and false color displays of multispectral digital images. J. Burkle and E. Barón (IBM de América Latina, Centro Científico, Mexico City, Mexico). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 190-193.

It is noted that when viewed by a multispectral sensor, ground resolution elements may manifest mixtures of object categories in such a way that image pixels are not representative of any category. A method is derived for the correlation of intensity variations and false color displays. The technique indicates whether a particular image may be represented by a linear mixture model. In addition, it is found that false color displays may filter the effects of intensity variations caused by shadows or changes in incident light conditions so that uniform combined colors are produced for homogeneous areas. The results of these effects are evaluated for a series of Landsat images. S.C.S.

A78-40177 A least-square error approach to Landsat image classification. A. Y. Hung (TRW Defense and Space Systems Group, Redondo Beach, Calif.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 240-249. 15 refs.

A nonparametric classifier based on a least-square-error approach has been developed to discriminate features or substances in Landsat imagery even when the functional form of the class distributions is unknown. Software implementation of the nonparametric classification is described, and an application of the technique to the classification of geological features in a region of Nevada is presented. The least-square-error classifier provides better results than the density-slice technique and may be a useful alternative to parametric Bayes classification. J.M.B.

A78-40178 A four-dimensional histogram approach to the clustering of Landsat data. M. Goldberg and S. Shlien (Canada Centre for Remote Sensing, Ottawa, Canada). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 250-259. 10 refs.

Unsupervised classification of Landsat data in spectrally distinct sets may be accomplished by use of a four-dimensional histogram in table form. The classification algorithm described here is designed to be implemented in a timesharing system and therefore requires a minimum of computer core memory. At least 280,000 pixels may be clustered at a time with the algorithm. Because of the high speed of the clustering operation (two minutes for the 280,000-pixel unit), the algorithm is suitable for an interactive system. J.M.B.

A78-40182 The use of analysis of variance procedures for defining ground conditions of categories generated in an automatic analysis of Landsat MSS digital data. S. J. Daus and M. J. Cosentino (California, University, Berkeley, Calif.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 298-306. 5 refs.

A78-40184 ISURSL levels classification - A low cost approach to multispectral data analysis. R. F. Hyde, S. N. Goward, and P. W. Mausel (Indiana State University, Terre Haute, Ind.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 322-332. 6 refs.

An economical levels classification of multispectral remote sensing data has been developed; identification of numeric boundaries in a multidimensional feature space is the key component of the classification algorithm. Single and multidimensional histogram analysis provides a sophisticated means for identifying the levels boundaries. Applications of the levels classification to a land cover inventory of Indiana, coastal area ecological zone mapping, a land use inventory, and a forest survey are reported. J.M.B.

A78-40185 Advancements in machine-assisted analysis of multispectral data for land use applications. P. H. Swain (Purdue University, West Lafayette, Ind.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 336-343. 7 refs. U.S. Geological Survey Contract No. 14-08-0001-14725.

Results are reported of a three-year study participated in by the Laboratory for Applications of Remote Sensing of Purdue University, the Center for Advanced Computation of the University of Illinois, and the Geographic Applications Program of the U.S. Geological Survey. The outcome of the study has been a demonstration of the feasibility of applying digital analysis of satellite data to land use inventory and mapping. Advancements have been made in the areas of data analysis techniques, data processing products, and education and training of personnel within the potential user agency. (Author)

A78-40205 Imaging sensors for RPVs. N. Sherman and K. Stich (U.S. Army, Night Vision Laboratory, Fort Belvoir, Va.). In: Airborne reconnaissance - Tactical/real time; Proceedings of the Seminar, Reston, Va., April 18-21, 1977. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 26-37.

Mission requirements for mini RPVs are given which set the boundary conditions for electro-optical sensor operation. Sensor performance goals are postulated and from these objectives a class of sensor is identified. These include high performance thermal imaging and silicon television as well as more austere intensified solid state imagers and pyroelectric vidicons. Current development status and improvements for these devices is forecast. Finally some system design features are given for various stabilization schemes. (Author)

A78-41359 # Algorithms for thematic interpretation of multispectral aerospace video information (Algoritmy tematicheskogo deshifrirovaniia mnogospektral'noi aerokosmicheskoi videoinformatsii). V. I. Borisenko and L. S. Chesalin. *Kosmicheskie Issledovaniia,* vol. 16, May-June 1978, p. 388-393. In Russian.

An algorithm and procedure are described for identifying quasi-uniform Landsat-patterns and automatically classifying them with respect to a spectral criterion. Owing to its low memory requirements, the algorithm can be realized on medium-size computers. V.P.

A78-41468 **Nighttime images of the earth from space.** T. A. Croft (SRI International, Menlo Park, Calif.). *Scientific American*, vol. 239, July 1978, p. 86-96, 98.

Nighttime images of the earth from space can be supplied by the Air Force meteorological satellite and the three Landsat spacecraft launched by NASA in 1972, 1975, and 1978. The Air Force satellite is well suited for conducting a wide-ranging survey of the entire earth, whereas the Landsat system can provide high-resolution color pictures of specific areas selected from the survey. The nighttime satellite images show bright gas flares in many parts of the world, but by far the greatest concentration of them is in the vicinity of the Persian Gulf. The burning of waste gas in oil fields is responsible for the observed flares. Pictures made at local midnight on February 6, 1974 are presented. They show a moonlit panorama of an expanse of earth stretching from northwestern Africa to southeastern Asia. Attention is given to city lights of the countries bordering the English Channel and the North Sea, bright lights in the Sea of Japan which coincide with the known position of the Japanese squid-fishing fleet at this time, and agricultural and natural fires. G.R.

A78-43056 **Contextual pattern classification for remotely sensed multispectral data.** T. S. Yu and K. S. Fu (Purdue University, West Lafayette, Ind.). In: Modeling and simulation. Volume 8 - Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa., April 21, 22, 1977. Part 1. Pittsburgh, Pa., Instrument Society of America, 1977, p. 469-473. 17 refs.

A technique employing contextual information in recognition systems for evaluating multispectral data obtained by remote sensing is discussed with reference to the minimization of the simple Bayes risk. Attention is given to a compound decision process, which generalizes the data so that evaluations of individual information cells can be made. An experiment involving data on a 128 x 128 format (200-327 lines, 120-247 columns) is described in terms of the simple decision, four neighbor, and eight neighbor rule. Overall accuracy improved as the number of neighbors for an individual cell was increased. D.M.W.

A78-43064 **Simulation of imaging radar systems.** J. C. Holtzman, V. H. Kaupp, J. L. Abbott, V. S. Frost, and R. L. Martin (Kansas, University, Lawrence, Kan.). In: Modeling and simulation. Volume 8 - Proceedings of the Eighth Annual Pittsburgh Conference, Pittsburgh, Pa., April 21, 22, 1977. Part 1.
Pittsburgh, Pa., Instrument Society of America, 1977, p. 591-598. 9 refs. Grant No. DAAG53-76-C-0154.

A closed system model has been developed for digital simulation of imaging radars. All system and terrain parameters are treated rigorously in this model. The model properly accounts for radar layover, shadow, dielectric and geometric variations, range compression, and etc. Stereo pairs of simulated radar images are shown to demonstrate the validity of the model. (Author)

N78-22345*# Geological Survey, Washington, D. C.
CALCULATION OF EVAPOTRANSPIRATION USING COLOR-INFRARED PHOTOGRAPHY
John Edwin Jones 1977 40 p refs Sponsored by NASA
(NASA-CR-156157; GSPP-655-0) Avail: NTIS MF A01; SOD HC CSCL 14E

Data from 38 color-infrared photographic missions flown during a five year period over the Gila River Phreatophyte Project in southeastern Arizona were analyzed to determine the possibility of identifying and measuring vegetative parameters and their associated hydrologic variables by spectral analysis of the photographs. The derived spectra equations are discussed, and a table of 24 statistical parameters describing the spectral and hydrologic variables is included. Author

N78-22433 Pennsylvania Univ., Philadelphia.
THE DETECTION OF COLOR BOUNDARIES BY MEANS OF CHROMATIC DISPERSION Ph.D. Thesis
Bruce Watts Bevan 1977 202 p
Avail: Univ. Microfilms Order No. 78-06556

A general technique for detecting the boundaries between objects of different color was developed. It is based on the principle that a color boundary imaged through a color dispersing prism will yield a color spectrum at the boundary which measures the difference between the two colors. Therefore, this colored band both indicates the presence of a boundary between different colors and also quantifies or records the difference between the colors. This colored band will be recorded as light or dark banding on a spectrum-integrating imager, such as a camera with black and white film, so that a color boundary will be detectable even though the two colors yield the same photographic gray density on the film Dissert. Abstr.

N78-22434 General Electric Co., Philadelphia, Pa.
IMAGE PROCESSING INVESTIGATIONS
G. J. Chafaris, F. Alyea, D. L. Dietrich, and J. Birkemeier 21 Dec. 1977 189 p refs
(IR/D Proj. 14RO-DT1-400)
(DOC-77SDB002) Avail: GE Space and RESD Libraries, P.O. Box 8555, Phila., Pa. 19101; Attn: Larry Chasen, Mgr., Rm. L-1343 HC $17.50

Four investigations aimed at improving LANDSAT image/data processing and analysis techniques are described. These are: (1) an investigation of the effects of radiometric compression/decompression on LANDSAT data; (2) an investigation of the advantages/disadvantages of maximum likelihood classification of LANDSAT data; (3) an investigation of the sensitivity of thematic mapper measurements to atmospheric parameters and (4) an investigation that developed a convolution matrix processor that improves GE IMAGE 100 operations. Author

N78-22435*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES USING THE LANDSAT-1 DATA COLLECTION SYSTEM. PART 3: HEAT DISCHARGE FROM MOUNT ST. HELENS, WASHINGTON Final Report, 1972 - 1975
Jules D. Friedman and David Frank, Principal Investigators May 1977 34 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E78-10122; NASA-CR-156972) Avail: NTIS HC A03/MF A01 CSCL 08K

The author has identified the following significant results. Two thermal anomalies, A at 2740 m altitude on the north slope, and B between 2650 and 2750 m altitude on the southwest slope at the contact of the dacite summit dome of Mount St. Helens, Washington were confirmed by aerial infrared scanner surveys between 1971 and 1973. LANDSAT 1 data collection platform 6166, emplaced at site B anomaly, transmitted 482 sets of temperature values in 1973 and 1974, suitable for estimating the differential radiant emission as 84 W/sq m, approximately equivalent to the Fourier conductive flux of 89 W/sq m in the upper 15 cm below the surface. The differential geothermal flux, including heat loss via evaporation and convection, was estimated at 376 W/sq m. Total energy yield of Mount St. Helens probably ranges between 0.1 and 0.4 x 10 to the 6th power W.

