



NASA SP-7041(12)

EARTH RESOURCES

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A CONTINUING BIBLIOGRAPHY WITH INDEXES

ISSUE 12

JANUARY 1977

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PREVIOUS EARTH RESOURCE BIBLIOGRAPHIES

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EARTH RESOURCES

**A Continuing Bibliography
With Indexes**

Issue 12

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between October 1976 and December 1976 in

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



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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

JANUARY 1977

Washington, D.C.

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 instrumentation on orbiting spacecraft or on aircraft.

This literature survey lists 526 reports, articles, and other documents announced between October and December 1976 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 A76-10,000 in ascending accession number order;

STAR entries identified by accession number series N76-10,000 in ascending accession number order.

After the abstract section, there are five indexes:

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

AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A76-10000 Series)

All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies are available at \$5.00 per document up to a maximum of 20 pages. The charge for each additional page is 25 cents. Microfiche⁽¹⁾ are available at the rate of \$1.50 per microfiche for documents identified by the # symbol following the accession number. A number of publications, because of their special characteristics, are available only for reference in the AIAA Technical Information Service Library. Minimum airmail postage to foreign countries is \$1.00. Please refer to the accession number, e.g., (A76-10543), when requesting publications.

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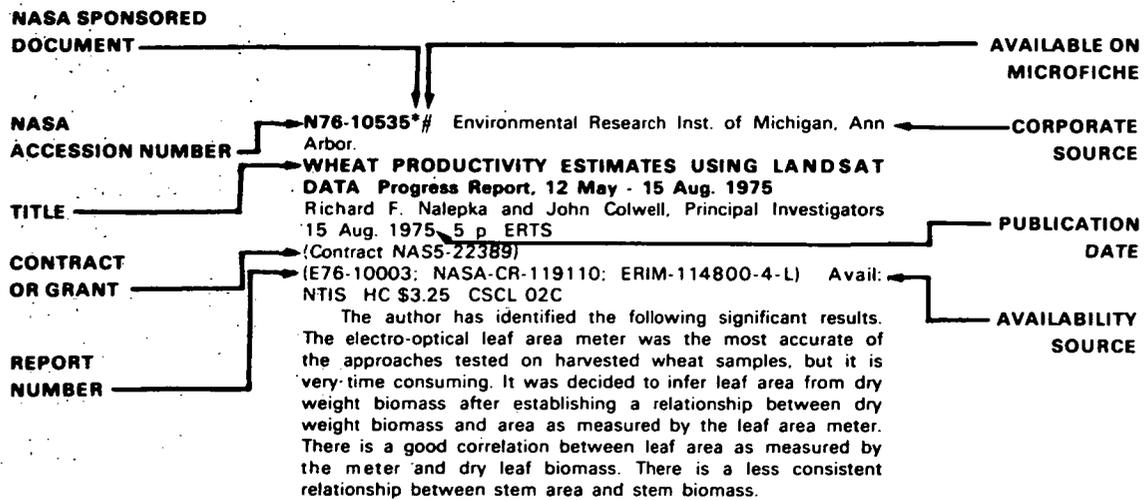
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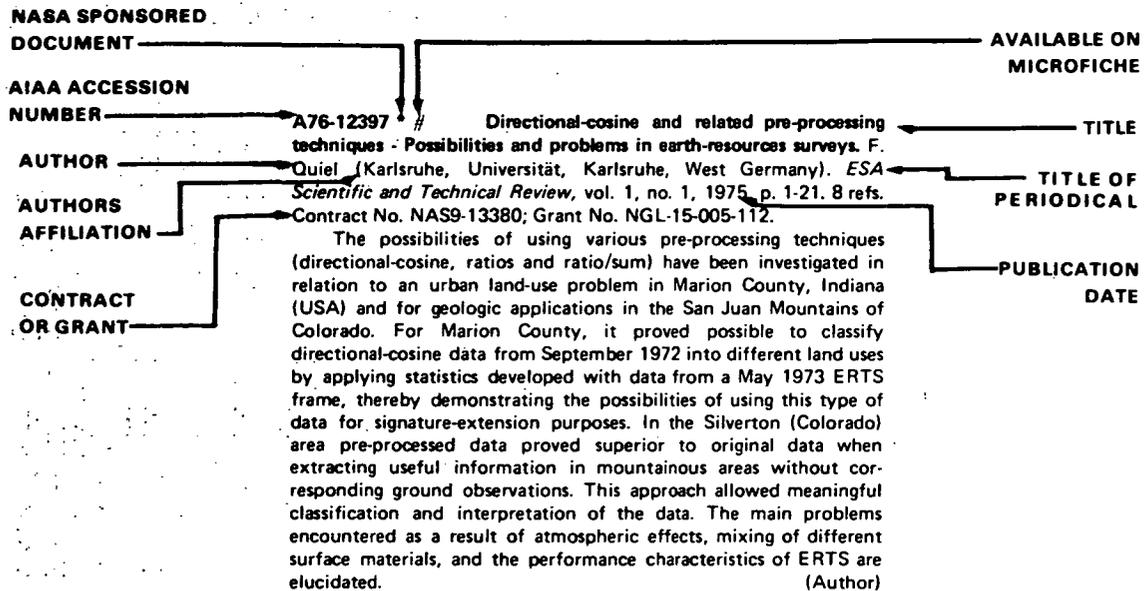
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EARTH RESOURCES

A Continuing Bibliography (Issue 12)

JANUARY 1977

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.

A76-38516 * A remote sensing-aided small grains inventory using sequential Landsat imagery. R. W. Thomas, C. M. Hay, and C. E. Brown (California, University, Berkeley, Calif.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 298-319. 6 refs. Contract No. NAS5-21827.

A procedure for manual acreage estimation from Landsat imagery is proposed which involves a stepwise sequence of area stratification, simple size estimation, acreage estimation, and acreage precision calculation. The sample design consists of a systematic point sample of the Landsat imagery for crop type presence calibrated by a double sample of several image points having crop season-coincident ground data. The sample point layout chosen for cost-efficiency in manual sampling is a doubly aligned point matrix. The significant advantage of this sampling approach is that crop information is available from throughout the agricultural reporting unit. For technique demonstration purposes three strata were selected for sampling. The proposed technique can complement more sophisticated computer-based acreage estimation methodologies, and refinements in the sampling techniques promise significant improvements for operational utility. S.D.

A76-38519 Detecting lethal yellowing palms for environmental control in Florida. J. P. Latham (Florida Atlantic University, Boca Raton, Fla.) and R. Elliot (Champlain Technology, Inc., West Palm Beach, Fla.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 368-373. 6 refs.

A76-38532 The utilization of remote sensing data for a multidisciplinary resource inventory and analysis within a rangeland environment. S. D. De Gloria, S. J. Daus, and R. W. Thomas (California, University, Berkeley, Calif.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 640-659.

The paper reports on a study aimed at comparing the amount of resource information that can be extracted from spacecraft imagery and from high-altitude, color-infrared imagery. These remote sensing techniques were applied in order to provide input data for maps of range and forested land in northeastern California and northwestern Nevada. The imagery was processed by several techniques: manual

analysis of medium- and small-scale aerial photography, human-automated interactive analysis for producing vegetation type maps based on Landsat-1 digital data inputs, and multistage sampling procedures for generating regional productivity estimates. P.T.H.

A76-38535 Large scale color photograph for erosion evaluations on rangeland watersheds in the Great Basin. P. T. Tueller and D. T. Booth (Nevada, University, Reno, Nev.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 708-753. 35 refs.

The practicability of using vertical, aerial photography to inventory erosion conditions on arid and semiarid range watersheds in the Great Basin has been determined. Established erosion movement transects resulted in the assurance that large scale (1:600) 70 mm sequential color photographs in stereo pairs can be used to detect and inventory soil movement. Soil surface factors which lend themselves to evaluation of erosion were flow patterns, wind erosion, litter movement, vesicular horizons, bare ground, rills and gullies. Ground observations were compared with photographic data to develop descriptions, keys and guidelines for the interpretation of each erosion condition. Specific examples of each soil surface factor have been developed. Photo evaluations on these large scale photographs were found to be as accurate and less costly than ground techniques. Costs involved in flight time and interpretation averaged less than \$0.025/hr (\$0.01/acre). (Author)

A76-38539 # Resource characterization through soil and land cover overlays. H. C. Hitchcock, F. P. Baxter, C. W. Smart (Tennessee Valley Authority, Norris, Tenn.), and T. L. Cox (South Dakota State University, Brookings, S. Dak.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 806-820. 6 refs.

Soil survey data for Knox County, Tennessee, were coded in 2.68-acre cells registered to geodetic coordinates; land cover information classified from geometrically corrected ERTS scanner data was processed and assigned to geodetic cells of the same size through the use of a special computer program. Ground registration of data permitted overlay analysis which greatly enhanced the value of both data sets. (Author)

A76-38540 Remote-sensing techniques for determining water table depths in irrigated agriculture. W. A. Lidster (U.S. Bureau of Reclamation, Denver, Colo.), F. A. Schmer, D. W. Ryland, and D. G. Moore (South Dakota State University, Brookings, S. Dak.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 821-838.

Preliminary results of a study to determine the applicability of Landsat and aerial imagery for the investigation of water table depths in irrigated areas are presented. Areas having high water tables were visually located in aircraft imagery and verified at the study site. Satellite and aircraft imagery were digitized and correlated with water table depths. Mode-seeking, multiple regression, and K-class

01 AGRICULTURE AND FORESTRY

classification analyses were applied. Mode seeking and K-class classification results for a corn field provided correct classification of 91% of the water tables into two depth categories: below 183 cm and between 183 cm and the surface. Limited but satisfactory results are reported for multiple regression analysis. C.K.D.

A76-38543 * The nature of spectral signatures in native arid plant communities. J. S. Conn, K. E. Foster, and W. G. McGinnies (Arizona, University, Tucson, Ariz.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings, Falls Church, Va., American Society of Photogrammetry, 1976, p. 876-883. NASA-supported research.

Radiometric data in ERTS bands 5 and 7 of spectral signature components were compared to the overall signatures obtained from an airborne radiometric data collection system flown at low altitude. Results indicate that due to the low density and low vigor of the vegetation, vegetation has little effect on the overall signature, thus making differentiation of desert plant communities on the basis of spectral signature extremely difficult. (Author)

A76-40447 * Biostratigraphy and depositional environment of algal stromatolites from the Mescal Limestone /Proterozoic/ of central Arizona. R. L. McConnell (Virginia Polytechnic Institute and State University, Blacksburg, Va.). *Precambrian Research*, vol. 2, 1975, p. 317-328. 22 refs. Research supported by the Museum of Northern Arizona, Bear Creek Mining Co., and University of California; NSF Grant No. 23809; Grant No. NGR-05-101-035.

A76-41783 # Pattern classification of agricultural and non-agricultural areas. E. S. Owen-Jones (Bedford College, London, England). In: Remote sensing data processing. Sheffield, University of Sheffield, 1975, p. 73-95. 24 refs.

Remote-sensor pattern classification principles and techniques are examined, with special emphasis given the supervised and the unsupervised methods. These classification methods are applied to the remote sensing (aerial photographic and multispectral scanner) of agricultural areas and noncultivated natural terrain. The use of microwave remote sensors is also considered. B.J.

A76-42819 Telemetry applications in wildland fire control. J. R. Warren (U.S. Department of Agriculture, Forest Service, Riverside, Calif.). In: International Telemetering Conference, Washington, D.C., October 14-16, 1975, Proceedings, Pittsburgh, Pa., Instrument Society of America, 1975, p. 310-314. 5 refs.

Telemetry will be coming into wider use in wildland fire control because it provides the real-time information needed in decision-making. Two applications are described: transmission of airborne infrared imagery of the fire scene, and the relaying of meteorological data from remote stations. Experimental systems using these types of telemetered data are being developed at the USDA Forest Service's Pacific Southwest Forest and Range Experiment Station. Also under development are computerized models using telemetered and other information for predicting fire behavior. (Author)

A76-46103 * # Benefits to world agriculture through remote sensing. A. C. Buffalano (NASA, Goddard Space Flight Center, Greenbelt, Md.) and P. Kochanowski (Indiana University, Bloomington, Ind.). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper A-76-22*. 8 p. 7 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 the econometric models used to establish this scenario and estimates the dollar value of benefits for world wheat as 200 million dollars annually for the United States and 300 to 400 million dollars annually for the rest of the world. (Author)

A76-47625 # Agricultural Resources Inventory and Survey Experiment. B. Sahai, S. Chandrashekar (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), N. K. Barde, and S. R. N. Bhushana (Indian Council of Agricultural Research, Regional Centre, Bangalore, India). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper*. 14 p.

The Agricultural Resources Inventory and Survey Experiment (ARISE) was an aerial remote sensing campaign carried out to establish the operational status of remote sensing technology. Two districts, Anantapur in Andhra Pradesh and Patiala in Punjab, were surveyed and multiband imagery was taken. On the basis of the analysis done for Anantapur, the operational utility of aerial surveys for agricultural purposes has been fully established. Crop differentiation, acreage estimates, accurate land-use classification, and a complete inventory of water resources were some of the major results of this experiment. (Author)

N76-28590 Kansas Univ., Lawrence.
SOIL MOISTURE AND TEMPERATURE REGIMES AND THEIR IMPORTANCE TO MICROWAVE REMOTE SENSING OF SOIL WATER Ph.D. Thesis
Josef Cihlar 1975 167 p
Avail: Univ. Microfilms Order No. 76-16703

Microwave remote sensing of soil moisture was studied, with particular attention to bare soil temperature and moisture regimes and their impact on the microwave technique. A layered water balance model was developed for determining soil water contents and their changes in the upper zone (top 30 cm of soil), while soil moisture regime characteristics at greater depths and those near the surface during the diurnal cycle were studied using experimental measurements. Soil temperature and its variations due to several parameters were investigated by means of a simulation model. Using the two models, moisture and temperature profiles of a hypothetical soil located at mid-latitudes were generated, analyzed, and subsequently used for computing microwave soil parameters at three frequencies (1.4 GHz, 4.0 GHz, 10.0 GHz) for a clear-sky summer day. Dissert. Abstr.

N76-28601*# Spectral Africa (Pty) Ltd., Randfontein (Republic of South Africa).
MONITORING THE GROWTH OR DECLINE OF VEGETATION ON MINE DUMPS Final Report, Jun. 1972 - Dec. 1975

B. P. Gilbertson, Principal Investigator Dec. 1975 144 p refs
Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10424; NASA-CR-148300; Rept-74/1) Avail: NTIS HC \$6.00 CSCL 08F

The author has identified the following significant results. It was established that particular mine dumps throughout the entire test area can be detected and identified. It was also established that patterns of vegetative growth on the mine dumps can be recognized from a simple visual analysis of photographic images. Because vegetation tends to occur in patches on many mine dumps, it is unsatisfactory to classify complete dumps into categories of percentage vegetative cover. A more desirable approach is to classify the patches of vegetation themselves. The coarse resolution of conventional densitometers restricts the accuracy of this procedure, and consequently a direct analysis

of ERTS CCT's is preferred. A set of computer programs was written to perform the data reading and manipulating functions required for basic CCT analysis.

N76-28602*# Maden Tetkik ve Arma Enstitüsü, Ankara (Turkey). **NATIONAL PROJECT FOR THE EVALUATION OF ERTS IMAGERY APPLICATIONS TO VARIOUS EARTH RESOURCES PROBLEMS OF TURKEY** Progress Report, 1 Jan. - 1 Mar. 1976

Sadrettin Alpan, Principal Investigator 1 Mar. 1976 22 p
Sponsored by NASA Original contains color illustrations ERTS (E76-10425; NASA-CR-148301; PR-2) Avail: NTIS HC \$3.50 CSCL 08F

N76-28603*# Mekong Committee Secretariat, Bangkok (Thailand).

AGRICULTURE/FORESTRY HYDROLOGY Quarterly Report W. J. VanDerOord, Principal Investigator Jun. 1976 31 p refs Sponsored by NASA ERTS (E76-10426; NASA-CR-148302; Rept-2) Avail: NTIS HC \$4.00 CSCL 08H

The author has identified the following significant results. It is observed that LANDSAT images can be used in preparing an accurate tectonic map of the study areas. These images are most useful in geological mapping areas where vegetation cover is sparse. LANDSAT images can be used to identify and separate evergreens and trees with leaves, and they can successfully delineate boundaries of forestry areas. Water holding capacity of the soil, internal and external drainage, vegetation pattern, irrigated and nonirrigated land, and fallow and planted fields are also detected on the LANDSAT imagery.

N76-28607*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.

APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 1 Apr. - 30 Jun. 1976

David S. Gilmer, Principal Investigator 6 Jul. 1976 20 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (NASA Order S-54049-A) (E76-10431; NASA-CR-148307) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. A newly developed software system for generating statistics on surface water features was tested using LANDSAT data acquired previous to 1975. This software test provided a satisfactory evaluation of the system and also allowed expansion of data base on prairie water features. The software system recognizes water on the basis of a classification algorithm. This classification is accomplished by level thresholding a single near infrared data channel. After each pixel is classified as water or nonwater, the software system then recognizes ponds or lakes as sets of contiguous pixels or as single isolated pixels in the case of very small ponds. Pixels are considered to be contiguous if they are adjacent between successive scan lines. After delineating each water feature, the software system then assigns the feature a position based upon a geographic grid system and calculates the feature's planimetric area, its perimeter, and a parameter known as the shape factor.

N76-28610*# California Univ., Berkeley. Space Sciences Lab.

SKYLAB DATA AS AN AID TO RESOURCE MANAGEMENT IN NORTHERN CALIFORNIA Final Report, 1 Oct. 1974 - 15 Oct. 1975

R. N. Colwell, Principal Investigator 15 Oct. 1975 44 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (Contract NAS9-14420) (E76-10434; NASA-CR-144487) Avail: NTIS HC \$4.00 CSCL 08F

N76-28611*# ECON, Inc., Princeton, N.J. **THE VALUE OF FORAGE MEASUREMENT INFORMATION IN RANGELAND MANAGEMENT** Final Report
Keith R. Lietzke 30 Aug. 1975 159 p refs (Contract NASw-2558) (NASA-CR-148152; Rept-75-127-4) Avail: NTIS HC \$6.75 CSCL 02B

An economic model and simulation are developed to estimate the potential social benefit arising from the use of alternative measurement systems in rangeland management. In order to estimate these benefits, it was necessary to model three separate systems: the range environment, the rangeland manager, and the information system which links the two. The rancher's decision-making behavior is modeled according to sound economic principles. Results indicate substantial potential benefits, particularly when used in assisting management of government-operated ranges; possible annual benefits in this area range from \$20 to \$46 million, depending upon the system capabilities assumed. Possible annual benefit in privately-managed stocker operations range from \$2.8 to \$49.5 million, depending upon where actual rancher capabilities lie and what system capabilities are assumed. Author

N75-28624*# Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Agronomy.

USE OF REMOTE SENSING IN AGRICULTURE Technical Report, Jul. 1973 - Dec. 1974

David E. Pettry and N. L. Powell May 1975 35 p refs (Contract NAS6-2388) (NASA-CR-137477) Avail: NTIS HC \$4.00 CSCL 02C

The remote sensing studies of (a) cultivated peanut areas in Southeastern Virginia; (b) studies at the Virginia Truck and Ornamentals Research Station near Painter, Virginia, the Eastern Virginia Research Station near Warsaw, Virginia, the Tidewater Research and Continuing Education Center near Suffolk, Virginia, and the Southern Piedmont Research and Continuing Education Center Blackstone, Virginia; and (c) land use classification studies at Virginia Beach, Virginia are presented. The practical feasibility of using false color infrared imagery to detect and determine the areal extent of peanut disease infestation of *Cylindrocladium* black rot and *Sclerotinia* blight is demonstrated. These diseases pose a severe hazard to this major agricultural food commodity. The value of remote sensing technology in terrain analyses and land use classification of diverse land areas is also investigated. Continued refinement of spectral signatures of major agronomic crops and documentation of pertinent environmental variables have provided a data base for the generation of an agricultural environmental prediction model. Author

N76-28625*# Earth Satellite Corp., Washington, D.C. **EARTHSAT SPRING WHEAT YIELD SYSTEM TEST 1975** Final Report

Apr. 1976 491 p refs (Contract NAS9-14655) (NASA-CR-147711; E/S-1052) Avail: NTIS HC \$12.50 CSCL 02C

The results of an operational test of the EarthSat System during the period 1 June - 30 August 1975 over the spring wheat regions of North Dakota, South Dakota, and Minnesota are presented. The errors associated with each sub-element of the system during the operational test and the sensitivity of the complete system and each major functional sub-element of the system to the observed errors were evaluated. Evaluations and recommendations for future operational users of the system include: (1) changes in various system sub-elements, (2) changes in the yield model to affect improved accuracy, (3) changes in the number of geobased cells needed to develop an accurate aggregated yield estimate, (4) changes associated with the implementation of future operational satellites and data processing systems, and (5) detailed system documentation. Author

N76-29661*# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). **SURVEY OF CAPEWEED DISTRIBUTION IN AUSTRALIA IN RELATION TO CLIMATE, LANDFORMS, SOIL TYPES AND MANAGEMENT PRACTICES**

01 AGRICULTURE AND FORESTRY

Graham W. Arnold and Frank R. Honey, Principal Investigators [1975] 7 p Sponsored by NASA ERTS (E76-10387; NASA-CR-148167) Avail: NTIS HC \$3.50 CSCL 08F

The author has identified the following significant results. The ground measurements of the reflectivity of the capeweed species shows significant variation from the pasture species measured. The variation in the capeweed signature, as a function of the flower cover indicates that the optimum time for a survey would be when the capeweed is at peak flowering.

N76-29664*# Ceylon Inst. of Scientific and Industrial Research, Colombo (Sri Lanka).

INVESTIGATION OF THE AGRICULTURAL RESOURCES IN SRI LANKA Technical Report, Aug. 1975 - Jun. 1976

A. T. M. Silva, S. D. F. C. Nanayakkara, and L. S. K. B. Herath, Principal Investigators Jun. 1976 14 p Sponsored by NASA ERTS

(E76-10422; NASA-CR-148298) Avail: NTIS HC \$3.50 CSCL 05B

The author has identified the following significant results. It is observed that LANDSAT data is easily adaptable to photogrammetric techniques. With such adaptations, revision of topographic or thematic maps can be performed at very little cost. Revision of maps up to scale 1:100,000 (or better) can be performed. The LANDSAT image has definite advantages over the standard methods in areas of extensive development where the synoptic view of the LANDSAT image offers the required control in the form of distant mapped data in one frame.

N76-29667*# National Marine Fisheries Service, Bay Saint Louis, Miss.

LANDSAT FOLLOW-ON EXPERIMENT: GULF OF MEXICO MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION Progress Report, 31 Oct. 1975 - 31 Jan. 1976

Kenneth Savastano, Principal Investigator, Andrew J. Kemmerer, and Kenneth Faller (Natl. Space Technology Labs., Bay Saint Louis, Miss.) Feb. 1976 37 p refs ERTS (NASA Order S-54114)

(E76-10437; NASA-CR-148545; SEFC-Contrib-442; MARMAP-Contrib-111; Rept-3) Avail: NTIS HC \$4.00 CSCL 08A

The author has identified the following significant results. The most significant achievement realized is the successful mapping of high probability fishing areas from LANDSAT MSS data for two Mississippi Sound missions.

N76-29669*# Columbia Univ., New York.

APPLICATION OF LANDSAT DATA TO AGRICULTURAL RESOURCE PROBLEMS WITH EMPHASIS ON THE NORTH AMERICAN GREAT PLAINS Progress Report

Kempton Webb, Colin J. High, and Jerry C. Coiner, Principal Investigators 28 Feb. 1976 34 p refs ERTS (Grant Nsg-5080)

(E76-10439; NASA-CR-148516) Avail: NTIS HC \$4.00 CSCL 02C

N76-29677*# Agricultural Research Service, Westaco, Tex. **SOIL, WATER, AND VEGETATION CONDITIONS IN SOUTH TEXAS** Quarterly Progress Report, 13 Apr. - 13 Jul. 1976

Craig L. Wiegand, Harold W. Gausman, Ross W. Leamer, Arthur J. Richardson, James H. Everitt, and Alvin H. Gerbermann, Principal Investigators Jul. 1976 17 p refs ERTS (NASA Order S-53876-AG)

(E76-10447; NASA-CR-148524; QPR-6) Avail: NTIS HC \$3.50 CSCL 08F

The author has identified the following significant results. Field spectral measurements and laboratory densitometric measurements showed that tree canopy reflectance differences among the Marrs, Redblush, and Valencia varieties in the visible spectral region were due to their different leaf chlorophyll concentrations. Field measurements of visible light reflectance were directly related to the tonal responses on infrared color

photos of the varietal tree canopies. Consequently, densitometric measurements of the foliage on the infrared color transparency with red-filtered light successfully discriminated among the three varieties. Reflectance measurements with a field spectroradiometer on nine dates the growing season of two wheat varieties Miami and Penjaino, documented their spectra over the 0.45 to 2.50 micron wavelength interval associated with plant cover and physiological development. An image analyzer system was used to optically planimeter the percentage of soil background, vegetation and shadow in the vertical photographs taken within the FOV of the spectroradiometer on each measurement date.

N76-29679*# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.

EXTENSIVE INVENTORY OF FOREST RESOURCES BY MULTISTAGE SAMPLING Progress Report, 7 Mar. - 7 Jun. 1976

Robert C. Aldrich, Robert W. Dana, and Edwin H. Roberts, Principal Investigators 21 Jun. 1976 4 p ERTS

(NASA Order S-54053-A) (E76-10450; NASA-CR-148527; PR-5) Avail: NTIS HC \$3.50 CSCL 02F

N76-29688*# Transemanatics, Inc., Washington, D.C. **USE OF SATELLITES FOR THE STUDY OF TROPICAL VEGETATION**

M. Soto, A. Gomez Pompa, F. Menendez, and G. Arp Washington NASA Aug. 1976 13 p refs Transl. into ENGLISH from Ciencia y Desarrollo (Mexico), v. 2, no. 7, Mar - Apr. 1976 p 3-6

(Contract NASw-2792) (NASA-TT-F-17169) Avail: NTIS HC \$3.50 CSCL 08F

The results obtained in the first attempt to use remote satellite sensing to assist in the preparation of maps of the vegetation of Veracruz are presented. Tropical vegetation is difficult to study because of its diversity, constant change and lack of ground studies. The research obtained from remote satellite sensing contributes to the solution of this type of problem in tropical studies. Author

N76-30622*# National Marine Fisheries Service, Bay Saint Louis, Miss.

LANDSAT FOLLOW-ON EXPERIMENT: GULF OF MEXICO MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION Progress Report, 1 May - 31 Jul. 1976

Kenneth J. Savastano, Principal Investigator, Andrew J. Kemmerer, Thomas D. Leming, Hillman Holley, and Kenneth Faller (NASA, Johnson Space Center) Aug. 1976 50 p refs ERTS (NASA Order S-54114)

(E76-10454; NASA-CR-148585; SEFC-Contrib-456; Rept-5) Avail: NTIS HC \$4.00 CSCL 08A

The author has identified the following significant results. The most significant achievements realized thus far include the successful charting of high probability fishing areas from LANDSAT MSS data and the successful simulation of an operational satellite system to provide tactical information for the commercial harvest of menhaden.

N76-30625*# National Marine Fisheries Service, Bay Saint Louis, Miss.

THE FEASIBILITY OF UTILIZING REMOTELY SENSED DATA TO ASSESS AND MONITOR OCEANIC GAMEFISH

Kenneth J. Savastano, Principal Investigator and Thomas D. Leming 23 May 1975 48 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(NASA Order T-8217-B) (E76-10457; NASA-CR-148588) Avail: NTIS HC \$4.00 CSCL 08A

N76-30626*# Alaska Univ., Fairbanks. Cooperative Wildlife Research Unit.

USE OF LANDSAT IMAGERY FOR WILDLIFE HABITAT MAPPING IN NORTHEAST AND EASTCENTRAL ALASKA

Progress Report

A. J. LaPerriere, Principal Investigator 20 Aug. 1976 31 p
 refs ERTS
 (Contract NAS5-20915)
 (E76-10458; NASA-CR-148589; PR-4) Avail: NTIS
 HC \$4.00 CSCL 06C

The author has identified the following significant results. Indications are that Alaskan scenes dated later than about September 5th are unsuitable for vegetational analyses. Such fall data exhibit a limited dynamic range relative to summer scenes and the informational content of the data is reduced such that discrimination between many vegetation types is no longer possible.

N76-30631*# California Univ., Berkeley. Space Sciences Lab.

APPLICATION OF PHOTOINTERPRETATIVE TECHNIQUES TO WHEAT IDENTIFICATION. SIGNATURE EXTENSION AND SAMPLING STRATEGY Final Report, 15 May 1975 - 14 May 1976

Robert N. Colwell, Principal Investigator, Claire M. Hay, and Randall W. Thomas 14 May 1976 358 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(Contract NAS9-14565)
 (E76-10463; NASA-CR-147833; SSL-Ser-17-Issue-33) Avail: NTIS HC \$10.50 CSCL 08G

The author has identified the following significant results. Significant variance in actual wheat proportion is accounted for by quick-look, phase one estimates on full frame LANDSAT data from the previous crop year. An average correlation coefficient of approximately .8 can be expected between sample phase one and phase two wheat proportion data in the Kansas environment types examined. An average correlation coefficient between phase one cultivated land estimates and phase two wheat proportion estimates can be expected to be in the range of .7 to .9 in the Kansas environments. No statistically significant difference from zero was obtained for the average difference between regression wheat proportion estimates and corresponding USDA-based estimates for the 14 counties within the Kansas southwest CRD.

N76-30637*# Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.

SOIL-MOISTURE GROUND TRUTH, HAND COUNTY, SOUTH DAKOTA Mission Report, 22 Jun. 1976

E. Bruce Jones Jul. 1976 24 p refs
 (Contract NAS5-22312)

(NASA-CR-144805) Avail: NTIS HC \$3.50 CSCL 08M

Soil samples were taken in the field and carefully preserved in taped metal containers for later laboratory gravimetric analysis to determine soil-moisture content. The typical sampling pattern used in this mission is illustrated, and the soil types encountered on the soil-moisture lines are summarized. The actual soil-moisture data were tabulated by range, township and section. Soil-moisture data obtained in fields of winter wheat and spring wheat are briefly summarized. Author

N76-30644# Geological Survey, Reston, Va. Office of International Geology.