N78-22436*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DISTRIBUTED-SWITCH DICKE RADIOMETER Patent Application
Curt A. Levis, inventor (to NASA) (Ohio State Univ., Columbus) Filed 29 Mar. 1978 19 p Sponsored by NASA
(NASA-Case-GSC-12219-1; US-Patent-Appl-SN-891356) Avail: NTIS HC A02/MF A01 CSCL 14B

A radiometer was designed with an array of transducers which simultaneously feed a number of processing channels that are periodically connected to be responsive to noise sources at a predetermined noise temperature. The noise sources are utilized to control the gain of the processing channels to enable each processing channel to derive an output that is an accurate replica of the amplitude and phase of the radiometric signal supplied to it. The array of antenna elements or subapertures transduces electromagnetic energy from a terrestrial or atmospheric region

being monitored into electric signals. Output signals from each channel, indicative of radiation from the region being monitored, are combined in a beam former that derives one or more signals that are replicas of the radiant energy from subregions of the total region being monitored. The signals derived from the beam former are amplitude detected to derive the required information. NASA

N78-22437*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GENERATION AND PHYSICAL CHARACTERISTICS OF THE LANDSAT-1, -2 AND -3 MSS COMPUTER COMPATIBLE TAPES
Valerie L. Thomas Dec. 1977 83 p Revised
(NASA-TM-78018; X-563-75-223-Rev) Avail: NTIS HC A05/MF A01 CSCL 05B

The generation and format of the LANDSAT 1, 2, and 3 system corrected multispectral scanner computer compatible tapes are discussed. Included in the discussion are the spacecraft sensors, scene characteristics, the transmission of data, and the conversion of the data to computer compatible tapes. Also included in the discussion are geometric and radiometric corrections, tape formats, and the physical characteristics of the tape. Author

N78-22441*# General Electric Co., Philadelphia, Pa. LANDSAT Operations Control Center.
LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT, 23 JANUARY - 23 APRIL 1977
23 May 1977 217 p refs
(Contract NAS5-21808)
(NASA-CR-156750; DOC-77SDS4228) Avail: NTIS HC A10/MF A01 CSCL 05B

The LANDSAT operations from launch through orbital instrument observations are reviewed. Orbital parameters, power subsystem, attitude control subsystem, and command/clock subsystem are discussed. Other subsystems are also considered, such as telemetry, orbit adjust, electrical interface, thermal, wideband telemetry, multispectral scanner, and data collection. J.A.M.

N78-22450# Control Data Corp., Minneapolis, Minn. Digital Image Systems Div.
IMAGE COMPRESSION TECHNIQUES Final Technical Report, 30 Jun. 1977 - 30 Jun. 1978
A. E. Labonte and C. J. McCallum Dec. 1977 104 p refs
(Contract F30602-76-C-0350)
(AD-A050679; RADC-TR-77-405) Avail: NTIS HC A06/MF A01 CSCL 14/5

Timely transmission of large format digital imagery over narrow bandwidth lines requires efficient and high compression of the digitized images. The techniques developed, Micro-Adaptive Picture Sequencing (MAPS), are a two-dimensional, spatial adaptive technique which uses the Redundant Area Coding (REARC) concept along with a very versatile algorithm developed by Control Data Corporation. Compression ratios of 30:1 have been achieved with MSE ranging from .548 to 2.534 percent for a broad variety of visible and radar imagery. Author (GRA)

N78-22457# Geological Survey, Reston, Va.
US GEOLOGICAL SURVEY SOURCES OF PHOTOGRAPHS AND IMAGES OF BIOSPHERE RESERVES TAKEN FROM SPACECRAFT AND AIRCRAFT: 19-ORGAN PIPE CACTUS NATIONAL MONUMENT
Janet M. Bonner 1977 76 p
(PB-276550/1) Avail: NTIS HC A05/MF A01 CSCL 08B

Each data report in this series lists remotely sensed data gathered from spacecraft and aircraft available for a single biosphere reserve. Computer listings of data are provided by the EROS Data Center of the U.S. Geological Survey, which contains in its archives all of the listed material in photographic form and, in the case of LANDSAT images, can make available computer-compatible magnetic tapes of any LANDSAT scene. GRA

N78-22805 Maryland Univ., College Park.
AUTOMATIC CLOUD CLASSIFICATION AND SEGMENTATION Ph.D. Thesis
Josephine Ann Parikh 1977 424 p
Avail: Univ. Microfilms Order No. 78-04502

A comparative study of statistical pattern recognition techniques demonstrated a need for application of image segmentation techniques prior to the feature extraction process. Segmentation models for identification of cloud-type objects were defined and tested on sample sets of meteorological satellite data. Significant improvement in classification accuracy was achieved by incorporating the most promising of the segmentation techniques into a statistical pattern recognition model based on cloud segment features. Dissert. Abstr.

N78-23409# Engins Matra, Velizy (France). Lab. de Traitement des Images.
STUDY OF IMAGE ON-BOARD PROCESSING METHODS
Gabriel E. Lowitz and Alain G. Spiwack Paris ESA 15 Dec. 1977 216 p refs
(Contracts ESTEC-2898)
(Rept-60/382; ESA-CR(P)-1031) Avail: NTIS HC A10/MF A01

Image data compression techniques that could be implemented onboard satellites were studied. Classical image processing techniques considered are digital pulse code modulation systems, run length coding systems, transform coding, and syntactic coding. Theoretical aspects include natural dimension reduction and Karhunen-Loeve preprocessing; structure of black and white and multispectral images; syntactic data compression by class extraction; and Matra clustering algorithm. Onboard implementation and simulation results are discussed. In annexes a clustering technique based on the partitioning of the data histogram, stability and dimensionality of Karhunen-Loeve multispectral image expansions, and an iterative procedure for the KL transform of a sequence of adjacent data blocks are presented. ESA

N78-23498*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES USING THE LANDSAT-1 DATA COLLECTION SYSTEM. PREFACE AND PART 1: THE SURTSEY, ICELAND, TEMPERATURE DATA RELAY EXPERIMENT VIA LANDSAT-1 Final Report, 1972 - 1975
Jules D. Friedman, David Frank, Duane M. Preble, and Sveinn Jakobsson, Principal Investigators (Museum of Natural History, Reykjavik, Iceland) Dec. 1975 89 p refs Submitted for publication Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-70243-AG)
(E78-10121; NASA-CR-156971) Avail: NTIS HC A05/MF A01 CSCL 08K

The author has identified the following significant results. Combined aerial IR surveys and DCP heat flux estimates at Mt. Baker, Washington, revealed that recurrent snow, ice, and debris avalanches were in part induced by subglacial geothermal emission and led to the prediction that geothermally-induced volcanic events would occur again at Mt. Baker. On March 10, 1975, the prediction was substantiated when significant and sudden increase in subglacial steam emission perforated the crater glacier in Sherman Crater at Mt. Baker. Analysis of sterographic pairs of LANDSAT MSS images led to the discovery of three large ring structures (the largest, 34 km in diameter) that were interpreted as volcanic centers and possible collapsed calderas or volcanotectonic depressions of post Miocene age in Lassen volcanic region.

N78-23499*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES USING THE LANDSAT-1 DATA COLLECTION SYSTEM. PART 4: LASSEN VOLCANIC REGION Final Report, 1972 - 1975
Jules D. Friedman and David Frank, Principal Investigators Apr. 1978 83 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(NASA Order S-70243-AG)
(E78-10123; NASA-CR-156973) Avail: NTIS HC A05/MF A01 CSCL 08K

The author has identified the following significant results. Analysis of LANDSAT 1 MSS images of October 6, 24, and 25, 1972 of the Lassen volcanic region, California, revealed the existence of three large geomorphic rings between Lassen Peak and Lake Almanor. Ring 1, about 16 x 33 km and 490 sq km in area, was centered on the North Branch of the North Fork of the Feather River. Ring 2, 18 x 20.5 km and 300 sq km in area, was concentric to and enclosed by ring 1. Ring 3, 23 x 11 km and 230 sq km in area, was centered on Butt Mountain and cuts ring 1 on the south. All three rings consisted of composite curvilineaments that represent geologic features of two categories: (1) geologically mapped structures and volcanic landforms, and (2) landforms and lines of geomorphic origin that were inferred to represent the surface expression of subsurface structures. Stream-valley and lake-shoreline continuations of mapped faults, escarpments, and aligned segments of stream valleys were included in the 2d category. The rings overlap a gravity low 5300 sq km in area, and might be the surface expression of volcanotectonic collapse structures that followed eruption of voluminous ash flow tuffs begining in Miocene times.

N78-23500*# Geological Survey, Denver, Colo.
THERMAL SURVEILLANCE OF ACTIVE VOLCANOES USING THE LANDSAT-1 DATA COLLECTION SYSTEM. PART 5 ELECTRONIC THERMAL SENSOR AND DATA COLLECTION PLATFORM TECHNOLOGY Final Report, 1972 - 1975
Duane M. Preble, Jules D. Friedman, and David Frank, Principal Investigators Feb. 1976 64 p refs ERTS
(NASA Order S-70243-AG)
(E78-10124; NASA-CR-156974) Avail: NTIS HC A04/MF A01 CSCL 08K

The author has identified the following significant results. Five LANDSAT data collection platforms were integrated electronically with thermal sensing systems, emplaced and operated in an analog mode at selected thermal significant volcanic and geothermal sites. The DCP's transmitted 3260 messages comprising 26,080 ambient, surface, and near surface temperature records at an accuracy of + or - 1.15 C for 1121 instrument days between November 14, 1972 and April 17, 1974. In harsh, windy, high altitude volcanic environments, the DCP functioned best with a small dipole antenna. Sixteen kg of alkaline batteries provided a viable power supply for the DCP systems, operated at a low duty cycle, for 5 to 8 months.

N78-23505*# IBM Federal Systems Div., Gaithersburg, Md.
THEMATIC MAPPER DESIGN PARAMETER INVESTIGATION Final Report, Jun. 1976 - Jan. 1978
C. P. Colby, Jr. and S. G. Wheeler Jan. 1978 147 p refs
(Contract NAS5-23585)
(NASA-CR-156756; FSD-780001) Avail: NTIS HC A07/MF A01 CSCL 08B

This study simulated the multispectral data sets to be expected from three different Thematic Mapper configurations, and the ground processing of these data sets by three different resampling techniques. The simulated data sets were then evaluated by processing them for multispectral classification, and the Thematic Mapper configuration, and resampling technique which provided the best classification accuracy were identified. Author

N78-23512*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
THE NATURE OF LIGHT
In its Remote Sensing and the Earth Dec. 1977 p 18-25

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 20F

Basic information about the sun, what light is, and the atmospheric effects on light transmission are presented. Author

N78-23527*# Virginia Univ., Charlottesville.
HIGH-ALTITUDE AERIAL PHOTOGRAPHS AID IN INVESTIGATIONS
Robert Dolan and Linwood Vincent *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 305-314 refs Sponsored in cooperation with NASA. Wallops Station and USGS
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08C

Results of crescentic features study of sandy coasts, using high altitude aerial photography are presented. Author

N78-24594# Indian Space Research Organization, Ahmedabad. Image Processing and Analysis Div.
A PROGRAMMING SYSTEM FOR DIGITAL IMAGE PROCESSING OF REMOTELY SENSED DATA
Bangalore, India Apr. 1977 65 p refs
(ISRO-SAC-TR-04-77) Avail: NTIS HC A04/MF A01

The programming system designed for processing of multispectral data and multiband photographs is described and defined in terms of preprocessing and picture handling, pattern recognition and statistical analysis routines, data management, input/output routines, and computer programming. M.V.

N78-26516# Giddings (L. E., Jr.), Houston, Tex.
BOLIVIA FROM SPACE: IMAGES AND OTHER INFORMATION FROM SATELLITES, WITH CATALOGS
L. E. Giddings, Jr. Jan. 1977 275 p
(Giddings-77-01) Avail: NTIS HC A12/MF A01

Information about Bolivia is presented that was obtained from manned and unmanned satellites. A comprehensive catalog of photographs taken from the Gemini, Apollo, and Skylab manned missions is included. Information available from umanned satellites includes the LANDSAT earth resources technology satellites, the ITOS/NOAA polar orbiting meteorological satellites, and the SMS/GOES geosynchronous orbiting meteorological satellites. Some information on future satellites is also reported. Sample images of all types of data are included. G.G.