APPLICATIONS OF ERTS PRODUCTS IN RANGE AND WATER MANAGEMENT PROBLEMS, SAHELIAN ZONE, MALI, UPPER VOLTA, AND NIGER Technical Report, Apr. - May 1974

M. E. Cooley and R. M. Turner 1975 96 p refs
 (Grant PASA-TA(IC)-02-74)

(PB-251731/6; IR-WA-4) Avail: NTIS HC \$5.00 CSCL 13B

The results are described of a brief field investigation to evaluate application of ERTS imagery to range and water management problems in Mali, Upper Volta, and Niger. It is concluded that the imagery can provide general overviews of regions or even countries and may be used in areas where few or no good ground surveys exist; can provide a basis for repetitive inventorying and monitoring transient environmental changes on

the earth's surface; and can aid in solving special problems of disease sector control or human activity. Specific applications of the ERTS imagery were identified in river-blindness control; tse-tse fly control; bush-burning evaluation; distinction of arable from nonarable lands; analysis of problems of accelerated erosion; the annual flood of the Niger River; and ground-water development in fractures. GRA

N76-31628*# Department of Agriculture, Washington, D.C. Statistical Reporting Service.

AREA SAMPLING FRAME CONSTRUCTION FOR AN AGRICULTURE INFORMATION SYSTEM WITH LANDSAT-2 DATA Progress Report, 17 Jul. 1975 - 16 Jul. 1976

William H. Wigton, Principal Investigator Sep. 1976 10 p
 Sponsored by NASA ERTS

(E76-10482; NASA-CR-148789) Avail: NTIS HC \$3.50 CSCL 05B

N76-31629*# Kansas Univ., Lawrence. Space Technology Center.

A COMPREHENSIVE DATA PROCESSING PLAN FOR CROP CALENDAR MSS SIGNATURE DEVELOPMENT FROM SATELLITE IMAGERY Progress Report

R. M. Haralick, Principal Investigator, G. Minden, and A. Singh 1 Jul. 1976 59 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(Contract NAS5-20943)
 (E76-10483; NASA-CR-148790; TR-286-3; PR-3) Avail: NTIS
 HC \$4.50 CSCL 05B

N76-31630*# Mekong Committee Secretariat, Bangkok (Thailand).

AGRICULTURE/FORESTRY HYDROLOGY Quarterly Report, Jun. - Aug. 1976

W. J. VanderOord, Principal Investigator Sep. 1976 7 p
 Sponsored by NASA ERTS

(E76-10484; NASA-CR-148791; QR-4) Avail: NTIS
 HC \$3.50 CSCL 08B

N76-31631*# Geological Survey, Miami, Fla.

AN ANALYSIS AND COMPARISON OF LANDSAT-1, SKYLAB (S-192) AND AIRCRAFT DATA FOR DELINEATION OF LAND-WATER COVER TYPES OF THE GREEN SWAMP, FLORIDA Final Report

A. L. Higer, Principal Investigator, A. E. Coker, N. F. Schmidt, and I. E. Reed Nov. 1975 45 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(NASA Order CC-30280-A)

(E76-10485; NASA-CR-144855; BSR-4198) Avail: NTIS
 HC \$4.00 CSCL 05B

The author has identified the following significant results. LANDSAT 1 and Skylab (S192) data from the Green Swamp area of central Florida were categorized into five classes: water, cypress, other wetlands, pine, and pasture. These categories were compared with similar categories on a detailed vegetative map made using low altitude aerial photography. Agreement of LANDSAT and Skylab categorized data with the vegetative map was 87 percent and 83 percent respectively. The Green Swamp vegetative categories may be widespread but often consist of numerous small isolated areas, because LANDSAT has a greater resolution than Skylab, it is more favorable for mapping the small vegetative categories.

01 AGRICULTURE AND FORESTRY

N76-31641*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A CANOPY-RELATED STRATIFICATION OF A SOUTHERN PINE FOREST USING LANDSAT DIGITAL DATA

Darrel L. Williams Aug. 1976 16 p refs Presented at Proc., Am. Congr. on Surveying and Mapping, and Am. Soc. of Photogrammetry, Seattle, 28 Sep. - 1 Oct. 1976 (NASA-TM-X-71184; X-923-76-188) Avail: NTIS HC \$3.50 CSCL 02F

An investigation was undertaken to determine if a consistent stratification of a Southern pine forest could be obtained by using LANDSAT multispectral scanner data to assess crown closure. Winter and summer LANDSAT scenes of the North Carolina coastal region were analyzed individually and then registered and merged to take advantage of temporal changes in the forest canopy. Three levels of pine crown closure were accurately delineated. The applicability of this stratification as supplemental input to a forest inventory system is also discussed. Author

N76-31647# Cincinnati Univ., Ohio.

SEASONAL SOIL CREEP Final Report, 1 May 1974 - 30 Jun. 1976

Robert W. Fleming 15 Jan. 1976 67 p refs (Contract DAHC04-74-G-0156)

(AD-A022562; ARO-11288.1-GS) Avail: NTIS CSCL 08/13

The report for the first year is an investigation of seasonal creep of soil. Flexible pipes, which change position in response to creeping soil, have been installed in three areas on the San Francisco Peninsula and two areas near Cincinnati, Ohio. Measurement of creep is obtained from successive readings of tilt of the pipes as a function of depth. Creep is being measured independently on square steel rods which were driven into the ground to different depths. Tilt of the rods is measured at the ground surface with a modified alidade. GRA

N76-31655# Environmental Protection Agency, Corvallis, Oreg.

DESIGN GUIDELINES FOR AGRICULTURAL SOIL WARMING SYSTEMS UTILIZING WASTE HEAT Interim Report

David L. Slegel Mar. 1976 38 p refs (PB-252251/4; EPA-600/3-76-026) Avail: NTIS HC \$4.00 CSCL 02C

A computer program that solves the equations governing heat and water transfer in soils was used to simulate the operation of a soil warming system composed of a series of buried pipes at uniform spacing and depth carrying warm water. The results included temperature and moisture content distributions for various soil warming system pipe spacings and depths and for varying weather conditions. Annual temperature cycles are presented for Portland, Oregon; Athens, Georgia; and St. Paul, Minnesota; for soil with no heating; and for soil with a continuously operating soil warming system. GRA

N76-31661# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.

SOIL MOISTURE SURVEY EXPERIMENT AT LUVERNE, MINNESOTA. DATA OF SURVEY: 12 MAY 1975

E. L. Feimster and A. E. Fritzsche 12 May 1975 35 p refs (Contract NOAA-31-USC-686) (PB-250634/3; EGG-1183-1675; NOAA-76021105) Avail: NTIS HC \$4.00 CSCL 08M

An aerial survey employing the measurement of natural terrestrial gamma radiation was carried out over farm lands south of Luverne, Minnesota on May 12, 1975. The purpose of the survey was to determine soil moisture content. Soil moisture values were computed from airborne gamma data and compared to data collected during a similar survey of March 6, 1973. These soil moistures were compared to soil moistures computed gravimetrically. The results indicate very good agreement between the aerial and the ground measured soil moistures. The average soil moisture value for the 8-mi long survey lines derived from these aerial measurements were in good agreement with results from ground based soil sampling. Mile-by-mile averages of the aerial data ranged from 21 to 36% for Line A with an average

of 27%. This compares well to the ground based soil moisture values ranging from 23 to 29% with an average of 28%. GRA

N76-32612*# Commission of the European Communities, Ispra (Italy).

AGRICULTURAL RESOURCES INVESTIGATIONS IN NORTHERN ITALY AND SOUTHERN FRANCE (AGRESTE PROJECT). PART 1: ACTIVITY PERFORMED ON THE ITALIAN TEST-SITES Progress Report, 15 Feb. - 15 May 1976

J. Megier, Principal Investigator 15 May 1976 38 p refs Sponsored by NASA ERTS (E76-10499; NASA-CR-148819; PR-3) Avail: NTIS HC \$4.00 CSCL 05B

The author has identified the following significant results. Some qualitative results were obtained out of the experiment of reflectance measurements under greenhouse conditions. An effort was made to correlate phenological stages, production, and radiometric measurements. It was found that the first order effect of exposure variability to sun irradiation is responsible for different rice productivity classes. Effects of rice variety and fertilization become second order, because they are completely masked by the first order effects.

N76-32613*# Commission of the European Communities, Ispra (Italy).

AGRESTE PROGRAM. PART 2: FRENCH TEST-SITES Progress Report, Mar. - Jun. 1976

T. LeToan and P. Cassirame, Principal Investigators Jun. 1976 29 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10500; NASA-CR-148820) Avail: NTIS HC \$4.00 CSCL 02C

N76-32615*# Environmental Research Inst. of Michigan, Ann Arbor.

WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA Progress Report, 16 May - 15 Aug. 1976

Richard F. Nalepka, John Colwell, Principal Investigator, and Daniel P. Rice 15 Aug. 1976 23 p ERTS (Contract NAS5-22389)

(E76-10502; NASA-CR-148822; ERIM-114800-20-L) Avail: NTIS HC \$3.50 CSCL 02C

N76-32625*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

REMOTE SENSING OF SOIL MOISTURE WITH MICROWAVE RADIOMETERS, 2

T. Schmugge, T. Wilheit, W. Webster, Jr., and P. Gloerson Washington Sep. 1976 38 p refs (NASA-TN-D-8321; G-76114) Avail: NTIS HC \$4.00 CSCL 08M

Results are presented that were derived from measurements made by microwave radiometers during the March 1972 and February 1973 flights of National Aeronautics and Space Administration (NASA) Convair-9900 aircraft over agricultural test sites in the southwestern part of United States. The purpose of the missions was to study the use of microwave radiometers for the remote sensing of soil moisture. The microwave radiometers covered the 0.8- to 21-cm wavelength range. The results show a good linear correlation between the observed microwave brightness temperature and moisture content of the 0- to 1-cm layer of the soil. The results at the largest wavelength (21 cm) show the greatest sensitivity to soil moisture variations and indicate the possibility of sensing these variations through a vegetative canopy. The effect of soil texture on the emission from the soil was also studied and it was found that this effect can be compensated for by expressing soil moisture as a percent of field capacity for the soil. The results were compared with calculations based on a radiative transfer model for layered dielectrics and the agreement is very good at the longer wavelengths. At the shorter wavelengths, surface roughness effects are larger and the agreement becomes poorer. Author

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.

A76-38320 Atmospheric thermal emission 7-15 microns. A. W. Harrison (Calgary, University, Calgary, Alberta, Canada). *Canadian Journal of Physics*, vol. 54, July 15, 1976, p. 1442-1448. 16 refs. Research supported by the National Research Council of Canada and Environment Canada.

Atmospheric thermal emission spectra at 7-15 microns have been obtained under clear skies, at different elevation angles and for a spectral slit width of 200 Å. Absolute spectral radiances are compared with those calculated for a layer model of the atmosphere through the use of the radiative transfer equation and actual altitude profiles of temperature, pressure, and water vapor obtained by balloon sounding concurrently with thermal emission measurements.

(Author)

A76-38391 Ground level detection and feasibility for monitoring of several trace atmospheric constituents by high resolution infrared spectroscopy. C. M. Bradford, F. H. Murcay, J. W. VanAllen, J. N. Brooks, D. G. Murcay, and A. Goldman (Denver, University, Denver, Colo.). *Geophysical Research Letters*, vol. 3, July 1976, p. 387-390. 12 refs. NSF-supported research.

Ground-based infrared solar spectra at an unapodized resolution of 0.06 per cm are presented showing the detection of HNO₃, CF₂Cl₂ and CFC13 in the atmosphere and demonstrating the feasibility of ground monitoring of these species. Similar data indicate that higher resolution and/or a high altitude site are required for detection and monitoring of NO and HCl from the ground. Calculations show that it may be possible to monitor NO₂ from a high mountain station using this method.

(Author)

A76-38460 # Remote sensing of turbidity plumes in Lake Ontario. E. J. Pluhowski (U.S. Geological Survey, Reston, Va.). (*American Society of Civil Engineers, Annual Convention and CExpo 75, Denver, Colo., Nov. 3-7, 1975.*) *ASCE, Transportation Engineering Journal*, vol. 102, Aug. 1976, p. 475-488. 6 refs.

A combination of aerial photography (from a height of 60,000 ft) and Landsat remote sensing was used to investigate well-defined turbidity plumes in the watercourses flowing northward into Lake Ontario - the Niagara River, the Welland Canal, the Port-Dalhousie diversion channel, the Genesee River and the Oswego River. The objectives of the study were to identify the principal sources of suspended matter entering the lake, to define nearshore current patterns, and to analyze the characteristics and dynamics of large turbidity plumes. The sources of highest turbidity and suspended matter entering the south shore of Lake Ontario were found at the Genesee River and Welland Canal outlets. The concentration of suspended matter in both the Niagara and Oswego rivers was much lower due to effective sediment trapping by extensive lakes and impoundments within their basins.

B.J.

A76-38462 # Satellite observations of water quality. G. P. Harris (McMaster University, Hamilton, Ontario, Canada), R. P. Bukata, and J. E. Bruton (Canada Centre for Inland Waters, Burlington, Ontario, Canada). *ASCE, Transportation Engineering Journal*, vol. 102, Aug. 1976, p. 537-554. 28 refs. Research supported by the National Research Council of Canada and McMaster University; U.S. Geological Survey Contract No. 14-08-001-13169.

The paper presents results of Landsat-1 observations of turbidity and chlorophyll concentration in the Cootes Paradise marsh, Ontario and correlates these results with Landsat turbidity and chlorophyll

measurements of the western end of Lake Ontario and of other Great Lakes. Band by band limnological interpretations of the patterns observed in the digital print-outs of the Landsat apparent radiance data for the Great Lakes appear to be as follows: (1) band 4 patterns appear to be related to coastal hydrography in nonturbid waters or midlake dynamics in open waters; (2) bands 5, 6, and 7 respond to surface turbidity (organic and inorganic); and (3) due to strong chlorophyll absorption, surface algal blooms will produce patterns in bands 4 and 5, which display very low radiance values.

B.J.

A76-38517 * Classifying and monitoring water quality by use of satellite imagery. J. P. Scherz, D. R. Crane (Wisconsin, University, Madison, Wis.), and R. H. Rogers (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.). In: *American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings.*

Falls Church, Va., American Society of Photogrammetry, 1976, p. 320-343. 5 refs. Grant No. NGL-50-002-127; Contract No. NAS5-20942.

A technique is developed to eliminate the atmosphere and surface noise effects on Landsat signals of water bodies by manipulating the total signal from Landsat in such a way that only the volume reflectance is left as a residual. With the Landsat signal from a lake and the known volume reflectance for its clear water it is possible to eliminate the surface and atmospheric effects and have residual signals that are indicative only of the type and concentration of the material in other lakes. Laboratory values are more precise than field values because in the field one must contend with indirect skylight and wave action which can be removed in the laboratory. The volume reflectance of distilled water or a very clear lake approaching distilled water was determined in the laboratory by the use of the Bendix radiant power measuring instrument. The Bendix multispectral data analysis system provided a color categorized image of several hundred lakes in a Wisconsin area. These lakes were categorized for tannin and nontannin waters and for the degrees of algae, silt, weeds, and bottom effects present.

S.D.

A76-38518 Remote sensing of an oil outflow accident at the Inland Sea of Japan. H. Shimoda, T. Sakata (Tokai University, Hiratsuka, Japan), S. Tatsumi (Kagawa University, Kagawa, Japan), and K. Tanaka (Asia Air Survey Co., Tokyo, Japan). In: *American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings.* Falls Church, Va., American Society of Photogrammetry, 1976, p. 344-363.

A large outflow of heavy oils occurred at the Inland Sea of Japan at December in 1974. An oil tank cracked and about 8000 kl C heavy oils flowed into the sea a part of which still remains now. It also had an impact to the ecosystem of phyto-planktons. The following things were concluded from a remote sensing research on this accident. Natural color high altitude aerial photographs would be best to determine the spreading patterns of oil outflow. Thickness measurements of oil slicks are very difficult by remote sensing, but thermal scanner is sometimes effective when oil slicks are thick. Lightly clouded and no wind weather is best for oil slick observation. Red tides and oil slicks can be separated using blue, green and infra-red bands.

(Author)

A76-38524 Optical power spectrum analysis for land use classification. J. C. Leachtenauer (Boeing Aerospace Corp., Seattle, Wash.). In: *American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings.* Falls Church, Va., American Society of Photogrammetry, 1976, p. 466-480. 14 refs.

The use of optical power spectrum measurements for land use classification was tested on both small (ERTS 1) and large (1/24,000) scale imagery. Measurements were made using a recording optical power spectrum analyzer (ROSA) manufactured by Recognition Systems Incorporated. This device measures the relative power

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in each of 32 spatial frequency bands and 32 wedges or angular increments. The ROSA is, in effect, an optical computer, performing two dimensional Fourier transforms and providing the means to analyze spatial data. Readings were analyzed using a variety of techniques employing multiple spatial properties. Classification accuracies ranged from 75% to 95% depending on image scale, land use class, and the analysis technique employed. Optical power spectrum analysis appears to offer considerable promise in automatic land use classification, particularly when used in conjunction with spectral analysis techniques. (Author)

A76-38525 The application of Landsat data to habitat mapping in site and route selection studies. G. F. Shanholtzer and L. D. Alexander (Dames and Moore, Cranford, N.J.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 483-494. 7 refs.

An investigation is conducted of the practical aspects of an approach in which digital Landsat data are employed for habitat mapping in site and corridor selection studies. Questions are explored concerning the level of detail needed to make the necessary environmental judgments. The possibility to obtain the required information on the basis of Landsat data is investigated. The cost of using Landsat data is compared with the cost of using more conventional procedures. The results of the investigation indicate that the cost and accuracy of digital processing of Landsat data warrant its inclusion in site and corridor selection studies. G.R.

A76-38526 Transmission line siting in the United States and Canada using aerial photography. B. Howlett (Bruce Howlett, Inc., Brewster, N.Y.) and J. Lukens (Rhode Island School of Design, Providence, R.I.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 495-507.

Problems related to transmission line siting and the approaches used for solving these problems are considered, taking into account agency requirements, siting data secured by aerial photo interpretation, the regional phase of the process of line siting, the corridor phase, the selection of line locations within corridors, and the right-of-way phase. A number of illustrative projects are discussed, giving attention to line siting in rural Virginia, line siting in metropolitan Toronto, public participation, questions of accuracy, aspects of interpretation, and line siting in Arizona. G.R.

A76-38533 Landsat-1 Automated land-use mapping in lake and river watersheds. R. H. Rogers, L. E. Reed, N. F. Schmidt (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.), and T. G. Mara (Ohio-Kentucky-Indiana Regional Council of Governments, Cincinnati, Ohio). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 660-672.

In connection with programs to fight water pollution, the Ohio-Kentucky-Indiana Regional Council of Governments developed a deterministic model for the prediction of water quality in rivers and lakes. Land-use information needed for the model were obtained through the machine processing of a Landsat-1 scene. A description is given of the approaches used in the processing procedure. Attention is given to the employed processing equipment, the establishment of map categories, the development of processing coefficients, the selection of training areas and processing coefficients, the production of categorized map overlays, and area measurement tables. G.R.

A76-38534 Small area population estimation using land use data derived from high altitude aircraft photography. D. Thompson (Maryland, University, College Park, Md.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 673-696. 24 refs. U.S. Geological Survey Contract No. 14-08-0001-13702.

A population estimation technique for small areas using data derived from high altitude aircraft photography was applied to tracts in the Washington urban area. Estimates were based on the change in residential land area over a two-year period and on the base-year population density and number. Estimates within 5% of those obtained from the housing unit method were produced. An analysis of error sources indicates that the data are best for suburban locations rather than inner cities, rapidly changing environments, for areas with little multifamily development, and for areas with relatively few high-rise housing developments. C.K.D.

A76-38536 Effectiveness of a computer land use planning system utilizing generalized data. B. E. Frazier (Washington State University, Pullman, Wash.) and G. B. Lee (Wisconsin, University, Madison, Wis.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 754-777. 6 refs.

Four computer models using generalized information such as soil associations, slopes derived from 15 ft quadrangles, and photo-interpreted land use data, stored as percentages of 1/9 sq km grids, were used to plot highway corridors through an agricultural region in Wisconsin. The models differed in the weighting of the variables to reflect different values placed on prime agricultural land, residential areas, recreational areas, and natural features. Routes automatically plotted by each model were compared with standard routes connecting the specified end points by straight lines, and the effectiveness of each model in avoiding prime agricultural land without large increases in the length of the route was assessed. Subtle differences between models resulted in significantly different route locations in routes about 17 km in length; major differences resulted in significantly different placement of routes 6 km in length. C.K.D.

A76-38537 Land use mapping of Mercer County, North Dakota utilizing remotely sensed imagery. G. E. Johnson, R. D. Mower (North Dakota, University, Grand Forks, N. Dak.), and J. R. LaFevers (Argonne National Laboratory, Argonne, Ill.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 779-787.

A76-38538 An analysis application of land-use data. A. H. Voelker (Oak Ridge National Laboratory, Oak Ridge, Tenn.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 788-805. 12 refs.

The extraction of land-use data from high-altitude photography, and the application of these data in a computerized land-use model are discussed. For individual 43.5 acre cells, the type of land use or vegetation is determined visually, and the data are digitized manually for computer storage. This information serves as input for the elaboration of a land-use compatibility index. Additional variables include zoning, the presence of roads and interchanges, and the presence of railroads or industrial parks. Index variables are synthesized by a linear summation of these factors weighted by their relative importance. The total index score of a given cell is the sum of the weighted variables for that cell and for the adjacent two rings

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of cells. Results have been in good correlation with the on-location assessment of compatibility for a given land use. C.K.D.

A76-38541 * Hierarchical resource analysis for land use planning through remote sensing. B. H. Byrnes, C. J. Frazee, and T. L. Cox (South Dakota State University, Brookings, S. Dak.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 839-853. 6 refs. Grant No. NGL-42-003-007.

A hierarchical resource analysis was applied to remote sensing data to provide maps at Planning Levels I and III (Anderson et al., U.S. Geological Survey Circular 671) for Meade County, S. Dak. Level I land use and general soil maps were prepared by visual interpretation of imagery from a false color composite of Landsat MSS bands 4, 5, and 7 and single bands (5 and 7). A modified Level III land use map was prepared for the Black Hills area from RB-57 photography enlarged to a scale of 1:24,000. Level III land use data were used together with computer-generated interpretive soil maps to analyze relationships between developed and developing areas and soil criteria. C.K.D.

A76-38542 * Remote sensing as an aid to community development in an arid area. K. E. Foster and R. N. Weisz (Arizona, University, Tucson, Ariz.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 856-875. NASA Order W-125.

High-altitude color infrared photography of a 70,000 acre site north of Tucson, Ariz., has been used to construct maps for land-use planning. Remote sensing data on land use, soil type, vegetation type, ground water recharge areas, and slope were categorized and digitized. Individual categories were assigned ranks indicating their suitability for urban development. Maps of individual characteristics were weighted according to their importance in a given land-use decision, and composite maps indicating good, average, and poor locations for a given type of development were plotted. These composite maps were found to be in good agreement with ground truth results. C.K.D.

A76-38544 * Planning applications of remote sensing in Arizona. R. B. Clark and D. A. Mouat (Arizona, University, Tucson, Ariz.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 884-888. NASA-sponsored research.

Planners in Arizona have been experiencing the inevitable problems which occur when large areas of rural and remote lands are converted to urban-recreational uses over a relatively short period of time. Among the planning problems in the state are unplanned and illegal subdivisions, suburban sprawl, surface hydrologic problems related to ephemeral stream overflow, rapidly changing land use patterns, large size of administrative units, and lack of land use inventory data upon which to base planning decisions. (Author)

A76-39680 # Correlation interferometric measurement of carbon monoxide and methane from the Canada Centre for Remote Sensing Falcon fan-jet aircraft. H. W. Goldstein, M. H. Bortner, R. N. Grenda (General Electric Co., Space Div., Philadelphia, Pa.), R. Dick, and A. R. Barringer (Barringer Research, Ltd., Toronto, Canada). (Canadian Aeronautics and Space Institute, Aerospace Electronics Symposium, Halifax, Nova Scotia, Canada, Feb. 4, 5, 1975.) Canadian Journal of Remote Sensing, vol. 2, May 1976, p. 30-41. 5 refs.

Measurements of CO on a global scale conducted with the aid of satellites and aircraft are required to solve problems related to an introduction of carbon monoxide into the atmosphere. An instrument, called the correlation interferometer, has been developed for the conduction of the considered measurements. The principles of operation of the instrument are discussed and a description is given of aircraft flight tests which have been carried out to test the suitability of the instrument for the intended applications. G.R.

A76-39681 # Air-borne water-colour measurements off the Nova Scotia coast. J. R. Miller (York University, Downsview, Ontario, Canada), D. Kamykowski (Dalhousie University, Halifax, Nova Scotia, Canada), and K. S. Gordon. (Canadian Aeronautics and Space Institute, Aerospace Electronics Symposium, Halifax, Nova Scotia, Canada, Feb. 4, 5, 1975.) Canadian Journal of Remote Sensing, vol. 2, May 1976, p. 42-47. 8 refs. Research supported by the National Research Council.

Water color measurements have been made with a 4-channel spectral-scanning photometer on a 160-mile flight line heading 50 deg SE from Halifax out over the continental shelf. Observations were made in the spectral regions .46-.44, .59-.55, .70-.68, and .75-.72 micron using the four-channel photometer and at .97 micron using a silicon photodiode photometer. The spectral data obtained are compared with ship-based chlorophyll measurements made along the same transect. (Author)

A76-40325 Computation of long-term average SO₂ concentration in the Venetian area. E. Runca, P. Melli, and P. Zannetti (IBM Italia S.p.A., Centro Scientifico, Venice, Italy). Applied Mathematical Modelling, vol. 1, June 1976, p. 9-15. 10 refs.

A76-40348 The use of low temperature matrix isolation infrared spectroscopy for the identification and measurement of air-borne amines. D. F. Ball and C. J. Purnell (Salford, University, Salford, England). International Journal of Environmental Studies, vol. 9, no. 2, 1976, p. 131-138. 5 refs.

A76-41003 Satellite survey of particulate distribution patterns in Lake Kainji. A. A. Abiodun. Remote Sensing of Environment, vol. 5, no. 2, 1976, p. 109-123. 14 refs. Research supported by the Department of Energy, Mines and Resources.

Landsat-1 spectral data have been used to examine the distribution of suspended particles at the initial stage of the annual flood in Lake Kainji, Nigeria. Five major water masses which correspond to the horizontal distribution of turbidity or suspended particle concentrations are clearly delineated. The western and eastern arms of River Niger which serve as the inflow channels into the lake are clearly delineated by their relative spectral radiance values. (Author)

A76-41209 High latitude, outer zone boundary observations of electrons and protons. W.-C. Lin, H. H. Sauer (NOAA, Space Environment Laboratory, Boulder, Colo.), and H.-E. Lin. Planetary and Space Science, vol. 24, Aug. 1976, p. 757-763. 15 refs. National Research Council Grants No. A-2425; No. A-4480.

The diurnal variation of the high latitude outer zone boundary at 1400 km has been determined for electrons above 140 keV and for protons in two energy intervals: 0.56 to 1.1 MeV, and 1.1 to 3.2 MeV, from detectors aboard the NOAA-2 satellite. The dependence of the 140 keV electron boundary on Dst has been examined as well. A well-defined correlation of boundary position with Dst is found to exist during the main phase of disturbances, together with an evident local time dependence. All the boundaries are found to be consistent with the supposition of adiabatic drift and demonstrate the stability of the boundary position over approximately ten years of comparable observation. No statistically significant hemispheric differences in boundary location were observed to occur. (Author)

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A76-41576 Conference on Weather Forecasting and Analysis, 6th, Albany, N.Y., May 10-13, 1976, Preprints. Conference sponsored by the American Meteorological Society. Boston, American Meteorological Society, 1976. 379 p. \$20.

Topics discussed in the papers are grouped under: (1) forecast- ing public and private, long and short range; (2) objective and automated weather forecasts; (3) small scale analysis and prediction; (4) numerical prediction and model comparisons; (5) initialization and sensitivity of numerical models; (6) precipitation systems and clouds; (7) satellite meteorology; (8) status of weather forecasting; and (9) synoptic and mesoscale circulations. Among specific topics discussed are: satellite-aided meteorological observations and satellite imagery, satellite sounding, multivariate objective analysis of weather parameters, potential vorticity analysis, regional numerical weather prediction, and computer-assisted forecast and warnings text generation.

R.D.V.

A76-41884 * Remote measurements of ambient air pollutants with a bistatic laser system. R. T. Menzies and M. S. Shumate (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Applied Optics*, vol. 15, Sept. 1976, p. 2080-2084. 22 refs. Contract No. NAS7-100.

The ambient air pollutants ozone, nitric oxide, and ethylene have been monitored in the Pasadena area with a bistatic IR laser apparatus. These pollutants were measured with a differential absorption technique, using selected wavelengths in the 9.5-, 5.2-, and 10.5-micron regions, respectively. The transmitted laser radiation was detected using both direct and heterodyne detection techniques. In the direct detection case, cube corner retroreflectors provided the return, and the heterodyne detection responded to scattered radiation from various rough surfaces, ranging from 400 m to 1.9 km in distance from the apparatus. Significant departures from ambient background concentration levels were noticed in the region near a local freeway during periods of moderate and heavy traffic. (Author)

A76-41969 # Aerial observations for environmental monitoring. A. G. Trakowski, Jr. (U.S. Environmental Protection Agency, Office of Monitoring and Technical Support, Washington, D.C.). In: National Association for Remotely Piloted Vehicles, Annual Symposium, 3rd, Dayton, Ohio, May 3-5, 1976, Proceedings.

Dayton, Ohio, National Association for Remotely Piloted Vehicles, 1976. 8 p.