N78-27473 Maryland Univ., College Park.
LINEAR FEATURE DETECTION AND MAPPING Ph.D. Thesis
Gordon James VanderBrug 1977 263 p
Avail: Univ. Microfilms Order No. 78-08196

The methods developed are applicable to many types of pictures, but the examples used in the dissertation are all taken from remote sensory imagery. In such imagery, roads, rivers, and geologically significant structures known as lineaments all appear as linear features. The approach taken involves several steps: (1) detection of the features on a local basis using a local matching process; (2) iterative enhancement of the local feature detection output using contextual information; (3) representation of the resulting curve segments in a data structure; and (4) merging the segments, as guided by the data structure, to yield global linear features. Dissert. Abstr.

N78-27495# Army Engineer Topographic Labs., Fort Belvoir, Va.
ELEVATION DATA COMPACTION BY POLYNOMIAL MODELING
James R. Jancaitis Apr. 1978 47 p refs
(AD-A054003; ETL-0140) Avail: NTIS HC A03/MF A01 CSCL 08/2

This report details the status of ongoing research directed towards development of a near-term production implementation of digital data compression of terrain elevation information. The first section discusses the important data characteristics, the major applications, and the compression needs. The second section discusses the various published terrain representations, their capabilities and limitations. The third section presents an overview of the Polynomial Terrain Model's characteristics and construction. The next section contained the development plan identified for production implementation of the polynomial modeling technique, and the remaining sections report on the status of various phases of this development. The results showed that the Polynomial Matrix method is the most promising of the various digital terrain formats (DFT). Author (GRA)

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A78-34124 * Stratospheric ozone measurement with an infrared heterodyne spectrometer. M. M. Abbas (NASA, Goddard Space Flight Center, Infrared and Radio Astronomy Branch, Greenbelt; Maryland, University, College Park, Md.), T. Kostiuk, M. J. Mumma, D. Buhl, V. G. Kunde, and L. W. Brown (NASA, Goddard Space Flight Center, Infrared and Radio Astronomy Branch, Greenbelt, Md.). *Geophysical Research Letters,* vol. 5, Apr. 1978, p. 317-320. 13 refs.

Measurements of a stratospheric ozone concentration profile are made by detecting infrared absorption lines with a heterodyne spectrometer. The infrared spectrometer is based on a line-by-line tunable CO2 lasers, a liquid-nitrogen cooled HgCdTe photomixer, and a 64-channel spectral line receiver. The infrared radiation from the source is mixed with local-oscillator radiation. The difference frequency signal in a bandwidth above and below the local-oscillator frequency is detected. The intensity in each sideband is found by subtracting sideband contributions. It is found that absolute total column density is 0.32 plus or minus 0.02 cm-atm with a peak mixing ratio at about 24 km. The (7,1,6)-(7,1,7) O3 line center frequency is identified as 1043.1772/cm. Future work will involve a number of ozone absorption lines and measurements of diurnal variation. Completely resolved stratospheric lines may be inverted to yield concentration profiles of trace constituents and stratospheric gases. S.C.S.

A78-34203 Collection and analysis of spectral reflectance data and their use in the design of a multiband photographic system. R. J. Drewett (Plessey Radar, Havant, Hants., England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 15-25. Research supported by the Home Office.

The basic concepts of a complete multiband photographic system are discussed, stressing the importance of spectral reflectance data in the choosing of camera filters, and the need for high-quality output material. A system to provide these needs has been developed, and the elements of the system are described. The paper concludes with a section on current and potential applications in the field of remote sensing. (Author)

A78-34205 Remote sensing by radar. K. G. Corless (Royal Radar Establishment, Malvern, Worcs., England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 38-53. 6 refs.

Side-looking airborne imaging radar, synthetic aperture radar, pulse Doppler radar and two-frequency radar systems are described. Radar measurements of range, range rate and the spatial Fourier transform of range are given attention. In addition, applications of two-frequency radar to the identification of surface wave patterns, as well as the spaceborne uses of synthetic aperture radars, are mentioned. J.M.B.

A78-34206 Passive microwave radiometry from a European spacecraft. H. M. Mooney, E. P. L. Windsor (British Aircraft Corp., Ltd., Bristol, England), E. Nilsson, and L. Thrane. In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 54-68.

Applications of passive microwave radiometry to remote sensing of the terrestrial environment were examined in a feasibility study for an ESA satellite to be orbited after 1980. The chief reason for selecting a microwave rather than infrared sensing system was the all-weather performance of the former. Use of the ESA satellite for ship routing, air quality assessments, sea surface temperature and wind speed determinations, glaciology studies, arid zone studies and weather forecasting were given particular attention. A sun-synchronous orbit with a recurrence period of four days was envisaged. In addition, the study focused on horns, reflectors and phased arrays as antenna options, and on noise-injection and dual-reference designs for the radiometer. J.M.B.

A78-34207 A critical review of the Quantimet 720 image analyser in remote sensing. B. L. Wignall (Image Analysing Computers, Royston, Yorks., England). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 71-79. 8 refs.

The Quantimet 720 is a general purpose image analyzer. It works on a television principle using nonstandard scan parameters designed to optimize the measurement processes. The basis of the measurements is selection of regions of interest by gray level thresholding, although this can be augmented by use of some textural information and also a wide range of interaction techniques. The instrument can also be used to digitize images for software analysis. A number of instruments are in regular use for remote sensing applications which include studies of ice and snow cover, afforestation, water resources and crop diseases and yields. (Author)

A78-34855 The role of ground truth data and an approach to its collection. T. H. L. Williams. In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 39-49. 8 refs.

Ground truth data has two main functions in remote sensing studies; (1) the provision of training and calibration information for ongoing surveys and (2) in a ground-based research facility for investigations into sensor response/environmental parameters relationships. A ground truth data collection system was developed at the University of Bristol to fulfill the general requirements of both these functions. It was designed with three objectives in mind: speed of operation for rapid per-site coverage, simplicity of operation for use by semi-skilled personnel, and with a low cost factor to enable multiple systems to be used. It is based on a Land-Rover with attached telescopic mast. The mast carries a six-channel radiometer and 35 mm camera mounted on a servomechanism. Techniques developed include the use of photographic quadratting and data storage techniques, automated continuous soil moisture measurement, soil surface roughness description and the use of low level aerial photography as a means of collecting synoptic data. (Author)

A78-34859 * Characteristic vector analysis as a technique for signature extraction of remote ocean color data. G. W. Grew (NASA, Langley Research Center, Hampton, Va.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 109-144. 10 refs.

Characteristic vector analysis is being used to extract spectral signatures of suspended matter in the ocean from remote ocean color data collected with MOCS (Multichannel Ocean Color Sensor), a multispectral scanner. Spectral signatures appear to be obtainable either directly from characteristic vectors or through a transformation of these eigenvectors. Quantification of the suspended matter associated with each resulting signature seems feasible using associated coefficients generated by the technique. This paper presents eigenvectors associated with algae, 'sediment', acid waste, sewage sludge, and oil. The results suggest an efficient method of transmitting from satellites multispectral data of pollution in our oceans. (Author)

A78-34873 **A camera system for small format aerial photography.** J. C. Rea and M. Ashley (Maine, University, Orono, Me.). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference. 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 365-374. 19 refs.

A camera control system suited for operation of any electrically operated small-format camera used in aerial reconnaissance is described. The control system includes intervalometers, connecting cables and a mount adaptable to light aircraft. Sequential firing of a single camera, simultaneous firing of two or more cameras, and independent firing of two cameras are among the options made available by the control unit. The control system is economical and does not interfere with the pilot's activities during flight. J.M.B.

A78-34879 **Feature selection and sample classification algorithms of INPE.** R. Kumar (Conselho Nacional de Desenvolvimento Científico e Tecnológico, Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil). In: Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Tullahoma, Tenn., University of Tennessee, 1977, p. 487-497. 18 refs.

In the remote sensing of earth resources, the problem of feature selection reduces to the following. Given a set of N features (e.g., multispectral channels), find a subset consisting of n channels which provides an optimal trade off between classification cost and classification accuracy. An algorithm for feature selection based on B-distance (derived from Bhattacharyya distance) has been developed. This algorithm can be used for Landsat data, aircraft multispectral scanner (MSS) data and Skylab MSS data. In addition, a branch and bound algorithm to select the best subset of n features from a set of N features without exhaustive search is also being developed. A sample classifier based on B-distance has been developed. B-distance is computed between a test field and each of the training classes and classified into the class for which the B-distance is minimum. (Author)

A78-34910 * # **System implementation for Earth Radiation Budget Satellite System.** J. E. Cooper and C. V. Woerner (NASA, Langley Research Center, Hampton, Va.). *American Meteorological Society, Conference on Atmospheric Radiation, 3rd, Davis, Calif., June 28-30, 1978, Paper.* 5 p. 13 refs.

A description is presented of the instrument system which is needed for the Earth Radiation Budget Satellite System (ERBSS). The system is to be composed of instruments on two of NOAA's near-polar sun-synchronous Tiros-N/NOAA A through G series of operational satellites and on a NASA midinclination satellite of the Applications Explorer Mission (AEM) type referred to as ERBS-A/AEM. The Tiros-N/NOAA satellites will be in nominal 833 km altitude circular orbits with orbital inclinations of 98 deg. The AEM satellite will be in a circular orbit with an inclination of approximately 56 deg and a nominal altitude of 600 km. Each satellite will carry wide field-of-view (WFOV) and medium field-of-view (MFOV) sensors, a sensor for measuring the solar constant, and a narrow field-of-view (NFOV) cross-track scanner. The conceptual design of the W/MFOV instrument is discussed along with the conceptual design of the scanner. G.R.

A78-34926 # **Applications of satellite thermal infrared measurements to earth's resources studies.** J. Cihlar and A. K. McQuillan (Canada Centre for Remote Sensing, Ottawa, Canada). *(Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb. 21-23, 1977.) Canadian Journal of Remote Sensing,* vol. 4, Apr. 1978, p. 10-28. 87 refs.

The application of thermal infrared measurements to earth resources studies in Canada is discussed, with emphasis on the capabilities of the Advanced Very High Resolution Radiometer of Tiros-N and the Heat Capacity Mapping Mission, scheduled for launch in 1978. Astronomical, atmospheric, topographic, surface and subsurface parameters affecting thermal infrared data are considered. Among the applications contemplated for this type of remote sensing are groundwater assessments, mapping of thermal patterns in bodies of water, soil moisture analyses, plant stress surveys, forest fire monitoring, and investigations of sea ice, snow cover and permafrost zones. J.M.B.

A78-34930 # **Passive electro-optical remote sensors at the Canada Centre for Remote Sensing.** H. H. Zwick (Canada Centre for Remote Sensing, Ottawa, Canada). *(Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb. 21-23, 1977.) Canadian Journal of Remote Sensing,* vol. 4, Apr. 1978, p. 51-62. 13 refs.

The basic design parameters of passive electrooptical sensors used at the Canada Centre for Remote Sensing are reviewed; photometers, spectrometers and imaging devices, most of which operate in the 0.4- to 14-micron spectral region, figure in the review. Parameters studied include spectral resolution, throughput, instantaneous field of view, number of sensors, transmission, integration/acquisition time and outputs. In addition, the resolving power of each sensor is studied as a function of radiance response or a signal-to-noise parameter. J.M.B.

A78-35181 # **Technical description of remote-sensing data receivers and transmitters for balloon experiments (Description technique de récepteurs et d'émetteurs de télémesure pour expériences ballon).** R. Tissier (CNRS, Laboratoire de Géophysique Externe, Saint-Maur-des-Fossés, Val-de-Marne, France). *SBARMO Bulletin,* vol. 6, Dec. 1977, p. 263-304. 11 refs. In French.

A balloon-borne receiver and transmitter and a ground-based receiver and transmitter designed for a maximum transmission distance of 700 km are described. The remote sensing communications system employs PCM transmission and FM; a tolerance for temperatures in the range -40 C to plus 50 C is specified for the balloon-borne equipment. A 200-250 mW transmitter is the chief component of the balloon-borne communications package. A receiver operating in the 135-140 MHz range provides on-ground reception. J.M.B.