The use of aerial observation techniques - including aerial photography, thermal imaging, and multispectral scanning - in Environmental Protection Agency efforts to detect violations of air and water pollution standards and ensure their enforcement is discussed. The resulting data, together with those obtained from the analysis of atmospheric gas samples and aerosols, have been used to track stack plumes from major point sources (industries with one or more stacks in close proximity emitting more than 100 metric tons per year of any pollutant for which standards have been established) and to determine their emission levels. In addition, airborne platforms have been used to detect heat plumes in bodies of water and to monitor runoffs from feedlot operations. The remote sensing instrumentation for a rotary wing aircraft is discussed. C.K.D.

A76-41999 Rapid frontal zone cyclogenesis, 31 October 1975. D. R. Cochran (NOAA, National Environmental Satellite Service, Honolulu, Hawaii) and H. M. Johnson (NOAA, National Environmental Satellite Service, Applications Group, Washington, D.C.). *Monthly Weather Review*, vol. 104, Aug. 1976, p. 1078-1080.

Infrared pictures taken by the SMS-2 satellite of the middle and high cloud band of a weak frontal zone with an approximately SSW-NNE axis north of the Hawaiian Islands are presented. The pictures taken on Oct. 31, 1975 at different GMTs (0345, 0645, 0945, 1245, and 1545) point to the development of a significant cyclonic system. B.J.

A76-42363 # Meteorological observations from space and Spacelab. H.-J. Bolle (München, Universität, Munich, West Germany). *American Astronautical Society and Deutsche Gesellschaft für Luft- und Raumfahrt, International Meeting on Utilization of Space Shuttle and Spacelab, Bonn, West Germany, June 2-4, 1976, Paper*. 12 p.

The incorporation of Spacelab into the operational meteorological satellite system for global monitoring of weather and climatic changes is discussed, with emphasis on the sorts of meteorological and climatic conditions Spacelab might observe. These include atmospheric energetics, and the criticality of some atmospheric parameters (solar constant, optical depth, cloud cover, composition, etc.) with respect to climate. Attention is also paid to the ability of satellites to monitor sea surface temperature, surface albedo, snow and ice distribution, precipitation, soil moisture, and wind stress over the ocean. The possible role of Spacelab in the meteorological satellite system is considered, giving attention to spectral correlation experiments, and to the uses of Spacelab as a calibration laboratory, and an intercomparison and selection facility. B.J.

A76-42377 # Remote sensing of atmospheric constituents of interest in the photochemistry of the ozone layer. D. G. Murcray (Denver, University, Denver, Colo.). *American Astronautical Society and Deutsche Gesellschaft für Luft- und Raumfahrt, International Meeting on Utilization of Space Shuttle and Spacelab, Bonn, West Germany, June 2-4, 1976, Paper*. 9 p.

A remote sensing technique which could be used on a manned satellite (such as Skylab) to measure atmospheric constituents of interest in the photochemistry of the ozone layer is described. The technique makes use of an interferometer system currently under construction, which can be cooled to 77 K. The system will permit the observation of atmospheric emission spectra at the earth's limb with a resolution of at least 0.1/cm in the 3 to 20 micrometer range; these observations can then be used to infer the temperature profile up to 40 km using the 15 micrometer CO₂ band. These data are used to derive the mixing profiles of the atmospheric constituents of interest. C.K.D.

A76-42388 # Global behaviour of ozone and stratospheric temperatures from satellite measurements during January 1971. A. Ghazi (Köln, Universität, Cologne, West Germany). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper*. 10 p. 11 refs. Research supported by the Deutsche Forschungsgemeinschaft.

Nimbus IV observations of ozone by the Backscatter Ultraviolet instrument and stratospheric temperatures deduced from Selective Chopper Radiometer measurements are comparatively discussed. Global mean monthly maps of total ozone and ozone amount between 10-1 mb are presented along with maps of lower and upper stratospheric temperatures to reveal the interaction. Observational evidence is given of planetary wave activity influencing the meridional structure of zonal mean ozone and temperature distribution during a stratospheric warming in the Northern Hemisphere. (Author)

A76-42708 The location of the field-aligned currents with respect to discrete auroral arcs. Y. Kamide (Alaska, University, Fairbanks, Alaska; Cooperative Institute for Research in Environmental Sciences; NOAA, Data Studies Div., Boulder, Colo.) and S.-I. Akasofu (Alaska, University, Fairbanks, Alaska). *Journal of Geophysical Research*, vol. 81, Aug. 1, 1976, p. 3999-4003. 7 refs. NSF Grants No. GA-37094; No. DES-74-23832.

A76-42998 # Ground level observation for electromagnetic remote sensing. R. Lougeay (New York, State University, Geneseo, N.Y.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 3, Apr. 1976, p. 5-22.

The paper discusses specific techniques of ground truth measurements, i.e., ground level observations whose data can increase the accuracy of remote sensing interpretation for aerial photography, thermal scanning and radar airborne or satellite sensing systems. Ground level measurements of surface albedo, reflectance, and infrared emissivity of surface materials are considered, along with instruments for these measurements. The total energy balance approach to thermal remote sensing is considered as the most accurate. Temporal and spatial scale problems regarding compatibility of remote sensing and ground level observations are discussed, as well as some methods of solving these problems. It is stressed that the importance of ground truth increases when signal contrasts approach the resolution limits of the remote sensing systems. S.N.

A76-43375 # Aerial surveys of highway routes and bridge crossings (Aeroizyskaniia avtomobil'nykh dorog i mostovykh perekhodov). V. I. Fedorov. Moscow, Izdatel'stvo Transport, 1975. 200 p. 16 refs. In Russian.

A handbook of modern techniques and equipment in aerial survey work aiding design, tracing, and siting of automotive highways and bridge crossings. Special methods in air photosurveys, interpretation of photographic plates and stereographic pairs, stereophotogrammetry, and computer modeling of highway routing are discussed, with profuse illustration and a few color plates (including stereo pairs). Topics covered include: aerial photographic materials, stereocomparators and stereometers; reading topographic, geological and hydrological features of terrain off aerial survey photographs; analytic layout of highways based on mathematical models of terrain, three-dimensional stereophotogrammetry in highway planning; aerohydrology, and reconstruction of roadbeds from aerial survey materials. R.D.V.

A76-43455 # Use of aerial photographs in the analysis of land use. D. S. Kamat, K. L. Majumdar, C. V. S. Prakash, V. L. Swaminathan, and N. K. Vyas (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper*. 30 p. 7 refs.

The paper describes an unsupervised classification technique for aerial photographs taken during the Agricultural Resources Inventory and Survey Experiment sponsored by the Indian Space Research Organization and the Indian Council of Agricultural Research. The automatic technique classifies multiband pixels of the imagery on the basis of the natural relationships - clustering - existing in the data. The technique utilizes the minimum distance criterion, using the absolute difference of the gray level components in the different bands. B.J.

A76-43472 * Determination of sulfur dioxide in stack gases by ultraviolet absorption spectrometry. H. E. Winkler (NASA, Johnson Space Center, Houston, Tex.; Pennsylvania, Indiana University, Indiana, Pa.) and A. Syty (Pennsylvania, Indiana University, Indiana, Pa.). *Environmental Science and Technology*, vol. 10, Sept. 1976, p. 913-916. 22 refs.

A76-43701 Interplanetary dust and zodiacal light; Proceedings of the Colloquium, 31st, Heidelberg, West Germany, June 10-13, 1975. Colloquium sponsored by IAU, COSPAR, Deutsche Forschungsgemeinschaft, and Max-Planck Gesellschaft. Edited by H. Elsässer (Max-Planck-Institut für Astronomie, Heidelberg, West Germany) and H. Fechtig (Max-Planck-Institut für Kernphysik, Heidelberg, West Germany). Berlin and New York, Springer-Verlag (Lecture Notes in Physics. Volume 48), 1976. 208 p. \$16.

Space and ground measurements of zodiacal light, lunar studies and simulation experiments, particle collection experiments, comet dust, meteors and their relation to interplanetary dust, and the dynamics and evolution of interplanetary dust are among the topics treated. Papers are presented on the Helios zodiacal light experiment, on the D2B satellite zodiacal light experiment (field recognition), on

discrepancies in the use of the S sub 10 (V), the unit of zodiacal light measurements, and on OSO-5 measurements of zodiacal light. Attention is also paid to zodiacal light scattering by meteor stream particles, the reliability of ground observations of zodiacal light and the plotting of twilight luminance curves from balloon photometry data.

B.J.

A76-44051 Aurorae and nightglow. Number 24 (Poliarnye siania i svechenie nochnogo neba. Number 24). Edited by V. I. Krasovskii. Moscow, Izdatel'stvo Sovetskoe Radio, 1976. 88 p. In Russian.

Regular nocturnal and seasonal variations of the intensity of OH, Na D and O I 557 A emissions in the upper atmosphere are examined. Internal gravity waves in the upper atmosphere are studied from observations of OH and Na emission, and the rotational temperatures of OH emission are determined. Variations of the vibrational excitation of upper atmospheric hydroxyl, are found to be conditioned by gravity waves, and the seasonal variations of hydroxyl emission are examined. The 6330 A emission line is investigated, along with variations of the Doppler temperature of the 5577 A emission line in auroras. Auroral orientation and auroral spectral characteristics are considered. A cooled photomultiplier tube with an oxide cathode for measuring near-infrared OH emission is described, and H alpha nightglow emission is investigated.

B.J.

A76-44053 # Recording of internal gravity waves in the upper atmosphere from observations of hydroxyl and sodium emission (Registratsiia vnutrennikh gravitatsionnykh voln v verkhnei atmosfere po nabluceniim emissii gidroksila i natriia). T. I. Toroshelidze. In: Aurorae and nightglow. Number 24. Moscow, Izdatel'stvo Sovetskoe Radio, 1976, p. 16-20.

8 refs. In Russian.

A76-44079 Lidar study of the atmospheric boundary layer (Etude par lidar de la couche limite planétaire). H. Bardeau, A. Costecalde, and J. Fontan (Toulouse III, Université, Toulouse, France). *Journal of Aerosol Science*, vol. 7, May 1976, p. 213-221. 21 refs. In French.

Lidar backscattering measurements combined with numerical calculations are used to study the temporal and spatial structure of the atmospheric boundary layer and to determine the height of the mixing layer. Backscattering signal amplification was observed at the upper level of the mixing layer, thus showing the mixing layer to be located either at the level of a temperature inversion or at the level of a change in dew point. Lidar was also used to study exhaust emissions from an urban area. B.J.

A76-44101 * Compensating for environmental variability in the thermal inertia approach to remote sensing of soil moisture. S. B. Idso, R. D. Jackson, and R. J. Reginato (U.S. Department of Agriculture, Water Conservation Laboratory, Phoenix, Ariz.). *Journal of Applied Meteorology*, vol. 15, Aug. 1976, p. 811-817. 15 refs. NASA-supported research.

A procedure is developed for removing data scatter in the thermal-inertia approach to remote sensing of soil moisture which arises from environmental variability in time and space. It entails the utilization of nearby National Weather Service air temperature measurements to normalize measured diurnal surface temperature variations to what they would have been for a day of standard diurnal air temperature variation, arbitrarily assigned to be 18 C. Tests of the procedure's basic premise on a bare loam soil and a crop of alfalfa indicate it to be conceptually sound. It is possible that the technique could also be useful in other thermal-inertia applications, such as lithographic mapping. (Author)

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A76-44176 Long-wavelength infrared; Proceedings of the Seminar, San Diego, Calif., August 21, 22, 1975. Seminar sponsored by the Society of Photo-Optical Instrumentation Engineers. Edited by W. L. Wolfe (Arizona, University, Tucson, Ariz.). Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings, Volume 67), 1975. 120 p. \$34.

Papers are presented on a telescopic imaging system using 10.6-micron laser illumination, a comparison of laser imaging and thermal imaging OTFs in the longwave IR region, and an infrared silicon bolometer with self-calibrating capability. Also considered are far infrared photoconductive detectors for infrared astronomy, the low-temperature transmittance of materials in the infrared, and a comparison of calculated and observed atmospheric transmittances in the far infrared. The spectral calibration of infrared space sensors, optical design considerations for a far infrared spectrophotometer, and coherent and noncoherent far infrared calibration are also discussed.

B.J.

A76-44188 Comparison of calculated and observed atmospheric transmittances in the far infrared. W. G. Mankin (National Center for Atmospheric Research, Boulder, Colo.). In: Long-wavelength infrared; Proceedings of the Seminar, San Diego, Calif., August 21, 22, 1975. Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers, 1975, p. 69-75. 11 refs.

Far infrared transmission spectra were obtained with a Fourier spectrometer from a mountain top and from an aircraft in the lower stratosphere. The spectra covered the range 15-60/cm with a resolution of 0.065/cm and revealed absorption features due to oxygen, water vapor, ozone and nitrous oxide. The known rotational parameters for these molecules are used to compute the expected atmospheric transmission for a given distribution of these absorbers.

B.J.

A76-44290 The effect of surface characteristics on diffuse reflection radiation at a wavelength of 0.40 microns. T. Takashima. *Astrophysics and Space Science*, vol. 43, Aug. 1976, p. 213-232. 33 refs.

The diffuse radiation in the upward direction at the top and at an internal level of an inhomogeneous atmosphere is computed at a wavelength of 40 microns. The surface is assumed to reflect light in accordance with a hybrid mode of a diffuse and specular reflector. The objective is to estimate the effect of underlying surface characteristics in terms of the diffuse radiation field. By making use of these results, accuracy in monitoring the atmospheric aerosols would be increased for the employment of remote-sensing satellite techniques. The Junge power law (1963) is adopted for the size distribution of aerosols, while the data given by McClatchy et al. (1971) is used for the number density of aerosols with height distribution. It is noted from the computations that the diffuse reflection radiation is affected by the surface characteristics, even if the albedo of the surface is a fixed constant and very small. (Author)

A76-44398 # Investigation of trapped radiation by Cosmos 426. IV - Structure of electron flows at the outer boundary of the geomagnetic trap (Issledovanie sakhvachennoi radiatsii na ISZ 'Kosmos-426'. IV - Struktura elektronnykh potokov na vneshnei granitse geomagnitnoi lovushki). S. N. Kuznetsov, G. B. Lopatina, V. V. Mel'nikov, T. I. Pervaia, I. A. Savenko, B. I. Savin, and V. G. Stolpovskii. *Kosmicheskie Issledovaniia*, vol. 14, July-Aug. 1976, p. 637-641. 7 refs. In Russian.

Data are presented on the electron energy distribution at high latitudes at 400 to 2000 km, obtained on March 6-8, 1971, under conditions of low magnetic activity. A storage unit mounted aboard the satellite made it possible to obtain the complete electron flux distribution profile in both polar cap regions within 24 hr. The data on the electron spectra in the regions of closed and open lines of

force ('hard' and 'soft' zones) suggest that electrons penetrate the magnetosphere in two regions: the plasma layer region in the magnetosphere tail (characterized by exponentially decreasing electron spectra); and the dayside neutral point region (where a peak was observed for electrons of about 1 keV). The energy of the electrons was found to increase during the drift. In the radiation belt regions on the morning side of the earth, an intensity peak was occasionally observed for 10-keV particles. The peak may be caused by 'local' acceleration mechanisms. Drifting appears to be accompanied by intensive precipitation of electrons, since at 14-17 h MLT the 10-keV electron fluxes disappear. S.N.