A78-35338 **Processing of ocean wave data from a synthetic aperture radar.** R. A. Shuchman and J. S. Zelenka (Michigan, Environmental Research Institute, Ann Arbor, Mich.). *(Inter-Union Commission on Radio Meteorology and U.S. Navy, Colloquium on Radio Oceanography, Hamburg, West Germany, Sept. 29-Oct. 6, 1976.) Boundary-Layer Meteorology,* vol. 13, Jan. 1978, p. 181-191. 10 refs. Grant No. NOAA-04-6-158-44078; Contract No. N00014-76-C-1048.

The processing of data obtained by synthetic aperture radar (SAR) on ocean waves is examined, and the effect of defocusing caused by moving ocean waves is analyzed. Conventional processing of Doppler data from moving ocean waves produces images that are defocused in the azimuthal direction. The defocusing is corrected by readjusting the azimuthal focus an amount proportional to the relative velocity of the wave trains. In addition to varying azimuth focus, the effects of varying the Doppler center frequency, the range focus, and the number of coherently averaged images on SAR wave imagery were also observed. P.T.H.

A78-35932 **Tutorial review of synthetic-aperture radar /SAR/ with applications to imaging of the ocean surface.** K. Tomiyasu (GE Valley Forge Space Center, Philadelphia, Pa.). *IEEE, Proceedings,* vol. 66, May 1978, p. 563-583. 65 refs.

This review paper shows how an airborne (or spaceborne) synthetic-aperture radar (SAR) - comprising a pulsed microwave transmitter, antenna, and a phase-coherent receiver - can produce high-resolution two-dimensional images of radar-mapped areas. A major feature is that the antenna beam is typically at right angles to the velocity vector. The discussion covers the synthetic aperture,

relevant range and cross-range (azimuth) ambiguities, signal processing, phase errors, mapping rate, SNR, radar image of ocean waves, and radar-frequency dependence for a fixed resolution. High resolution in range is obtained using wideband transmitted pulses, and high resolution in azimuth is achieved by signal processing the coherent phase history of target-reflected signals collected for the integration time period. SAR images of ocean waves are reported which correlate well with optical photographs and visual observations. A SAR is expected to measure the directional spectra of oceanic waves. S.D.

A78-36196 # **Estimates of the effectiveness of using AFU-75 cameras in photographic satellite tracking and satellite geodesy (Nekotorye otsenki effektivnosti primeneniia kamer AFU-75 v fotograficheskoi sputnikometrii i sputnikovoi geodezii).** K. Lapushka, L. Lautsenieks, and Ia. Balodis (Astronomicheskaia Observatoriia, Riga, Latvian SSR). *Nauchnye Informatsii,* no. 35, 1977, p. 80-99. 20 refs. In Russian.

Analysis of a large number of satellite photographs taken with AFU-75 cameras shows that this camera has sufficient power and accuracy to be used for photographing nearly all types of satellites used in geodesy and studies of atmosphere and earth dynamics. The rms error for one direction to a satellite is + or - 1.1 arcsec for active satellites, + or - (1.1-2.5) arcsec for bright satellites, and + or - (0.7-2.5) arcsec for faint satellites. The average camera accuracy over all photographing conditions with high-grade code is + or - 1.1 arcsec, and for processing photographs with mixed first- and second-grade codes it is + or - 1.6 arcsec. P.T.H.

A78-36307 Recent advances in the application of thermal infrared scanning to geological and hydrological studies. D. A. Pratt, C. D. Ellyett, E. C. McLauchlan, and P. McNabb (Newcastle University, Newcastle, New South Wales, Australia). *(International Geological Congress, 25th, Symposium on Exploration Remote Sensing, Sydney, Australia, Aug. 1976.) Remote Sensing of Environment,* vol. 7, Apr. 1978, p. 177-184.

The thermal scanner on board Landsat-C and the Heat Capacity Mapping Mission provide opportunities for the application of thermal infrared scanning to geological and hydrological studies. Calibration of scanners by internal black-body reference sources is described; digital and analog processing techniques for thermal infrared imagery are also discussed. Density slicing, contrast stretching, boundary enlargement and contouring are among the processing methods considered. In addition, attention is given to theoretical investigations of soil and rock temperature in an active thermal environment, and studies of the relationship between diurnal surface temperature variations and ground thermal properties. J.M.B.

A78-36644 The Space Oblique Mercator projection. J. P. Snyder. *Photogrammetric Engineering and Remote Sensing,* vol. 44, May 1978, p. 585-596. 5 refs.

The Space Oblique Mercator projection, a concept that was originated by Colvocoresses in 1974, has been mathematically implemented as the first map projection to provide continuous mapping of satellite imagery true to scale along the groundtrack, and within a few millionths of accurate conformal projection. Specifically designed for Landsat (formerly ERTS) imagery, it is also suitable for other satellites with broader scans. Formulas are given for both sphere and ellipsoid. A unique feature is the need for a curved groundtrack and skewed scan lines on the SOM projection, although they would be straight and parallel, respectively, on a normal oblique cylindrical projection. (Author)

A78-36925 Effect of f-number and other parameters on FLIR performance in nearly BLIP systems. H. Barhydt (Hughes Aircraft Co., Culver City, Calif.). *Optical Engineering,* vol. 17, Mar.-Apr. 1978, p. SR-28 to SR-32. 13 refs.

The article discusses the effect of the f-number and related parameters on the performance of forward looking infrared sensors (FLIRs) in the case of nearly background limited performance (BLIP) systems. It is noted that in nearly BLIP systems the detectivity of an appropriately cold shielded detector array varies with the f-number in a manner which eliminates the f-number dependence to the first order. Other performance-determining characteristics in nearly BLIP systems include wavelength interval, sizing parameters, and various efficiency factors. An expression is derived for the noise equivalent temperature difference which is also associated with the minimum resolvable temperature difference and the minimum detectable temperature difference. S.C.S.

A78-38460 # **Near-infrared remote-sensing radiometer (Teleradiometr dlia blizhnego infrakrasnogo diapazona).** V. K. Veismann and Ch. I. Villmann. *Meteorologicheskie Issledovaniia,* no. 23, 1977, p. 57-60. 16 refs. In Russian.

The paper describes the design, principle of operation, and absolute calibration of a four-channel near-infrared radiometer for remote-sensing applications. The basic metrological characteristics of the instrument are: (1) absolute energetic sensitivity, (2) relative spectral sensitivity characteristics, and (3) directivity characteristics. The dependence of photoresistor sensitivity on temperature is plotted, and directivity curves are presented for one channel of the radiometer. B.J.

A78-40203 Electronic solid state wide angle camera system - ESSWACS. G. T. Burton (RCA, Burlington, Mass.). In: Airborne reconnaissance - Tactical/real time; Proceedings of the Seminar, Reston, Va., April 18-21, 1977. Bellingham, Wash., Society of Photo-Optical Instrumentation Engineers, 1977, p. 10-19. Contract No. F33615-76-C-1276.

A system for real time wide angle reconnaissance from low flying, high performance aircraft is described. The system combines a multiple lens - linear CCD array, airborne sensor head, an air to ground data link; and a ground based, dry silver film, laser beam recording system that produces hard copy imagery on the ground within 30 seconds of data acquisition. The airborne sensor employs five lenses, each with its own CCD array to cover a 140 degree ground swath. Resolution from 1000 feet in a push broom mode is 0.75 foot. Data from the five arrays and synchronization, V/H and roll data are multiplexed into a single data line for airborne storage or direct transmission to the ground. On the ground, sync, roll and V/H are extracted as the video information is buffered in a dual line buffer. Using the sync and roll data to derive control signals the buffered data is processed to correct for optical image distortion and system time base instabilities. The resultant video signal drives a high performance laser beam recorder. (Author)

A78-40487 SCIMP - A scanning interferometric multiplex photometer. G. G. Shepherd, A. J. Deans, and Y. P. Neo (York University, Toronto, Canada). *Canadian Journal of Physics,* vol. 56, June 1978, p. 681-686. 20 refs. Research supported by the National Research Council of Canada and Canada Centre for Remote Sensing.

An interference filter photometer concept is described in which equally-spaced spectral elements of equal width are generated. The method takes advantage of the wavelength shift of off-axis radiation transmitted by the filter, and is accomplished by the use of masks in the location of the field stop. This technique lends itself to multiplexing, using Fourier or Hadamard coding, but a direct spectral configuration is also possible. The advantages of the concept and a comparative analysis of signal-to-noise ratio are described. The technique has been employed in ground based airglow studies, airborne remote sensing, and rocket measurements of airglow and aurora. (Author)

A78-41189 In situ measurement of water transparency. J. W. Sheldon (Florida International University, Miami, Fla.). *Photogrammetric Engineering and Remote Sensing,* vol. 44, June 1978, p. 717-720. 5 refs. Research supported by the Florida Atlantic University and Florida International University.

This paper describes how the well-known modulation transfer function theory and experimental technique can be employed to monitor suspended particulates in the aqueous environment by using instrumentation that rivals the Secchi disk in simplicity, but which has many advantages over this older method. The design of a simple low-cost underwater camera-light source-target system is reported and its use is demonstrated by observing the temporal variation in the transparency of Biscayne Bay water during the passage of a barge-tug vehicle. (Author)

A78-41208 # Remarks on calibration of photogrammetric cameras (Kilka uwag o kalibracji kamer fotogrametrycznych). A. Majde. *Geodezja i Kartografia,* vol. 27, no. 2, 1978, p. 155-160. In Polish.

The merits of different methods of calibrating photogrammetric cameras are judged in terms of the method of determining the interior orientation parameters. It is shown that during processing of aerial photographs of rather large area, only the distortions of the central projection have significant effect. The optimal method recommended in this case is to take the position of the interior projective center obtained by interior calibration and determine the distribution of the total distortions on the basis of photographs of the test field. P.T.H.

N78-22429 Oklahoma State Univ., Stillwater.
THE TEMPORAL CORRELATIBILITY OF DIGITAL THERMAL INFRARED SCANNER DATA Ph.D. Thesis
Edmund Henry Conrow 1976 210 p
Avail: Univ. Microfilms Order No. 78-01228

The correlatability of thermal patterns obtained by terrain mapping with a scanning radiometer was explored. The NOAA-3 vhrr thermal IR digital data was utilized to determine whether invariant and/or mean-biased consistent thermal features on the earth's surface can be detected. After geometric registration, point-by-point differencing was used in day/day, day/night, and night/night analyses to determine if the correlation between data sets was sufficiently high to warrant further investigation for application to position-location systems. In addition, an investigation was made to determine if observed physical and environmental factors would have an effect on the degree of correlatability between data sets. Dissert. Abstr.

N78-22442*# Old Dominion Univ., Norfolk, Va. School of Engineering.
LABORATORY REQUIREMENTS FOR IN-SITU AND REMOTE SENSING OF SUSPENDED MATERIAL Final Report
Chin Y. Kuo and Robert Y. K. Cheng Mar. 1978 90 p refs (Contract NAS1-11707)
(NASA-CR-145367; TR-76-C2) Avail: NTIS HC A05/MF A01 CSCL 08H

Recommendations for laboratory and in-situ measurements required for remote sensing of suspended material are presented. This study investigates the properties of the suspended materials, factors influencing the upwelling radiance, and the various types of remote sensing techniques. Calibration and correlation procedures are given to obtain the accuracy necessary to quantify the suspended materials by remote sensing. In addition, the report presents a survey of the national need for sediment data, the agencies that deal with and require the data of suspended sediment, and a summary of some recent findings of sediment measurements. Author

N78-22443# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
SYSTEMATIC IMAGE ERRORS [SYSTEMATISCHE BILDFEHLER]
Bayerische Akad. der Wiss. 1977 70 p refs In GERMAN Proc. of a Photogrammetry Conf. held at Bonn, 5 Dec. 1975 (Ser-B-226; ISBN-3-7696-8528-8) Avail: NTIS HC A04/MF A01

Papers are presented concerning adjustment of systematic errors in photogrammetry. The compensation of systematic image errors by photoflight dispositions, together with bundle adjustment, is discussed. Partial calibration based on a test field is reviewed. A simultaneous block adjustment method with self-calibration is outlined. Computer techniques are discussed for extensive image associations using the bundle method. Results of photogrammetric fixed point determination are presented.