A76-44576 Inter-noise 75; Proceedings of the International Conference on Noise Control Engineering, Sendai, Japan, August 27-29, 1975. Conference sponsored by the Acoustical Society of Japan, Institute of Noise Control Engineering, et al. Edited by K. Kido (Tohoku University, Sendai, Japan). Sendai, Japan, Tohoku University, 1975. 784 p. \$28.

The present collection of papers is concerned with relevant amendments to noise control regulations and prospects of environmental noise abatement. Attention is focused on surface transportation noise, aircraft and industrial noise control, the so-called vibration pollution control as related to the detrimental effects of vibrational noise on the human organism, and ducts and silencers. The methodology and instrumentation for noise and vibration measurements are discussed, along with noise problems associated with sound propagation under specific conditions. Other areas of interest include noise control engineering in buildings, community noise and its assessment, and standards and legislation for noise and vibration.

S.D.

A76-44580 German Federal regulations for sound insulation against aircraft noise /Decree on sound insulation/. H. Gummlich (Bundesministerium des Innern, Bonn, West Germany) and H. Reich (Federal Ministry for Regional Planning, Building and Urban Development, Bonn, West Germany). In: Inter-noise 75; Proceedings of the International Conference on Noise Control Engineering, Sendai, Japan, August 27-29, 1975. Sendai, Japan, Tohoku University, 1975, p. 147-150. 9 refs.

The paper discusses the contents and scope of the decree of the Federal Government of Germany on sound insulation against aircraft noise. The key items discussed concern the adoption of the airborne sound insulation index established by ISO as a criterion for assessing airborne sound insulation of a structural shell, the requirement of a minimum airborne sound insulation index of 50 dB and 45 dB for the structural shell of rooms of leisure activities, and data on the properties of building elements meeting the requirements without individual certification. The airborne sound insulation index combines the advantage of providing a set of reference values with a psychological merit of always giving positive figures. S.D.

A76-44591 Monitoring system of environmental noise. M. Okuda and H. Fukuhara (Rion Co., Ltd., Kokubunji, Tokyo, Japan). In: Inter-noise 75; Proceedings of the International Conference on Noise Control Engineering, Sendai, Japan, August 27-29, 1975. Sendai, Japan, Tohoku University, 1975, p. 461-464.

A system for monitoring traffic and factory noise is designed which can operate its integral function to statistically process the noise that varies greatly and irregularly and which can give processed data at the monitoring site. For aircraft noise, the monitoring system yields a computerized record automatically for each aircraft flight, maximum noise level and time (month, day, hour and minute), and period of time during which the noise exceeds a prescribed level. The microphone unit used is a condenser microphone with a wind screen of negligible effect on the acoustic characteristics of the microphone.

The system described for monitoring aircraft and traffic noise is simple in operation than the conventional method and is capable of yielding ample data. S.D.

A76-44633 Observations of magnetohydrodynamic waves on the ground and on a satellite. L. J. Lanzerotti, H. Fukunishi, C. G. MacLennan (Bell Telephone Laboratories, Inc., Murray Hill, N.J.), and L. J. Cahill, Jr. (Minnesota, University, Minneapolis, Minn.). *Journal of Geophysical Research*, vol. 81, Sept. 1, 1976, p. 4537-4545. 37 refs.

A comparison is made of magnetohydrodynamic waves observed near the equator on Explorer 45 and at an array of ground stations in the northern hemisphere and at their conjugate station at Siple, Antarctica. The data comparisons strongly support the notion that the observed waves can be considered odd-mode standing waves in the magnetosphere. This conclusion has important implications for the interpretation of single-point satellite and ground measurements of ULF plasma-wave phenomena in the magnetosphere. The data comparisons strongly suggest that the overall ULF (about 5-30 mHz) power levels are quite similar in the magnetosphere and on the ground, at least during the intervals studied. (Author)

A76-44654 On the distribution of global auroras during intervals of magnetospheric quiet. F. T. Berkey (Auroral Observatory, Tromso, Norway) and Y. Kamide (Alaska, University, Fairbanks, Alaska). *Journal of Geophysical Research*, vol. 81, Sept. 1, 1976, p. 4701-4714. 30 refs. Research sponsored by the Norges Almenvitenskapelige Forskningsrad; NSF Grant No. GA-36873; National Research Council of Canada Grants No. A-3131; No. A-7.

The instantaneous distribution of auroras during intervals of very quiet magnetic activity was derived from Defense Meteorological Satellite Program data. Results show that the size of the instantaneous auroral oval is highly sensitive to relatively small changes in the magnitude of the auroral electrojet. Certain morphological features associated with expanded auroral substorms in the morning sector - omega bands, torchlike structure and patchy auroras were not observed, while sun-aligned arcs were observed on numerous orbits and were most frequent when magnetic disturbances were minimal. B.J.

A76-44936 The equivalent air mass theory - A simplified approach to the prediction of near-IR atmospheric effects. J. A. Milam (Martin Marietta Aerospace, Orlando, Fla.). In: Electro-optical Systems Design Conference and International Laser Exposition, Anaheim, Calif., November 11-13, 1975, Proceedings of the Technical Program. Chicago, Industrial and Scientific Conference Management, Inc., 1975, p. 121-132. 6 refs.

A microscopic approach has been adopted in most current atmospheric models for prediction of broadband near-IR atmospheric effects. The unit path length spectral properties of molecular and aerosol scattering and absorption have been modeled in detail, and finite path atmospheric effects have been determined along the path. The present paper shows that the equivalent air mass theory adopts a macroscopic approach whereby the measured spectral properties of a real atmospheric path are used to predict atmospheric effects in other path configurations. The direct computation of path radiance by an appropriate formula allows accurate predictions of atmospheric scene contrast reduction over a broad spectral range without requiring any empirical compensating factors such as sky-to-ground ratio. S.D.

A76-45719 Surface temperatures in the Ruhr area on the basis of thermal images (Oberflächentemperaturen im Ruhrgebiet nach Wärmebildern). P. Stock (Siedlungsverband Ruhrkohlenbezirk, Essen, West Germany). *Bildmessung und Luftbildwesen*, vol. 44, Sept. 15, 1976, p. 174-181. 17 refs. In German.

The Ruhr area from Duisburg to Dortmund in West Germany was studied with an IR scanner in the morning and at night. The result of a manual data reduction study is presented as a map with squares in different colors. The magnitude, form and distribution of the areas of equal temperature are described and a comparison is conducted concerning the conditions found at morning and at night. Attention is given to the meteorological conditions during the flight, details of data evaluation, and the surface-temperature pattern for the cities of Duisburg, Bochum, and Dortmund. G.R.

A76-45926 # Determination of the earth-atmosphere radiation balance from NOAA satellites. A. Gruber (NOAA, National Environmental Satellite Service, Washington, D.C.). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper*. 11 p.

The manner in which scanning-radiometer observations in the visible and infrared are processed to obtain estimates of albedo and outgoing longwave radiation of the earth/atmosphere system is described. The models and assumptions used in reducing the operational data (which are of limited spectral resolution) to estimates of radiation budget parameters are discussed. The major problems that must be overcome are: estimating albedo in the 0.2 to 0.4 micron region from the limited spectral observations of 0.5 to 0.7 microns; estimating the outgoing longwave flux in the 4 to 50 micron region from 10.5 to 12.5 micron observations; correction for the dependence of the measured values on the zenith and azimuth angles of measurement; and computation of daily average values (which for albedo implies the variation of albedo with solar zenith angle). V.P.

A76-45945 # Peculiarities in ion concentration distribution in the Brazilian magnetic anomaly region. T. P. Dachev (B'lgarska Akademiia na Naukite, Laboratoriia za Kosmicheski Izsledvaniia, Sofia, Bulgaria). *Bolgarskaia Akademiia Nauk, Doklady*, vol. 29, no. 7, 1976, p. 987-989. 10 refs.

Intercosmos-2 measured the distribution of light ions - O(+), H(+), and He(+) - in the Brazilian magnetic anomaly region of the ionosphere. Peculiarities in the distribution of these ions are determined chiefly by peculiarities in the distribution of H(+). It is shown that the geographic longitude, by means of large scale inhomogeneities of the geomagnetic field, plays an essential role in determining the type of ion distribution around the geomagnetic equator, the equatorial trough gradually filling up in the region of the Brazilian anomaly and disappearing in a direction east of the minimum. B.J.

A76-46043 # The magnetosphere. C. T. Russell (California, University, Los Angeles, Calif.). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-068*. 8 p. 23 refs. Grant No. NGR-05-007-004.

The terrestrial magnetic field shields the earth from the supersonic wind of the expanding solar atmosphere, forming a cavity called the magnetosphere. Since the velocity of the solar wind is supersonic, a detached shock wave stands in front of this cavity. The flow past the cavity is viscous, drawing the field lines back into a long tail. In this paper we review briefly the nature of the magnetosphere, the outstanding problem areas in this field, and what space missions are needed to attack these problems. (Author)

A76-46104 # Environmental remote sensing from aircraft and space. W. K. Talley (U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C.). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper A-76-23*. 4 p.

Comprehensive environmental monitoring is absolutely necessary to accomplish the U.S. EPA's mandate 'to reduce pollution to acceptable levels'. The Agency uses a variety of monitoring methods: one of these, which has received increasing emphasis in the last few

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years, is remote sensing from aircraft and space. Recent application of remote sensing for monitoring, measuring, and detecting environmentally significant information has demonstrated two advantages over more conventional methods: broadened perspective, and cost effectiveness. This paper describes the present EPA remote sensing program, the advantages of remote sensing, the direction of the program over the next 3-5 years, and the benefits expected to be derived from developing and utilizing remote sensing methods.

(Author)

A76-46200 * Satellite measurement of mass of Sahara dust in the atmosphere. R. S. Fraser (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Applied Optics*, vol. 15, Oct. 1976, p. 2471-2479. 27 refs.

Landsat 1 measurements of nadir radiance are used to obtain the mass of particulates in a vertical column of dust from the Sahara Desert. A radiative transfer model, constructed with knowledge of a few values of optical parameters measured from a ship, is developed to account for the measured radiance values. Measurement and model accuracies are discussed. It is found that the mass of particulates with smaller than a 10 micron radius in a vertical column is 1.6 g/sq m.

B.J.

A76-46567 * # Evaluation of upwelling infrared radiance from the earth's troposphere. S. N. Tiwari and S. K. Gupta (Old Dominion University, Norfolk, Va.). *American Society of Mechanical Engineers and American Institute of Chemical Engineers, Heat Transfer Conference, St. Louis, Mo., Aug. 9-11, 1976, ASME Paper 76-HT-5*. 9 p. 11 refs. Members, \$1.50; nonmembers, \$3.00. Grant No. NsG-1153.

Basic equations for calculating the upwelling atmospheric radiance are presented. Theoretical formulation of the transmittance models (line-by-line and quasi-random band) and computational procedures for the evaluation of transmittance and radiance are discussed. This information is useful in the interpretation of the data obtained from measuring gaseous pollutants in the troposphere.

(Author)

A76-46676 Cloud physics and cloud seeding (Fizika oblakov i aktivnye vozdeistviia). Edited by V. P. Lominadze. Leningrad, Gidrometeoizdat (Zakavkazskii Nauchno-Issledovatel'skii Gidrometeorologicheskii Institut, Trudy, No. 63/69/), 1975. 152 p. In Russian.

The papers deal with such topics as the numerical solution of the kinetic equations of cloud particles; the evolution of the spectrum of large particles in convective clouds; and the seeding of convective clouds to produce artificial precipitations. The results obtained with a system for protection against hail damage are analyzed, and the seeding schemes and amounts of seeding agents are defined. Laboratory research work aimed at identifying the condensation-induced growth of droplets formed on aerosols at various temperatures under conditions of 100% humidity is reviewed. A method of determining the spectrum of explosively dispersed NaCl is described.

V.P.

A76-46709 Effects of anomalous resistivity on auroral Birkeland current systems. J. A. Fedder (U.S. Navy, Naval Research Laboratory, Washington, D.C.). *Annales de Géophysique*, vol. 32, Apr.-June 1976, p. 175-184. 40 refs. Research supported by the U.S. Defense Nuclear Agency.

A76-46795 The relation between cloud pattern motion and wind shear. L. F. Hubert (NOAA, Meteorological Satellite Laboratory, Washington, D.C.). *Monthly Weather Review*, vol. 104, Sept. 1976, p. 1167-1171.

Cloud motions in the immediate vicinity of a tropical disturbance, measured with geosynchronous satellite data, were compared with independent aircraft wind observations by Smith and Hasler (1976). These data have been further analyzed here to determine whether a component of cloud pattern motion might be associated with vertical shear. An association was detected between vertical shear and cloud pattern motion only in the region of enhanced convection east of the disturbance center. The shear-related effect is to produce a motion component (probably cloud generation) that can add to or subtract from the speed and direction of the cloud patterns as they are advected by winds in the cloud layer. (Author)

A76-47424 # Aerospace methods of geographical surveying (Aerokosmicheskie metody geograficheskikh issledovani). L. E. Smirnov. Leningrad, Izdatel'stvo Leningradskogo Universiteta, 1975. 304 p. 41 refs. In Russian.

Aerial and spaceborne photography of the earth surface for the purpose of geographical surveying is examined. Attention is given to the natural conditions of photography (meteorological conditions, optical properties of the earth surface, seasonal conditions), the geometrical properties of photographs, photointerpretation, image properties of photographs, information content of photographs, and geographical photomapping.

B.J.

N76-28591 Wisconsin Univ., Madison.
THE NATURE, FUNCTION AND DESIGN CONCEPTS OF MULTI-PURPOSE CADASTRES Ph.D. Thesis
John Douglas McLaughlin 1975 528 p
Avail: Univ. Microfilms Order No. 76-8599

A broad conceptualization of the nature and function of the multi-purpose cadastre within a North American setting is first developed. Methods for creating and maintaining cadastral parcels and records are developed. An approach for recording land transfers is formulated. The desirability of relating land tenure information to other types of land information is examined. Design concepts required to implement the multi-purpose cadastre concept are then analyzed. Based upon an examination of efforts to develop cadastral systems in the Maritime Provinces of Canada, Massachusetts and Wisconsin, several necessary elements in a cadastral system are identified and analyzed: (1) a spatial framework; (2) a large scale mapping base; (3) a positive title and boundary registration process; and (4) an integrated information storage and retrieval process. Criteria for developing and implementing these elements are proposed. A program for implementing the multipurpose cadastre over a finite period of time is formulated.

Dissert. Abstr.

N76-28606*# Army Construction Engineering Research Lab., Campaign, Ill.

EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIR ON THE ENVIRONMENT AND ECOLOGY

Progress Report, 1 Apr. - 30 Jun. 1976

R. K. Jain, Principal Investigator 6 Jul. 1976 2 p ERTS
(E76-10430; NASA-CR-148306) Avail: NTIS HC \$3.50 CSCL 08B

N76-28608*# Geological Survey, Iowa City, Iowa.
LAND CLASSIFICATION OF SOUTH-CENTRAL IOWA FROM COMPUTER ENHANCED IMAGES Progress Report,
3 Oct. 1975 - 3 Feb. 1976

James R. Lucas, Principal Investigator, James V. Taranik (EROS Data Center, Sioux Falls, S. D.), and Frederic C. Billingsley (JPL) 3 Feb. 1975 60 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10432; NASA-CR-148308; Rept-4) Avail: NTIS HC \$4.50 CSCL 08B

N76-28609*# Nebraska Univ., Lincoln. Conservation and Survey Div.