N78-22444# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
COMPENSATION OF SYSTEMATIC IMAGE ERRORS BY PHOTOFLIGHT DISPOSITIONS? [KOMPENSATION SYSTEMATISCHER BILDFEHLER DURCH DIE BILDFLUGANORDNUNG?]
Joachim Thomas *In its* Systematic Image Errors 1977 p 12-22 refs Partly in GERMAN and ENGLISH

Copyright. Avail: NTIS HC A04/MF A01

The question is being considered of whether a compensation of systematic image errors is to be reached by manifold flying and subsequent simultaneous bundle adjustment. Fundamental connections between types of systematic image errors and optimal compensating flight dispositions were found based on extensive empirical investigations. The resulting compensation can be reduced to the arithmetic mean (of all photooverlaps) of the systematic errors in the image plane. A graphical and an algebraic method were developed to determine the average of two-dimensional errors in a two-dimensional distribution. Partly new flight dispositions for compensation of systematic image errors were conceived based on both methods. Author (ESA)

N78-22445# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
PARTIAL CALIBRATION OF A PHOTOGRAMMETRY SYSTEM USING TEST FIELDS [TEILKALIBRIERUNG EINES PHOTOGRAMMETRISCHEN SYSTEMS UNTER VERWENDUNG VON TESTFELDERN]
L. Mauelshagen *In its* Systematic Image Errors 1977 p 23-38 refs In GERMAN
Copyright. Avail: NTIS HC A04/MF A01

Partial calibration based on a test field is discussed as a method for the treatment of the systematic image errors in photogrammetry. The mathematical model determining the photogrammetric mapping by the projection relations between measured image and photographic object is described. Practical results of partial calibrations are outlined. These show that considerable accuracy improvements in block adjustment may be expected as a result of the elimination of systematic image errors. ESA

N78-22446# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
BLOCK ADJUSTMENT WITH SELF CALIBRATION [BLOCKAUSGLEICHUNG MIT SELBSTKALIBRIERUNG]
H. Ebner *In its* Systematic Image Errors 1977 p 39-54 refs In GERMAN
Copyright. Avail: NTIS HC A04/MF A01

A block adjustment method with self-calibration is described for photogrammetry. The method is simultaneous in that the systematic image or model deformations are compensated by additional parameters of the adjustment. A strategy is proposed based on a sufficiently general functional and stochastic model, and on suitable statistical tests, with which the significance of calculated correction terms is rigidly tested. A certain standardization of the method is aimed at. Practical test results of bundle block adjustments and of block adjustments with independent models are described, which demonstrate the performance of the proposed simultaneous self-calibration strategy. ESA

N78-22447# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
CONCEPT FOR THE CALCULATION OF EXTENSIVE IMAGE ASSOCIATIONS USING THE BUNDLE METHOD [KONZEPT

ZUR BERECHNUNG GROSSER BILDVERBAENDE MIT HILFE DER BUENDELMETHODE]
Juergen Mueller *In its* Systematic Image Errors 1977 p 55-65 In GERMAN
Copyright. Avail: NTIS HC A04/MF A01

A computer program system is proposed for calculation of extensive image associations in photogrammetry using the bundle method. The capabilities of data processing for block triangulation are demonstrated. A modular approach to the development of the system is discussed in which first the central functions are established (construction of image file, file management), and then the attached separate processing programs. ESA

N78-22448# Deutsches Geodaetisches Forschungsinstitut, Munich (West Germany).
FIRST RESULTS OF PHOTOGRAMMETRIC FIXED POINT CONCENTRATION HORDORF [ERSTE ERGEBNISSE DER PHOTOGRAMMETRISCHEN FESTPUNKTVERDICHTUNG HORDORF]
W. Tegeler *In its* Systematic Image Errors 1977 p 66-70 refs In GERMAN
Copyright. Avail: NTIS HC A04/MF A01

The trigonometric points of third and fourth order, all reference points, and the height points were determined using photogrammetry for a test area of 6 km by 12 km. Photoflights were carried out with two different cameras. Block adjustment took place by using the bundle method. Results are presented. ESA

N78-23125# Indian Space Research Organization, Bangalore. Satellite Centre.
ORBIT SELECTION FOR EARTH RESOURCES SATELLITES
C. K. Raja Singh and P. S. Goel Jan. 1977 14 p refs
(ISRO-ISAC-TN-05-77) Avail: NTIS HC A02/MF A01

Orbit parameters for earth resources satellites were determined. A proper choice of the orbit parameters is essential so as to reap better results from the mission. The basic concepts of satellite orbits, such as the elements of orbit and effects of the asphericity of the earth on orbital elements were explained. Expressions for calculating the orbit period, orbit regression, apseline rotation were given. The factors affecting the life of the orbit are discussed. The relationship between orbit life time versus altitude for Aryabhata and Rohini type of satellite configuration was also included. Various types of orbits such as sun synchronous, recursive, repetitive coverage were examined. The requirements of different payloads and their influence on the selection of orbit are summarized. The equations describing sun synchronism and ground trace were stated. Using these equations design charts relating the various parameters for different cases were drawn. Use of the charts was illustrated with a few examples. Author

N78-23329# Heriott-Watt Univ., Edinburgh (Scotland).
REMOTE SENSING
G. E. Peckham *In* AGARD Recent Advan. in Radio and Opt. Propagation for Mod. Commun., Navigation and Detection Systems Apr. 1978 14 p refs
Avail: NTIS HC A12/MF A01

The way in which emitted or reflected electromagnetic radiation is used to obtain information about the atmosphere, land, and sea is briefly described. The use of infrared scanners and radiometers on satellites to examine the land surface and properties of the atmosphere including temperature and composition, is considered. Author

N78-23405# Army Missile Research and Development Command, Redstone Arsenal, Ala. Technology Lab.
REAL-TIME ACOUSTICAL HOLOGRAPHY SYSTEMS
Virgil G. Irelan, Bobby R. Mullinix, and John G. Castle Oct. 1977 61 p refs
(DA Proj. 1L3-62303-A-214)
(AD-A052000; DRDMI-T-78-10) Avail: NTIS HC A04/MF A01 CSCL 14/5

The existing system for Acoustical Real Time Holographic Image Reproduction is described, together with operating instructions. Its novel features include: (1) large diameter (approximately 4 in.) ultrasonic beam and correspondingly large image area; (2) high intensity of the ultrasonic beam and therefore, improved penetrability for thick test objects; and (3) excellent damping in the water tanks and therefore, less background noise during real time viewing. Preliminary nondestructive testing measurements indicate that the system resolution is close to the theoretical diffraction limit for the acoustical wavelengths (in the water medium) of 0.3, 0.5, and 1.5 mm. For discerning flaws in samples with high internal scattering, the real-time feature is necessary. For highly reflecting test objects, an improvement in penetration has been demonstrated using a coating to reduce the reflection coefficient of the test object. Preliminary data are presented using 3 MHz beams through ceramic and foam test plates with the images recorded photographically. The Acoustical Real Time Holographic Image Reproduction system is ready to be tested as a nondestructive testing method for flaws in silica radomes. Author (GRA)

N78-23406# California Univ., Livermore. Lawrence Livermore Lab.
ELECTRIC AND MAGNETIC SENSING SYSTEMS: APPLICATIONS
F. Chilton (Science Applications, Palo Alto, Calif.), L. Wood, and R. Buntzen (Naval Ocean Systems Center, San Diego, Calif.) Sep. 1977 42 p
(Contract W-7405-eng-48)
(UCID-17597) Avail: NTIS HC A03/MF A01

The underlying principles of electric and magnetic sensing were reviewed. Recent advances in the associated technologies are discussed and some insight into the use of such systems in ocean surveillance was provided. ERA

N78-23504*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
INSTRUMENT TECHNOLOGY FOR REMOTE-SURFACE EXPLORATION, PROSPECTING AND ASSAYING, PART 2
Roy G. Brereton 28 Oct. 1977 89 p refs
(NASA-CR-156997; JPL-710-7-Pt-A) Avail: NTIS HC A05/MF A01 CSCL 14B

The capability to specify new instrument/mechanism technology needs, for effective remote surface exploration, prospecting and assaying (EPA), requires first, an understanding of the functions or major elements of such a task, and second an understanding of the scientific instruments and support mechanisms that may be involved. An analog or task model was developed from which the various functions, operational procedures, scientific instruments, and support mechanisms for an automated mission could be derived. The task model led to the definition of nine major functions or categories of discrete operational elements that may have to be accomplished on a mission of this type. Each major function may stand alone as an element of an EPA mission, but more probably a major function will require the support of other functions, so they are interrelated. Author

N78-23510*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
THE BASICS OF REMOTE SENSING; FORWARD
In its Remote Sensing and the Earth Dec. 1977 p 1-9

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 14E

Significant early developments of remote sensing are traced, as well as important contributions of the space program. Author

N78-23513*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
REMOTE SENSORS
In its Remote Sensing and the Earth Dec. 1977 p 26-41
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 14E

A variety of photographic and nonphotographic sensors are briefly described which were used for remote sensing purposes. Author

N78-23514*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
REMOTE SENSING PLATFORMS
In its Remote Sensing and the Earth Dec. 1977 p 42-59

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 14B

A multitude of remote sensing platforms are examined, including surface observations, balloons, various aircraft, spacecraft, and satellites. Author

N78-23515*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
THE ANALYSIS OF REMOTELY SENSED DATA
In its Remote Sensing and the Earth Dec. 1977 p 60-72

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 05B

Variables involved in data analysis and equipment used to process information are discussed. Standard photointerpretation keys for railroad trains and trees are included. J.A.M.