APPLICATION OF LANDSAT IMAGERY IN LAND USE INVENTORY AND CLASSIFICATION IN NEBRASKA
Progress Report, 10 Mar. - 10 Jun. 1976

Marvin P. Carlson, Principal Investigator and Paul M. Seevers
10 Jun. 1976 5 p ERTS
(Contract NAS5-20814)
(E76-10433; NASA-CR-148309; Rept-5) Avail: NTIS
HC \$3.50 CSCL 08B

N76-28627*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

AN ANALYSIS OF METROPOLITAN LAND-USE BY MACHINE PROCESSING OF EARTH RESOURCES TECHNOLOGY SATELLITE DATA

P. W. Mausel, W. J. Todd, and M. F. Baumgardner 1976 12 p refs
(Contract NAS9-14016)
(NASA-CR-147788; LARS-Inform-Note-031276) Avail: NTIS
HC \$3.50 CSCL 08B

A successful application of state-of-the-art remote sensing technology in classifying an urban area into its broad land use classes is reported. This research proves that numerous urban features are amenable to classification using ERTS multispectral data automatically processed by computer. Furthermore, such automatic data processing (ADP) techniques permit areal analysis on an unprecedented scale with a minimum expenditure of time. Also, classification results obtained using ADP procedures are consistent, comparable, and replicable. The results of classification are compared with the proposed U. S. G. S. land use classification system in order to determine the level of classification that is feasible to obtain through ERTS analysis of metropolitan areas.

Author

N76-28727*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EARTH-ATMOSPHERE SYSTEM AND SURFACE REFLECTIVITIES IN ARID REGIONS FROM LANDSAT MULTISPECTRAL SCANNER MEASUREMENTS

J. Otterman and R. S. Fraser Jun. 1976 40 p refs Submitted for publication
(NASA-TM-X-71164; X-911-76-147) Avail: NTIS HC \$4.00
CSCL 04A

Programs for computing atmospheric transmission and scattering solar radiation were used to compute the ratios of the Earth-atmosphere system (space) directional reflectivities in the vertical direction to the surface reflectivity, for the four bands of the LANDSAT multispectral scanner (MSS). These ratios are presented as graphs for two water vapor levels, as a function of the surface reflectivity, for various sun elevation angles. Space directional reflectivities in the vertical direction are reported for selected arid regions in Asia, Africa and Central America from the spectral radiance levels measured by the LANDSAT MSS. From these space reflectivities, surface vertical reflectivities were computed applying the pertinent graphs. These surface reflectivities were used to estimate the surface albedo for the entire solar spectrum. The estimated albedos are in the range 0.34-0.52, higher than the values reported by most previous researchers from space measurements, but are consistent with laboratory measurements.

Author

N76-28741*# Virginia Univ., Charlottesville. School of Engineering and Applied Science.

THE INTERACTION OF UNIDIRECTIONAL WINDS WITH AN ISOLATED BARCHAN SAND DUNE

Mohamed Gad-el-Hak, Deborah Pierce, Alan Howard, and Jeffrey B. Morton Jul. 1976 109 p refs
(Grant NGR-47-005-172)
(NASA-CR-148540; UVA/528035/ESS76/102) Avail: NTIS
HC \$5.50 CSCL 04B

Velocity profile measurements are determined on and around a barchan dune model inserted in the roughness layer on the

tunnel floor. A theoretical investigation is made into the factors influencing the rate of sand flow around the dune. Flow visualization techniques are employed in the mapping of streamlines of flow on the dune's surface. Maps of erosion and deposition of sand are constructed for the barchan model, utilizing both flow visualization techniques and friction velocities calculated from the measured velocity profiles. The sediment budget found experimentally for the model is compared to predicted and observed results reported. The comparison shows fairly good agreement between the experimentally determined and predicted sediment budgets.

Author

N76-28743# World Meteorological Organization, Geneva (Switzerland).

AUTOMATED METEOROLOGICAL SYSTEMS

1975 398 p refs Partly in ENGLISH and partly in FRENCH Proc. of WMO Tech. Conf. (Tecams), Washington, D. C., 14-19 Feb. 1975.
(WMO-420; ISBN-92-63-10420-4) Avail: NTIS HC \$10.75; WMO, Geneva Sw. Fr. 58

The conference was held to stimulate the timely exchange of information relating to design, test, and evaluation of new automatic and semi-automatic meteorological stations. Papers in the following items were presented: general aspects of automation, design problems, development of new sensors, operational experience, and stations for special purposes.

N76-28752 World Meteorological Organization, Geneva (Switzerland).

DATA QUALITY: A SYSTEMS APPROACH

G. W. Withee and W. C. Blasingame *In its* Automated Meteorol. Systems 1975 p 58-66 refs

Copyright.

An approach to the evaluation of data quality from synoptic automatic marine stations (buoys) is discussed. The method evaluates data quality by evaluating the impact to the data from all system components and system component/environment interactions. Examples are provided to show this technique can self-detect data quality deficiencies and can actually simplify the solution to data quality related problems. ESA

N76-28753 World Meteorological Organization, Geneva (Switzerland).

REQUIREMENTS OF MARINE METEOROLOGISTS [BESOINS DES METEOROLOGISTES MARITIMES]

J. M. Dury *In its* Automated Meteorol. Systems 1975 p 66-70 In FRENCH

Copyright.

The responses of 16 national members of the Commission de Meteorologie Maritime who replied to a circular letter regarding their requirements for automated system are analyzed. In general all were in favor of increased automation, however, further cost data was required. Suggestions made by various national members are listed and ship-board sensors and instruments are discussed. ESA

N76-28754 World Meteorological Organization, Geneva (Switzerland).

SOME TECHNICAL MEANS FOR OBTAINING HYDROMETEOROLOGICAL DATA UNDER CONDITIONS OF COMPLEX AUTOMATION OF SHIP OBSERVATIONS

A. D. Bogachev, A. A. Fokin, I. P. Kuzminih, A. G. Roschin, and V. P. Teslenko *In its* Automated Meteorol. Systems 1975 p 71-78

Copyright.

The importance of ship-born automated systems for collecting and processing hydrometeorological data is stressed and the characteristics of Mars-1 - a ship automatic weather station - and a hydrologic sound-bathometer are described. ESA

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N76-28759 World Meteorological Organization, Geneva (Switzerland).

THE DESIGN OF AN AUTOMATIC WEATHER STATION FOR THE ARCTIC OCEAN

R. J. Grauman and R. G. Catlin *In its Automated Meteorol. Systems* 1975 p 114-122 refs.
Copyright.

A real time environmental prediction system for the Beaufort Sea designed to collect data most strongly affecting the safety of drilling activities such as wind-waves and ice conditions, is discussed. The form of the station is described and specification guidelines for the instrumentation package are appended. ESA

N76-28793# Nebraska Univ., Lincoln. Agricultural Meteorology Section.

GREAT PLAINS EVAPOTRANSPIRATION BY A RESISTANCE MODEL USING REMOTELY SENSED THERMAL IMAGERY Progress Report

Norman J. Rosenberg, Blaine L. Blad, Shashi B. Verma, and Maximo W. Baradas Dec. 1975 165 p refs Sponsored in part by Kansas Agricultural Experimental Station, Manhattan, Kansas

(Contract DI-14-31-0001-4146)

(PB-250454/6; PR-75-3; OWRT-B-028-NEB(1); W76-05179)
Avail: NTIS HC \$6.75 CSCL 02D

The objectives of the project conducted in cooperation with the Kansas State University Evapotranspiration Laboratory were: (1) to test the utility of a resistance model for estimating evapotranspiration rates over large areas; (2) to determine the feasibility of obtaining ground and crop temperature data by remote sensing with infrared thermometry and the accuracy achievable by these means; and (3) to quantify the boundary layer resistance to diffusion as a function of crop height, crop roughness, and wind speed. Resistance models were tested in an extensive set of experiments conducted at Manhattan, Kansas using soybeans and sorghum; Mead, Nebraska using sorghum; and Scottsbluff, Nebraska using millet. GRA

N76-28820*# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.

MONITORING SPACECRAFT ATMOSPHERE CONTAMINANTS BY LASER ABSORPTION SPECTROSCOPY Final Technical Report, 1 Jan. 1974 - 31 Aug. 1976

J. I. Steinfeld 31 Aug. 1976 124 p refs

(Grant NGR-22-009-766)

(NASA-CR-148481) Avail: NTIS HC \$5.50 CSCL 06K

Laser-based spectrophotometric methods which have been proposed for the detection of trace concentrations of gaseous contaminants include Raman backscattering (LIDAR) and passive radiometry (LOPAIR). Remote sensing techniques using laser spectrometry are presented and in particular a simple long-path laser absorption method (LOLA), which is capable of resolving complex mixtures of closely related trace contaminants at ppm levels is discussed. A number of species were selected for study which are representative of those most likely to accumulate in closed environments, such as submarines or long-duration manned space flights. Computer programs were developed which will permit a real-time analysis of the monitored atmosphere. Estimates of the dynamic range of this monitoring technique for various system configurations, and comparison with other methods of analysis, are given. Author

N76-29665*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.

PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Progress Report, 12 Feb. - 11 May 1976

John W. Hannah (Brevard County Planning Dept., Titusville, Fla.), Garland L. Thomas (Brevard County Planning Dept., Titusville, Fla.), and Fernando Esparza, Principal Investigators 11 May 1976 19 p ref ERTS

(Contract NAS5-20907)

(E76-10435; NASA-TM-X-72965; BCPD-L2-5) Avail: NTIS HC \$3.50 CSCL 08B

N76-29666*# Brevard County Planning Dept., Titusville, Fla. **PLANNING APPLICATIONS IN EAST CENTRAL FLORIDA Final Report, 1 Jul. 1973 - 30 Jun. 1975**

John W. Hannah, Garland L. Thomas, Principal Investigators, and Fernando Esparza (NASA, Kennedy Space Center) 25 Aug. 1975 113 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (NASA Order C-30281-A)

(E76-10436; NASA-CR-139189; BCPD-E-8) Avail: NTIS HC \$5.50 CSCL 08B

N76-29668*# Tennessee Univ., Knoxville. Dept. of Geography.

THE VERIFICATION OF LANDSAT DATA IN THE GEOGRAPHICAL ANALYSIS OF WETLANDS IN WESTERN TENNESSEE Research Report, 21 Jul. 1975 - 21 Apr. 1976

John B. Rehder and Dale A. Quattrochi, Principal Investigators 21 Apr. 1976 59 p Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS8-31143)

(E76-10438; NASA-CR-144307) Avail: NTIS HC \$4.50 CSCL 05B

N76-29672*# Delaware Univ., Newark. Coll. of Marine Studies.

REMOTE SENSING OF COASTAL POLLUTANTS

V. Klemas, Principal Investigator, G. R. Davis, W. Whelan (ITT Electro-Physics Labs.), and G. Tornatore (ITT Electro-Physics Labs.) 24 Jul. 1976 2 p ERTS

(Contract NAS5-20983)

(E76-10442; NASA-CR-148519) Avail: NTIS HC \$3.50 CSCL 13B

N76-29673*# Science Applications, Inc., La Jolla, Calif. **DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM LANDSAT Progress Report, 1 May - 31 Jul. 1976**

M. Griggs, Principal Investigator 31 Jul. 1976 11 p ERTS (Contract NAS5-20899)

(E76-10443; NASA-CR-148520; SAI-76-691-LJ; PR-6) Avail: NTIS HC \$3.50 CSCL 04A

N76-29675*# West Virginia Dept. of Natural Resources, Charleston.

CONTRIBUTION OF ERTS-B TO NATURAL RESOURCE PROTECTION AND RECREATIONAL DEVELOPMENT IN WEST VIRGINIA Progress Report, 19 Mar. - 19 Jun. 1976

Ira S. Latimer, Jr., Principal Investigator 19 Jun. 1976 18 p refs ERTS

(E76-10445; NASA-CR-148522; PR-3) Avail: NTIS HC \$3.50 CSCL 08B

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

N76-29680* # Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

URBAN LAND USE MONITORING FROM COMPUTER-IMPLEMENTED PROCESSING OF AIRBORNE MULTISPECTRAL DATA

W. J. Todd, (EROS Data Center), P. W. Mausel, (Indiana St. Univ.), and M. F. Baumgardner 1976 7 p refs

(Contract NAS9-14016)

(NASA-CR-147789; LARS-I-N-032576) Avail: NTIS HC \$3.50 CSCL 08B

Machine processing techniques were applied to multispectral data obtained from airborne scanners at an elevation of 600 meters over central Indianapolis in August, 1972. Computer analysis of these spectral data indicate that roads (two types), roof tops (three types), dense grass (two types), sparse grass, (two types), trees, bare soil, and water (two types) can be accurately identified. Using computers, it is possible to determine land uses from analysis of type, size, shape, and spatial associations of earth surface images identified from multispectral data. Land use data developed through machine processing techniques can be programmed to monitor land use changes, simulate land use conditions, and provide impact statistics that are required to analyze stresses placed on spatial systems.

Author

N76-29741# Massachusetts Inst. of Tech., Cambridge.

DESIGN AND IMPLEMENTATION OF A DEMONSTRATION SUPPLEMENTARY CONTROL SYSTEM Progress Report, 1 Aug. 1974 - 31 May 1975

M. Ruane and B. Greene 1975 64 p refs

(Contract AT(11-1)-2428)

(COO-2428-4; PR-2) Avail: NTIS HC \$5.50

A Supplementary Control System (SCS) for maintaining acceptable ambient air quality was designed. The controlled pollutant is sulfur dioxide and the SCS design includes a real-time meteorology and air quality monitoring network, periodic weather forecasting, air quality modeling and a probabilistic control strategy. Four coal burning power plants (4800 MW) in the complex terrain near Chestnut Ridge in western Pennsylvania are controlled by the design, and control actions include fuel switching, load shifting and stack gas temperature modification. The design has been implemented and is beginning its field testing period. Nine months of field data have been collected by the monitoring system and several programs have been developed to sort and analyze the data. The 24 hour standard is threatened most frequently and the background influence of Pittsburgh and Johnstown can be significant. ERA

N76-29749# Aeronutronic Ford Corp., Newport Beach, Calif. **MONITORING NO AND CO IN AIRCRAFT JET EXHAUST BY A GAS-FILTER CORRELATION TECHNIQUE Final Report, 3 Mar. 1975 - 14 Jun. 1976**

David A. Gryvnak and Darrell E. Burch Wright-Patterson AFB, Ohio AFAPL Jan. 1976 71 p refs

(Contract F33615-75-C-2038)

(AD-A022353; U-6179; AFAPL-TR-75-101) Avail: NTIS CSCL 07/4

The exhaust from jet engines contains many pollutant gas species. At the present time a convenient, reliable method is needed to monitor their concentrations. There are many different methods available for determining concentrations of pollutant gases in the effluent from smokestacks, aircraft, automobiles and other pollutions sources. Each method has its merits and its difficulties depending on the application. A class of instruments employing gas-cell correlation spectroscopy to provide good sensitivity and specificity at relatively low cost has been developed for a variety of applications. An infrared instrument using a gas-filter correlation technique was used to in-situ monitor NO and CO in the exhaust plume of a T56 jet engine combustor.