N78-23531*# Earth Satellite Corp., Washington, D. C.
SOLID WASTE AND REMOTE SENSING. PRELIMINARY STUDIES SUGGEST THAT SMALL-SCALE AERIAL REMOTE-SENSING RECORDS AND, IN PARTICULAR, AERIAL PHOTOGRAPHS CAN CONTRIBUTE TO REGIONAL SOLID-WASTE MANAGEMENT AND PLANNING
Donald Garofalo and Frank J. Nobber *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 372-393 refs Presented at the Ann. Conv. of the Am. Soc. of Photogrammetry, Washington, D. C., Mar. 1973

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 13B

Preliminary results of a study exploring the use of aerial remote sensing techniques for solid waste management and planning purposes were considered. Author

N78-23552 Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).
DIGITAL DATA ACQUISITION SYSTEM IN GEOPHYSICAL SURVEY AIRCRAFT VH-BNG
D. N. Downie 1977 72 p refs
(BMR-185; BMR-MF8; ISBN-0-642-03115; Cat-77-6502-7; R77/198) Avail: Issuing Activity

The system records information from one magnetic channel, four gamma-ray spectrometer channels, and two Doppler navigation channels, in addition to altitude and fiducial numbers. Sampling rate is one second, except for magnetic data, which are sampled every 0.2 seconds. The integrated system is built around a Hewlett-Packard 2114B general-purpose computer, interfaced to a 16 channel digital input multiplexer and magnetic tape recorder. A visible and permanent analogue record of the input data is maintained by chart recorders, to enable the operator to monitor data quality and to assist later in interpretation of the data. The chart drive motors can be run at five fixed speeds or coupled to the Doppler signal so that chart speed is proportional to ground speed. The Doppler signals are also coupled to a display unit which assists the pilot to follow the planned flight path. The system is extremely reliable, and error-free flights are common. Author

N78-24519*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
ADVANCED VERY HIGH RESOLUTION RADIOMETER Final Engineering Report, Jan. 1973 - Dec. 1976
[1978] 325 p refs
(Contract NAS5-21900)
(NASA-CR-156764) Avail: NTIS HC A14/MF A01 CSCL 14B

The program covered the design, construction, and test of a Breadboard Model, Engineering Model, Protoflight Model, Mechanical/Structural Model, and a Life Test Model. Special bench test and calibration equipment was also developed for use on the program. Initially, the instrument was to operate from a 906 n.mi. orbit and be thermally isolated from the spacecraft. The Breadboard Model and the Mechanical/Structural Model were designed and built to these requirements. The spacecraft altitude was changed to 450 n.mi., IFOVs and spectral characteristics were modified, and spacecraft interfaces were changed. The final spacecraft design provided a temperature-controlled Instrument Mounting Platform (IMP) to carry the AVHRR and other instruments. The design of the AVHRR was modified to these new requirements and the modifications were incorporated in the Engineering Model. The Protoflight Model and the Flight Models conform to this design. Author

N78-24522# National Physical Research Lab., Pretoria (South Africa).
A NEW MEASURING SYSTEM FOR REALIZING PHOTOMETRIC AND RADIOMETRIC SCALES
Franz Hengstberger, Eberhard Thain, and Richard Turner 1977 33 p refs
(CSIR-RR-332; ISBN-0-7988-1146-3) Avail: NTIS HC A03/MF A01

A project is reviewed for the design and construction of a complete measuring system, capable of forming the basis of South Africa's national measuring scale in the fields of light and optical radiation measurement. The nucleus of this system was a new absolute radiometer. In order to cope effectively with the different tasks to be performed, the measuring system consisted of two independent subsystems, each of which was based on the same type of plug-in detector module. Filter holders, shutter modules, detector modules, and various other attachments were completely interchangeable between the two subsystems. One of these was designed for maximum flexibility and was built up on an optical bench. Author

N78-24604# Applied Science Technology, Inc., Arlington, Va.
MULTI-SENSOR SYSTEM (MUSS) FOR AIRBORNE SURVEILLANCE OF INSHORE WATERS
G. Daniel Hickman Nov. 1977 44 p refs
(Contract N00014-76-C-1042)
(AD-A052544; AST-7701) Avail: NTIS HC A03/MF A01 CSCL 15/7

Data were assembled and listed in this report on state-of-the-art aircraft sensors which could be integrated to form a Multi-Sensor System (MUSS) for surveillance of inshore waters. The following sensor categories are included: radars (active, imaging), optical multispectral spectrometers (passive, imaging), infrared scanners (passive, imaging), infrared radiometers/spectrometers (passive, non-imaging), cameras and active laser systems. The MUSS might be required to perform the following missions: (1) collect data on previously uncharted areas; (2) collect data on previously charted areas using different sensors, and (3) collect data for update and/or verification of archival data. The principal beach parameters which must be measured by the MUSS include: length, width, gradient, surf and tidal range and nearshore currents. It is possible that the MUSS would also be able to yield information on the type of sediment and trafficability of the nearshore zone in addition to locating obstacles in the surf zone and mapping the ground cover.
Author (GRA)

N78-24605# Aerojet Electrosystems Co., Azusa, Calif.
TRANSFER, INSTALLATION AND FLIGHT TESTING OF THE MODIFIED AIRBORNE OIL SURVEILLANCE SYSTEM (AOSS II) IN A HC-130 B AIRCRAFT Final Report

D. C. Meck, J. J. Bommarito, R. S. Schwantje, and A. T. Edgerton
Aug. 1977 147 p
(Contract DOT-CG-52660-A)
(AD-A052434; AESC-5546; USCG-D-60-77) Avail: NTIS HC A07/MF A01 CSCL 15/4

The prototype airborne oil surveillance system (AOSS I) developed for the U.S. Coast Guard by Aerojet ElectroSystems under Contract DOT-CG-22170A was modified and transferred from a HU-16 aircraft to a HC-130B aircraft. The added capabilities of the new system configuration were verified by a flight test program. Modifications to the system included (1) the addition of a high resolution aerial reconnaissance camera, (2) the addition of a dual look (left and right) capability for the SLAR, (3) automatic SLAR target position location, (4) an airborne remote temperature measurement capability, (5) simultaneous multispectral recording capability for the IR-UV line scanner data, and (6) improved processing of passive microwave imager data. The proven system capabilities of AOSS I combined with the added capabilities incorporated into AOSS II provide a unique and valuable system to support all U.S. Coast Guard missions. The system is currently operational and based at Elizabeth City, North Carolina. GRA

N78-27485*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SEASAT-A SATELLITE SCATTEROMETER (SASS) VALIDATION AND EXPERIMENT PLAN
Lyle C. Schroeder, ed. May 1978 106 p refs
(NASA-TM-78751) Avail: NTIS HC A06/MF A01 CSCL 14B

This plan was generated by the SeaSat-A satellite scatterometer experiment team to define the pre-and post-launch activities necessary to conduct sensor validation and geophysical evaluation. Details included are an instrument and experiment description/performance requirements, success criteria, constraints, mission requirements, data processing requirement and data analysis responsibilities. J.A.M.

N78-27647# Environmental Monitoring and Support Lab., Las Vegas, Nev.
OVERHEAD ENVIRONMENTAL MONITORING WITH LIGHT UTILITY AIRCRAFT: DEMONSTRATION AND EVALUATION OF THE SYSTEM
Gordon E. Howard, Jr. and Frank R. Wolle Jan. 1978 29 p refs
(PB-278748/9; EPA-600/4-78-008) Avail: NTIS HC A03/MF A01 CSCL 13B

The U.S. Environmental Protection Agency (EPA) is seeking to provide its 10 Regional Offices with a low cost remote sensing capability through development of a self contained sensor module called the Enviro-Pod (Pod). The design, development and manufacture of the prototype was accomplished by the U.S. Air Force Avionics Laboratory through an interagency agreement with the EPA. As presently configured, the Pod module contains two identical KA-85A panoramic cameras. One is mounted in the conventional vertical position and the second in an oblique position looking 45 degrees forward of the aircraft. The Pod has been successfully demonstrated in Washington, D.C., Boston, Atlanta, Philadelphia, and New York for EPA staff officials and personnel from eight other Federal agencies. Use of the Pod is foreseen in enforcement, compliance, episodic, and emergency monitoring activities. Results of feasibility demonstrations are summarized and a program is recommended for the production and suitability testing of the Pod module. Possible future sensor configurations for the Pod are also presented. GRA

09
GENERAL

Includes economic analysis.

A78-34202 The costs and benefits of space observations. B. Lovell. In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 1-12.

An account is presented of the development of communications satellites (beginning with Telstar in 1962), maritime navigation satellites, and remote sensing satellites (such as the Landsat series). Attention is also given to the Large Space Telescope, a NASA project which has been subject to numerous modifications and delays over the years. In addition, the recommendations of the United Nations Committee on the Peaceful Uses of Space, especially those regarding applications of remote sensing, are reviewed; recommended applications of satellite sensing systems to geological exploration and disaster warning are mentioned. J.M.B.

A78-34219 A European earth resources space programme. J. Plevin (ESA, Paris, France). In: Remote sensing of the terrestrial environment; Proceedings of the Twenty-eighth Symposium, Bristol, England, April 5-9, 1976. London, Butterworth and Co. (Publishers), Ltd., 1977, p. 263-275. 6 refs.

European utilization of data from existing and planned NASA remote sensing satellites is discussed, and European contributions to future remote resources monitoring programs are reported. Crop inventories, land use classification and mapping, snow melt and soil moisture studies and coastal zone surveys are cited as primary European applications for remote sensing data. The need for a high-resolution all-weather remote sensing capability is emphasized, since much of Europe is under nearly continuous cloud cover. In addition, Spacelab capabilities for cartographic mapping and geological surveys are mentioned. Development of Landsat data reception and preprocessing facilities in Europe also receives attention. J.M.B.

A78-34851 Remote sensing of earth resources. Volume 6 - Annual Remote Sensing of Earth Resources Conference, 6th, Tullahoma, Tenn., March 29-31, 1977, Technical Papers. Edited by F. Shahrokhi (Tennessee, University, Tullahoma, Tenn.). Tullahoma, Tenn., University of Tennessee, 1977. 626 p. $30.

Near-real time monitoring of Iowa corn with Landsat is considered along with vegetation mapping from color aerial photography of Lake Champlain wetlands, relations between ground truth and airborne measurements for thermal infrared remote sensing over vegetated surfaces, the role of ground truth data and an approach to its collection, Lagrangian drifter design for the determination of surface currents by remote sensing, and characteristic vector analysis as a technique for signature extraction of remote ocean color data. Attention is given to the remote sensing of algae, the multilevel analysis of ecosystem alteration due to water regime changes in a south Louisiana swamp, thermal infrared studies in Labrador, the monitoring of noxious aquatic plants, the computer enhancement of Landsat MSS digital images for land use assessments, a computer processed map of North Dakota, the determination of atmospheric formation characteristics by means of microwave radiometry, a solar energy estimation procedure using remote sensing techniques, and airborne thermography for crop water stress assessment. G.R.

A78-34904 * # Remote sensing R&D planning. L. S. Keafer, Jr. (NASA, Langley Research Center, Hampton, Va.). *Annual Remote Sensing of Earth Resources Conference, 7th, University of Tennessee, Tullahoma, Tenn., Mar. 27-29, 1978, Paper.* 17 p. 13 refs.

A NASA method is described for forecasting remote sensing needs in the last decade of this century and for planning the necessary space system technology R&D. Five- and ten-year plans for earth observations in various disciplines are extrapolated forward to circa 1995 via a scenario which envisions major advances in remote sensing and information management. Space system studies identify the 'technology drivers', and development programs are initiated to develop the enabling technology. An example is given for a multipurpose large-aperture microwave radiometer spacecraft. (Author)

A78-34927 # A poor man's digital image interpretation system. F. G. Peet and J. M. Wightman (Department of the Environment, Forest Management Institute, Ottawa, Canada). *(Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb. 21-23, 1977.) Canadian Journal of Remote Sensing,* vol. 4, Apr. 1978, p. 29-31. 10 refs.

Basic hardware for the interpretation of Landsat digital data has been assembled for a small research organization; the total cost of the hardware is less than $100,000. A magnetic tape drive, a disk drive, a microprogrammable minicomputer, a terminal, a lineprinter and a TV display constitute the digital processing system. Preprocessing, classification and filtering functions of the system are described. J.M.B.

A78-36499 Introduction to the mathematics of inversion in remote sensing and indirect measurement. S. Twomey (Arizona, University, Tucson, Ariz.). Amsterdam, Elsevier Scientific Publishing Co. (Developments in Geomathematics, No. 3), 1977. 253 p. 143 refs. $65.

The mathematical description of the response of a real physical remote sensing system is considered along with examples of real inversion problems, simple problems involving inversion, a theory of large linear systems, the physical and geometric aspects of vectors and matrices, and the information content of indirect sensing measurements. A description is presented of algebraic and geometric aspects of functions and function space, taking into account the norms and length of orthogonality, approximation by sums of functions, integral equations, the Fourier transform and Fourier series, and the spectral form of the fundamental integral equation of inversion. Linear inversion methods and other inversion techniques are discussed, giving attention to the quadrature inversion, the least squares solution, constrained linear inversion, sample applications of constrained linear inversion, the algebraic nature of constrained linear inversion, the geometric nature of constrained linear inversion, the synthesis approach to inversion, the solution in terms of kernels, the Prony algorithm, the Landweber iteration, and iterative, nonlinear methods of inversion. G.R.

A78-36649 Internationalization of remote sensing technology. C. K. Paul (Agency for International Development, Washington, D.C.). *Photogrammetric Engineering and Remote Sensing,* vol. 44, May 1978, p. 625-632.

The work of the Agency for International Development (AID) in connection with the transfer of remote sensing technology to the developing countries is discussed, taking into account two census projects, one in Kenya and the second in Bolivia. Developments regarding a controversy between Katz and NASA with respect to the value of earth-resources surveys by satellites are considered. Katz speculates that NASA's satellites do not really address earth resources problems, and hence, as tools, are inferior to aircraft in conducting international surveys. However, despite these criticisms, a great interest in Landsat imagery was shown by developing countries and by international assistance agencies. The NAS Committee on Remote Sensing for Development recommended that an international mechanism be established to promote consultation on technical and managerial aspects of remote sensing among user countries. G.R.

A78-40155 * Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, Purdue University, West Lafayette, Ind., June 21-23, 1977, Proceedings. Symposium sponsored by IEEE,

American Society of Agronomy, NASA, et al. Edited by D. B. Morrison and D. J. Scherer. New York, Institute of Electrical and Electronics Engineers, Inc., 1977. 370 p. Members, $18.75; nonmembers, $25.

Papers are presented on a variety of techniques for the machine processing of remotely sensed data. Consideration is given to preprocessing methods such as the correction of Landsat data for the effects of haze, sun angle, and reflectance and to the maximum likelihood estimation of signature transformation algorithm. Several applications of machine processing to agriculture are identified. Various types of processing systems are discussed such as ground-data processing/support systems for sensor systems and the transfer of remotely sensed data to operational systems. The application of machine processing to hydrology, geology, and land-use mapping is outlined. Data analysis is considered with reference to several types of classification methods and systems. S.C.S.

A78-40156 **Some applications of remote sensing technology for international funding agencies.** P.-M. Adrien (Inter-American Development Bank, Washington, D.C.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 3-8. 24 refs.

The paper discusses remote sensing technology with reference to international funding agencies. It is noted that funds from the Inter-American Development Bank have been used for a variety of projects in Latin America including agriculture, industry, transportation, and housing studies. The project cycle in each case consists of preparation, analysis, implementation, and appraisal phases. Remote sensing techniques have been used for the identification of resources, vegetative cover, crops, and land-use projects. Studies in the digital analysis of remotely sensed data have also been reported. Future work will concentrate on the further application of the Landsat program. S.C.S.

A78-40168 * **Parametric design of ground data processing/support systems for advanced sensor systems.** C. Denny, E. M. Johnson (Ford Aerospace and Communications Corp., Houston, Tex.), and E. L. Davis (NASA, Langley Research Center, Hampton, Va.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 150-159.

A parametric system design technique has been applied to ground data processing/support systems for advanced sensor applications. The system establishes a direct link between budget analysts and system planners. Three primary phases are identified: the definition of requirements, system design, and system costing. The system is evaluated for three cases: (1) a study of ground data handling systems for earth resource satellites, (2) a ground data mass storage and processing system for agricultural remote-sensing studies, and (3) a parametric study of shuttle era data processing support required for atmospheric and space physics. S.C.S.

A78-40169 **A remote sensing system for a nationwide data-bank.** H. D. Foster, J. Bos, and W. C. Richie (H. Dell Foster Co., San Antonio, Tex.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 160-171.

The paper discusses a remote sensing system which has been developed for a nationwide data bank. Eight instruments, including minicomputers and optomechanical devices, are used to convert aerial photography data into a digital data file on magnetic tape. The data file comprises a series of X-Y-Z real-world coordinates divided into descriptive primary levels and line-type identification. The output consists of a graphic manuscript file and a digital data-bank file. Component specifications are noted. S.C.S.

A78-40170 * **On the transfer of remote sensing technology to an operational data system.** J. D. Tarbet, L. H. Bradford, Jr. (Ford Aerospace and Communications Corp., Houston, Tex.), T. T. White (NASA, Johnson Space Center, Earth Observations Div., Houston, Tex.), and R. F. Purnell, Jr. (U.S. Department of Agriculture, Houston, Tex.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 172-176.

Data processing techniques for the transfer of remote sensing technology to an operational data system are evaluated. The study is aimed at developing a scheme for the improvement of the quantifying cost/performance ratio, noting the timeliness of the results, the ease of system development, system operating costs, and accuracy. The method is applicable to the Production Area and Yield Estimation System (PAYES) and the Large Area Crop Inventory Experiment (LACIE). S.C.S.

A78-40174 * **Estimating costs and performance of systems for machine processing of remotely sensed data.** R. J. Ballard and L. F. Eastwood, Jr. (Washington University, St. Louis, Mo.). In: Annual Symposium on Machine Processing of Remotely Sensed Data, 4th, West Lafayette, Ind., June 21-23, 1977, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1977, p. 208-214. 8 refs. Contract No. NAS5-20680.

This paper outlines a method for estimating computer processing times and costs incurred in producing information products from digital remotely sensed data. The method accounts for both computation and overhead, and may be applied to any serial computer. The method is applied to estimate the cost and computer time involved in producing Level II Land Use and Vegetative Cover Maps for a five-state midwestern region. The results show that the amount of data to be processed overloads some example computer systems, but that the processing is feasible on others. (Author)

A78-43070 **Remote sensing: Principles and interpretation.** F. F. Sabins, Jr. (Chevron Oil Field Research Co., La Habra; Southern California, University; California, University, Los Angeles, Calif.). San Francisco, W. H. Freeman and Co., 1978. 437 p. 236 refs. $25.

Various types of remote sensing, and the applications to which each type is best suited, are discussed together with a review of the physical principles involved in specific remote sensing techniques. Among the techniques considered are: aerial photography, manned satellite imagery (especially from Skylab), Landsat imagery (with attention to multispectral scanning), thermal IR imagery, radar imagery, and digital image processing. The overall effectiveness of remote sensing is evaluated in terms of resource exploration, and the detection of natural and environmental hazards, e.g., earthquake danger zones and patterns of air and water pollution. D.M.W.

N78-22432*# **New Mexico Univ., Albuquerque. Technology Application Center.**

QUARTERLY LITERATURE REVIEW OF THE REMOTE SENSING OF NATURAL RESOURCES Quarterly Report, Oct. - Dec. 1977

Charles B. Fears, ed. and Michael H. Inglis, ed. Dec. 1977 174 p refs Sponsored by NASA

(NASA-CR-156158; RS77-09604; QR-4) Copyright. Avail: NTIS HC A08/MF A01 for foreign requestors only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 08F

The Technology Application Center reviewed abstracted literature sources, and selected document data and data gathering techniques which were performed or obtained remotely from space, aircraft or groundbased stations. All of the documentation was related to remote sensing sensors or the remote sensing of the natural resources. Sensors were primarily those operating within the 10 to the minus 8 power to 1 meter wavelength band. Included are NASA Tech Briefs, ARAC Industrial Applica-

tions Reports, U.S. Navy Technical Reports, U.S. Patent reports and other technical articles and reports. Author

N78-22971*# National Aeronautics and Space Administration, Washington, D. C.
APPLICATION OF SPACE TECHNOLOGY TO THE STUDY OF THE USE OF NATURAL RESOURCES IN THE REPUBLIC OF PANAMA
Nidia Avila deNichols Mar. 1978 11 p refs Transl. into ENGLISH of conf. paper from the UN/FAO Regional Training Seminar (Bolivia), 1-9 Dec. 1977 p 1-7 Presented at the UN/FAO Regional Training Seminar on the Appl. of Satellite Remote Sensing, La Paz, Bolivia, 1-9 Dec. 1977 p 1-7 Transl. by Scientific Translation Service, Santa Barbara, Calif.
(Contract NASw-2791)
(NASA-TM-75089) Avail: NTIS HC A02/MF A01 CSCL 08F
The status of satellite remote sensing techniques used in the Republic of Panama up to November, 1977 is reviewed. Author

N78-23118# Royal Norwegian Council for Scientific and Industrial Research, Oslo.
SPACE ACTIVITY IN NORWAY Annual Report 1976
Jun. 1977 34 p refs Presented at the 20th COSPAR Plenary Meeting and Assoc. Activities, Tel Aviv, Israel, 13-18 Jun. 1977
(SAD-65-T) Avail: NTIS HC A03/MF A01
The scientific program, application program, and other space activities related to satellite geodesy, earth resources, etc., for 1976 in Norway are presented as well as activities planned for 1977, and beyond 1977. ESA

N78-23509*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
REMOTE SENSING AND THE EARTH
Craig A. Brosius (School Board of Brevard County, Fla.), Janette C. Gervin, and James M. Ragusa Dec. 1977 497 p refs Orignial contains color illustrations
(NASA-TM-79444) Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue Rockledge, Florida 32955 at $9.74 per copy CSCL 14E
A text book on remote sensing, as part of the earth resources *Skylab programs, is presented. The fundamentals of remote* sensing and its application to agriculture, land use, geology, water and marine resources, and environmental monitoring are *summarized.*

N78-23511*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APPLICATIONS TO EARTH RESOURCES
In its Remote Sensing and the Earth Dec. 1977 p 10-17

Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 05B
Remote sensing technology applications to such diverse areas as agriculture, range and forestry; land use; mineral resources; water resources; marine resources; and the environment are discussed. Author

N78-23519*# *Michigan State Univ., East Lansing.*
IMPROVED RESOURCE USE DECISIONS AND ACTIONS THROUGH REMOTE SENSING
R. Hill-Rowley, M. Boylan, W. Enslin, and R. Vlasin *In* NASA. John F. Kennedy Space Center Remote Sensing and the Earth Dec. 1977 p 147-171 Presented at the NASA Earth Resources Surv. Symp. Vol. 1C: Land Use and Marine Resources, Houston, Tex., Jun. 1975
Avail: NTIS MF A01; HC avail. from the School Board of Brevard County, Instructional Services Div., Project Remote Sensing, 1274 South Florida Avenue, Rockledge, Florida 32955 at $9.74 per copy CSCL 08F
Remote sensing was applied to the varied needs of government agencies and private organizations for the purpose of assisting decision makers that were responsible for actions *concerning resource users. Seven case situations are presented.* Author

N78-23533*# Alaska Univ., Fairbanks. Geophysical Institute.
APPLICATIONS OF REMOTE SENSING DATA IN ALASKA: A COOPERATIVE PROGRAM OF THE UNIVERSITY OF ALASKA WITH USER ORGANIZATIONS, INCLUDING LOCAL, STATE AND FEDERAL GOVERNMENT AGENCIES Annual Report, 1 Jul. 1975 - 30 Jun. 1976
J. M. Miller 30 Jun. 1976 182 p Original contains color illustrations
(Grant NGL-02-001-092)
(NASA-CR-156996) Avail: NTIS HC A09/MF A01 CSCL 05B
The development of the coastal-zone-related issues is generating an increasing need for information which is greater in quantity of natural resource data, greater in quality of detail of data, and more frequent in collection of data owing to the need to monitor certain aspects of programs. The array, detail, and frequency of information acquisition required to develop natural resources and to implement and maintain the resulting programs demand improved techniques of data gathering, processing, and interpretation which is conducive to the use of remote-sensing techniques. As Alaska, both in the state and federal domain, gears up to meet the energy-related issues facing the nation there will be a growing role for efforts which adapt state-of-the-art tools to solving existing problems. Author

N78-23536# Electrotechnical Lab., Tokyo (Japan).
REMOTE SENSING TECHNOLOGY
Yasuo Komamiya, Kazuo Kurokawa, Kenjiro Sakurai, Eizo Teranishi, Yoshimichi Aiyama, Shoei Kataoka, Hiroyuki Fujisada, Munekazu Takano, Hiroshi Shiomi, Kiyoshi Takahisa et al May 1977 277 p refs In JAPANESE; ENGLISH summary
(Rept-192) Avail: NTIS HC A13/MF A01
The current and future prospects of remote sensing technology are surveyed. This report describes remote sensing technology as it relates to the following topics: pollution; land surface and oceans, fundamental technology supporting remote sensing; fundamental properties of electromagnetic radiation and atmospheric effects on remote sensing; passive image sensors; active sensors, microwave sensors, laser radar; acoustic emission and radiant rays; satellite remote sensors and positioning of various platforms; information processing, data processing, data acquisition; and modelling techniques for understanding the cause-and-effect between behavior and environment. Author

N78-23540# International Institute for Applied Systems Analysis, Laxenburg (Austria).
ON MEASURES OF NATURAL RESOURCE SCARCITY
Anthony C. Fisher Aug. 1977 33 p refs
(IIASA-RR-17-19) Avail: NTIS HC A03/MF A01
The properties of a number of suggested economic measures (price, cost, and rent) of natural resource scarcity and their behavior as a resource depleted over time are studied. The effect on the current value of each measure of a change in the current estimate of the resource stock is also examined. ESA

N78-24040# Joint Publications Research Service, Arlington, Va.
COSMONAUTS STUDY THE EARTH
G. A. Ivanyan and K. Ya. Kondratyev *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 59-68 Transl. into ENGLISH from Priroda (Moscow), no. 12, 1977 p 48-55
Copyright. Avail: Issuing Activity
The great possibilities of space observation of earth stem from the highly developed capacity of human vision to distinguish

extremely fine variation in the color and brightness of various surfaces and atmospheric formations, and to detect objects and follow their movements. Because of manned space flight, a number of geophysical phenomena were observed for the first time. Soviet cosmonauts reported the vertically rayed structure of diurnal radiation in the upper atmosphere, the luminescence in the areas of the southern magnetic pole, the existence of a luminescence layer on the nocturnal side of the earth (whisker effect), and the specular reflection of solar radiation by the atmosphere when the sun is low in the horizon. Many of these observations became the foundation of the theory of the twilight halo of the earth. One of the most interesting visual observations was made of mesospheric (silver) clouds during the flight of Soyuz-9. Activities of the Skylab crew in using EREP instrumentation is described, as well as the special observations they elected to make. A.R.H.

N78-24041# Joint Publications Research Service, Arlington, Va.

VISUAL OBSERVATION OF THE NATURAL ENVIRONMENT FROM AN ORBITAL STATION

L. V. Denisov *In its* Transl. on USSR Sci. and Technol. (JPRS-71181) 25 May 1978 p 69-75 Transl. into ENGLISH from Priroda (Moscow), no. 12, 1977 p 56-61

Copyright. Avail: Issuing Activity

The first systematic Soviet experiment in the visual evaluation of the state of the natural environment was performed in two stages of the manned flight program in the Salyut-5 station during the summer of 1976 and the winter of 1977. The distinguishing characteristic of the experiment was the use of a specially designed optical view-finding instrument. The aim of the experiment was the development of methodological foundations for visual observation of earth. Space photographs on a scale of 1:2,500,000 were used in training and during the flight. Top priority was accorded to observations of geological objects, such as the Sevan fault, the Baykal rift system, and active volcanoes. Snow and ice conditions in the mountainous regions of Central Asia and South America, dust storms in the Takla Makan desert, forest and grass fires, and flooded jungle areas were also observed. Environmental pollution near petroleum refineries, dust clouds from open-pit mines, and the saturation and color contrasts on the water surface of the world oceans were explored. A.R.H.

N78-24257*# National Aeronautics and Space Administration, Washington, D. C.

PRINCIPAL CHARACTERISTICS OF A NATIONAL SATELLITE FOR EARTH OBSERVATION: PROJECT SPOT

Jun. 1978 49 p Transl. into ENGLISH from Report Centre Spatiale de Toulouse, France, Apr. 1978 p 1-55 Transl. by SCITRAN, Santa Barbara, Calif. Original doc. prep. by Centre Natl. d'Etudes Spatiales, Toulouse

(Contract NASw-2791)

(NASA-TM-75108) Avail: NTIS HC A03/MF A01 CSCL 22B

A preliminary user document for the French SPOT Earth mapping satellite to be operational in 1984 is presented. The mission is very similar to the LANDSAT series. Author

N78-25016# Pennsylvania Univ., Philadelphia. Dept. of Economics.

WORLD DEMAND FOR RAW MATERIALS IN 1985 AND 2000

W. Malenbaum Oct. 1977 161 p

(Grant NSF AER-75-23687)

(PB-277707; NSF/RA-770421) Avail: NTIS HC A08/MF A01 CSCL 05A

The future demand for the following minerals and metals in 1985 and in 2000 that are important inputs for industrial output throughout the world is analyzed: aluminum, chrome, cobalt, copper, iron, maganese, nickel, platinum, steel, tin, tungsten, and zinc. Together, they account for 80-90 percent of the value of world mineral production. Objectives are: (1) to provide realistic estimates of demand for these twelve materials in the future periods for the world, and for the ten component regions into which the world is divided; and (2) to contribute to methodology for such projections through application of intensity-of-use procedures. Strong support is provided of the relevance of the intensity-of-use method for deriving estimates of future demand for materials, including estimates for regions of the world with limited economic data. GRA

N78-25115*# National Aeronautics and Space Administration, Washington, D. C.

SKYLAB: A CHRONOLOGY

Roland W. Newkirk, Ivan D. Ertel, and Courtney G. Brooks 1977 476 p refs

(NASA-SP-4011; LC-77-608101) Avail: NTIS MF A01; SOD HC $7.00 CSCL 22A

The Skylab Program was specifically designed to conduct a series of experiments from beyond the earth's atmosphere. Since the number and types of experiments conducted during the operational phase of Skylab were constantly changing, rather than encumber the body of the chronology with these changes, a lengthy appendix on experiments is included in this document. This appendix identifies the principle investigators and coinvestigators; gives the types, numbers, and descriptions of the experiments; explains the purpose of the various experiments; and, where possible, gives the results or findings of the experiments. The body of the Skylab chronology is divided into three parts; early space station activities, Apollo applications, and Skylab development and operations. Author

N78-25496*# Cornell Univ., Ithaca, N. Y. Remote Sensing Program.

CORNELL UNIVERSITY REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1977 - 31 May 1978

Ta Liang, Arthur J. McNair, and Warren R. Philipson, Principal Investigators Jun. 1978 260 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS

(Grant NGL-33-010-171)

(E78-10130; NASA-CR-157004; SASR-12) Avail: NTIS HC A12/MF A01 CSCL 08B

The author has identified the following significant results. Available aerial photographs were used to characterize mosquito breeding sites in Oswego County, New York. Numerous wetlands are contained within this county; this area is the only inland area in North America to have confirmed outbreaks of eastern equine encephalitis. This photocharacterization of primary mosquito breeding sites will be used to develop effective spraying. Large scale color and color infrared aerial photographs were used to assess changes in aquatic vegetation that accompanied phosphorus reduction in an eutrophic lake in New York.

N78-26512*# Humboldt State Coll., 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 Progress Report, 1 Jun. - 31 May 1978

Donna Hankins, Principal Investigator 31 May 1978 25 p refs Sponsored by NASA ERTS

(E78-10142; NASA-CR-157176; Rept-2) Avail: NTIS HC A02/MF A01 CSCL 05B

N78-26982# General Accounting Office, Washington, D. C. Program Analysis Div.

FEDERAL REGULATORY PROGRAMS AND ACTIVITIES

16 Mar. 1978 239 p

(PB-278489/0) Avail: NTIS HC A11/MF A01 CSCL 05A

An inventory of Federal regulatory programs and activities by agency and authorizing legislation is presented. Federal agencies with regulatory activity or program responsibilities were identified. Agencies were classified by substantive areas, such as power and energy, and natural resources and environment. Agencies were also classified by type of regulatory activity and degree of regulation. GRA

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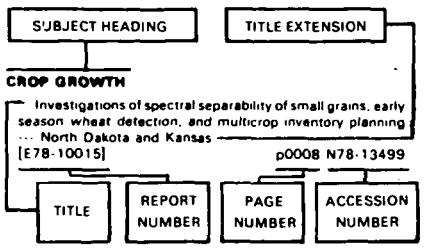

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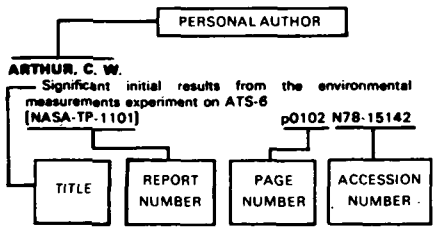

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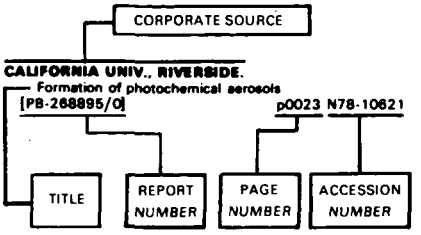

The title of the document is used to provide a brief description of the subject matter. The page number and the accession number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document.

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AGRICULTURAL RESEARCH SERVICE, PHOENIX, ARIZ.
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Heat capacity mapping mission
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AGRICULTURAL RESEARCH SERVICE, WESLACO, TEX.
Distinguishing saline from nonsaline rangelands with Skylab imagery p0179 A78-34856
Reflectance and photographic characteristics of three citrus varieties for discrimination purposes p0180 A78-34871
Plant cover, soil temperature, freeze, water stress, and evapotranspiration conditions
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Suspended sediments and related limnology of an alpine lake system
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The impact of groundwater development in arid lands: A literature review and annotated bibliography
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ARKANSAS UNIV., FAYETTEVILLE.
LANDSAT linear trend analysis: A tool for groundwater exploration in northern Arkansas
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COLLEGE FOR CIVIL ENGINEERING, BUCHAREST (ROMANIA).
Use of LANDSAT data for natural resources investigation in the lower basin of Danube and Danube Delta
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Remote sensing applied to exploration for vein-type uranium deposits, Front Range, Colorado p0196 N78-22510

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On the transfer of remote sensing technology to an operational data system p0226 A78-40170

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Usefulness of LANDSAT data for monitoring plant development and range conditions in California's annual grassland p0183 N78-23516

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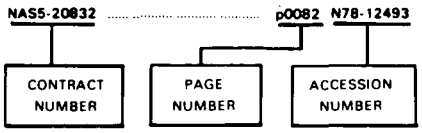

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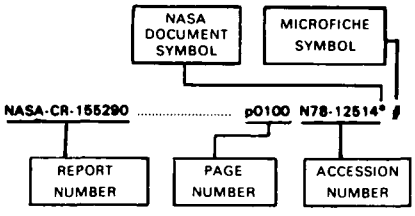

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15. Supplementary Notes

16. Abstract

This bibliography lists 337 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1 and September 30, 1978. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
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NASA SP-7039	NASA PATENT ABSTRACTS BIBLIOGRAPHY NASA patents and applications for patent	Semiannually
NASA SP-7041	EARTH RESOURCES Remote sensing of earth resources by aircraft and spacecraft	Quarterly
NASA SP-7043	ENERGY Energy sources, solar energy, energy conversion, transport, and storage	Quarterly
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