The instrument, built previously by Aeronutronic Ford for EPA, to monitor pollutant gases in smokestack exhausts, was modified for use on the combustor. Temperatures and concentrations ranged from 300 to 930K and up to 130 ppm for NO; for CO from 300 to 550K and up to 220 ppm. Optical results were obtained simultaneously by withdrawing the sample using probe techniques and analyzing the gas with a conventional gas analyzer. GRA

N76-29759# Naval Postgraduate School, Monterey, Calif. **AN ANALYSIS OF THE MANAGEMENT INFORMATION SYSTEM FOR US COAST GUARD AIRCRAFT POLLUTION PATROLS M.S. Thesis**

Jerald Howard Heinz Dec. 1975 144 p refs

(AD-A021785) Avail: NTIS CSCL 13/2

The purpose of this thesis is to examine the present data collected and to evaluate its usage in respect to water pollution detection by Coast Guard aircraft patrols. It was found that, in general, more detailed and specific information is needed about the patrols. A system for collecting this new data and linking it to the present Pollution Incident Reporting System data base is proposed. The proposed system would allow evaluation of patrols at more specific areas and levels instead of the present district, coast and nationwide levels. Policy decisions could then be more specifically oriented to an area and/or the individual air station. GRA

N76-29772# Environmental Protection Agency, Washington, D.C. Office of Research and Development.

ENVIRONMENTAL RESEARCH OUTLOOK FOR FY 1976 THROUGH 1980: REPORT TO CONGRESS

Feb. 1976 166 p

(PB-250523/8; EPA-600/9-76-003) Avail: NTIS HC \$6.75 CSCL 13B

This report represents the first attempt by the Office of Research and Development (ORD) to present a 5-year overview of ORD's research program, priorities and trends. The report will be updated annually. This overview is broken into ORD's five major programs which are: Health and ecological effect; Industrial processes; Public service activities; Monitoring and technical support; and Energy/Environment. ORD's working agreements with other Federal Agencies are also briefly described. In the near-term ORD has given priority to strengthening the Health and Ecological Effects Program. Another priority area is the Industrial Processes Program where pollution control technology R&D is needed if the 1985 water quality goals are to be more closely met. Emphasis will also be placed on monitoring and quality assurance R and D which support Agency regulatory actions. Author (GRA)

N76-29800# Polar Research Lab., Inc., Santa Barbara, Calif. **ARCTIC RESEARCH IN ENVIRONMENTAL ACOUSTICS AREA. TECHNICAL REPORT 1: THE SYNRAMS ICE STATION Interim Report**

S. P. Burke and B. M. Buck 1 Jan. 1976 10 p refs Repr. from IEEE Ocean, vol. 75, 1975 p 413-417

(Contract N00014-74-c-0065; NR Proj. 307-355)

(AD-A021138; PRL-TR-4) Avail: NTIS CSCL 08/10

A low power, unattended, ice station for collecting data has been developed to collect synoptic environmental data in polar regions for a period of two years. An array of 10 of these ice stations was installed 250-550 nautical miles north of the Alaskan coast during the spring of 1975. In each station, 24 hours worth of the most recent data, made up of eight 32-bit words, are retained in memory for burst transmission to the RAMS (Random Access Measurement System) receiver in the polar orbiting NIMBUS-F satellite. Surface platform location to a CPE of about 5 KM is obtained through Doppler measurement of the transmitted signal. GRA

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

N76-29804# Naval Electronics Lab. Center, San Diego, Calif.
THE EVOLUTION OF THE CLEAR AIR CONVECTIVE LAYER REVEALED BY SURFACE-BASED REMOTE SENSORS
Technical Report, Sep. 1973 - Oct. 1975

V. R. Noonkester 5 Dec. 1975 35 p refs
(AD-A021585; NELC-TR-1971) Avail: NTIS CSCL 04/1

Simultaneous observations of the surface-based convection region by two microwave radars and an acoustic echosounder reveal new features of the daytime growth and decay of the convective layer. GRA

N76-29861*# Texas A&M Univ., College Station.
A SINGLE FIELD OF VIEW METHOD FOR RETRIEVING TROPOSPHERIC TEMPERATURE PROFILES FROM CLOUD-CONTAMINATED RADIANCE DATA

Donald B. Hodges Washington NASA Aug. 1976 103 p refs

(Contract NAS8-26751)
(NASA-CR-2726; M-174) Avail: NTIS HC \$5.50 CSCL 04B

An iterative method is presented to retrieve single field of view (FOV) tropospheric temperature profiles directly from cloud-contaminated radiance data. A well-defined temperature profile may be calculated from the radiative transfer equation (RTE) for a partly cloudy atmosphere when the average fractional cloud amount and cloud-top height for the FOV are known. A cloud model is formulated to calculate the fractional cloud amount from an estimated cloud-top height. The method is then examined through use of simulated radiance data calculated through vertical integration of the RTE for a partly cloudy atmosphere using known values of cloud-top height(s) and fractional cloud amount(s). Temperature profiles are retrieved from the simulated data assuming various errors in the cloud parameters. Temperature profiles are retrieved from NOAA-4 satellite-measured radiance data obtained over an area dominated by an active cold front and with considerable cloud cover and compared with radiosonde data. The effects of using various guessed profiles and the number of iterations are considered. Author

N76-29885# Environmental Prediction Research Facility (Navy), Monterey, Calif.

ISLAND BARRIER EFFECTS ON SEA STATE AND ATMOSPHERIC MOISTURE AS DETECTED BY A NUMERICAL WAVE MODEL AND SENSORS OF THE DEFENSE METEOROLOGICAL SATELLITE PROGRAM (DMSP)

R. W. Fett and Kevin Rabe Oct. 1975 69 p refs
(WF52551713)

(AD-A020304; EPRF-TP-18-75) Avail: NTIS CSCL 08/3

Bow wave effect, Swells Marine, DMSP Defense meteorological Satellite Program. Defense meteorological satellite program Island barrier effects on sea state and atmospheric moisture have been studied through use of numerical wave model and examination of data from the Defense Meteorological Satellite Program (DMSP). It is found that calm areas do not extend an appreciable distance downstream. However, swell refraction effects cause a reduction in swell height, a change in swell period, and a reorientation of swell direction, long distances to the island's lee, which may account for the satellite-observed reflective patterns noted in sunglint situations over those areas. Bow-wave effects appear to be similarly observed due to sunglint from reoriented swell patterns. In conditions of a strong low-level inversion, DMSP data, being sensitive to water vapor absorption, reveal dry plumes extending downwind from islands. These dry plumes are apparently caused by the islands drying effect on atmospheric flow as it passes over and is influenced by topographical features of the island barrier. Author (GRA)

N76-30620*# Federation of Rocky Mountain States, Inc., Denver, Colo.

A REGIONAL LAND USE SURVEY BASED ON REMOTE SENSING AND OTHER DATA Quarterly Report, 10 Apr. - 10 Jul. 1976

George Nez, Principal Investigator 10 Jul. 1976 31 p ERTS
(Contract NAS5-22338)

(E76-10449; NASA-CR-148526; QR-5) Avail: NTIS HC \$4.00 CSCL 08B

N76-30621*# Direccion de Cartografia Nacional, Caracas (Venezuela).

DEVELOPMENT OF TECHNIQUES TO SIMPLIFY THE PROCESS OF INVESTIGATION AND ESTIMATE OF NATURAL RESOURCES IN REMOTE AND RELATIVELY UNEXPLORED AREAS, VENEZUELA Final Report

Adolfo C. Romero, Principal Investigator 1976 153 p refs
Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10451; NASA-CR-148560) Avail: NTIS HC \$6.75 CSCL 08F

The author has identified the following significant results. Based upon the results obtained by both interpretations, radar and satellite, highly fractured zones were outlined and checked against geologic rock samples. Most of the rock samples were collected along the Ventuari River that crosses most of the project area from NE to SE. The structural orientation and fracture patterns were taken into consideration during the planning of flight lines, also the magnetic declination of the area. Most of the flight lines were oriented N 30 deg W across known structural trends; the altitude above ground was 450 feet, and the distance between lines was 3000 feet. The ERTS image permits the obtention of a panoramic vision of the area, and facilitates the exact delineation of major drainages. Topographic changes are easily observed. Rocky outcrops are easily distinguishable on band 5 and 7. Shrub vegetation zones are distinguishable on both bands, without possible separation of forest types, this is possible only when the physiographic conditions of small textural differences are taken into account.

N76-30629*# California Univ., Berkeley, Space Sciences Lab.

AN INVENTORY OF IRRIGATED LANDS FOR SELECTED COUNTIES WITHIN THE STATE OF CALIFORNIA BASED ON LANDSAT AND SUPPORTING AIRCRAFT DATA Quarterly Progress Report, 25 Apr. - 25 Jul. 1976

Robert N. Colwell, Principal Investigator, Sharon Wall, and Dennis Noren 25 Jul. 1976 14 p refs ERTS
(Contract NAS5-20969)

(E76-10461; NASA-CR-148592; SSL-Ser-17-Issue-61) Avail: NTIS HC \$3.50 CSCL 08B

N76-30633*# Nebraska Univ., Lincoln, School of Life Sciences.

APPLICATION OF REMOTE SENSING IN THE DETERMINATION OF WATER QUALITY IN NEBRASKA RESERVOIRS
Gary L. Hergenrader 22 Jul. 1976 11 p Sponsored by NASA

(NASA-CR-148776) Avail: NTIS HC \$3.50 CSCL 08H

In June, July, and August, 1975, ground truth was collected from Lake McConaughy, a 35,000 acre reservoir in western Nebraska, coincident with the overflights of LANDSAT. Water samples were collected on six different dates and analyzed for turbidity, suspended solids, and chlorophyll, parameters which had correlated well with CCT reflectances. The correlations and regressions reported were derived from data obtained on only three of the six sampling dates. The radiance values from each of the four spectral bands were printed out in the form of a map of Lake McConaughy. Reflectances in the various bands were then obtained from the map at the appropriate sampling sites. The dependent variables chlorophyll, suspended solids, and turbidity were compared to the independent variables - reflectances in the four bands - by regression analysis. Both multiple and univariate regressions were examined. It is concluded that CCT's from LANDSAT can be used to detect and quantify the water quality parameters suspended solids, turbidity, and chlorophyll. Author

N76-30634*# Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.

APPLICATION OF REMOTE SENSING IN ESTIMATING EVAPOTRANSPIRATION IN THE PLATTE RIVER BASIN Final Report, 1 May 1972 - 30 Apr. 1976

Blaine L. Blad and Norman J. Rosenberg. 30 Apr. 1976 36 p refs

(Grant NGL-28-004-020)

(NASA-CR-148775) Avail: NTIS HC \$4.00 CSCL 08H

A 'resistance model' and a mass transport model for estimating evapotranspiration (ET) were tested on large fields of naturally subirrigated alfalfa. Both models make use of crop canopy temperature data. Temperature data were obtained with an IR thermometer and with leaf thermocouples. A Bowen ratio-energy balance (BREB) model, adjusted to account for underestimation of ET during periods of strong sensible heat advection, was used as the standard against which the resistance and mass transport models were compared. Daily estimates by the resistance model were within 10% of estimates made by the BREB model. Daily estimates by the mass transport model did not agree quite as well. Performance was good on clear and cloudy days and also during periods of non-advection and strong advection of sensible heat. The performance of the mass transport and resistance models was less satisfactory for estimation of fluxes of latent heat for short term periods. Both models tended to overestimate at low LE fluxes. Author

N76-30645# Minnesota Univ., Minneapolis. Water Resources Research Center.

ENVIRONMENTAL ASSESSMENT AND DESIGN: PROCEEDINGS OF A SEMINAR

Beatrice F. Willard, Robert F. Post, Winston Borden, John Mohr, and George Hite Jan. 1975 60 p Presented at Environmental Assessment and Design Seminar, Arden Hills, Minn., 25-26 Nov. 1974

(PB-251909/8; WRRRC-Bull-78; W76-06555;

OWRT-A-999-MINN(34)) Avail: NTIS HC \$4.50 CSCL 13B

The purpose of this publication is to provide information on Federal and State (Minnesota) environmental impact statement requirements. Topics discussed include the intent of the environmental impact legislation, projects which require impact statements, and information which should be included in environmental impact statements. Case studies detailing positive and negative aspects of the environmental impact statement process are presented. Author (GRA)

N76-30682 Washington Univ., Seattle.

THE NATURE OF AEROSOL PARTICLES FROM A PAPER MILL AND THEIR EFFECTS ON CLOUDS AND PRECIPITATION Ph.D. Thesis

Edward Evans Hindman, II 1975 260 p

Avail: Univ. Microfilms Order No. 76-17495

A series of airborne measurements was made to determine if the paper mill at Port Townsend, Washington, is a significant source of large and giant cloud condensation nuclei (CCN) and to determine if these CCN alter the droplet size distributions of clouds located downwind of the mill. The field data were used as inputs to theoretical cloud models to calculate the effects of the CCN on cloud droplet size distributions and on the amounts of rainfall from model cumulus and stratus clouds. Dissert. Abstr.

N76-30689# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Inst. fuer Reaktionskinetik.

USE OF DIODE LASERS IN THE INFRARED SPECTRAL RANGE FOR DETERMINING POLLUTANT CONCENTRATIONS [BESTIMMUNG VON SCHADSTOFF-KONZENTRATIONEN MIT HILFE VON DIODEN-LASERN IM INFRAROTEN SPEKTRALBEREICH]

S. Kelm Dec. 1975 30 p refs In GERMAN

(DLR-IB-453-75/1) Avail: NTIS HC \$4.00

Concentrations of some air pollutants were determined using infrared diode laser spectroscopy. The function of the specially developed PbS(1-x)Se(x) diode laser is described and the measuring procedure is presented. The choice of the optimal infrared spectral range is discussed, and an estimation of the attainable lower concentration limit is given. It is shown that concentrations down to 1 ppm can be measured with this new technique which, compared to the corresponding visible light or ultraviolet technique, has the advantage that all contaminants, such as CO, NO, NO₂, N₂O, SO₂, H₂S, NH₃, HCN, and O₃ have absorption lines in the infrared. Moreover the equipment used is cheaper. The disturbance, in the infrared, of the H₂O and CO₂ absorption bands can be largely overcome by using short (10 cm) absorption paths. ESA

N76-30734 Columbia Univ., New York.

ON THE USE OF INFRASOUND TO MONITOR THE UPPER ATMOSPHERE - THE INFRASOUND TECHNIQUE Ph.D. Thesis

David Harold Rind 1976 408 p

Avail: Univ. Microfilms Order No. 76-17861

The approximate meteorological and oceanographic conditions for infrasound generation are investigated, as well as their location, followed by the theoretical effect of observed atmospheric parameters on the infrasound propagation. A discussion of concurrently generated ground motion, microseisms, is presented with a comparison to microbaroms, to allow for an independent estimate of source conditions. The observed amplitude variations of the recorded infrasound at Palisades, N.Y. are then introduced and related to upper atmosphere effects. Methods of height determination, involving the effects of dissipation, and recovery of the speed of sound at the reflection level are given; these constitute the basis of the infrasound technique. The infrasound observations are then utilized to provide information about wind and temperature effects in the upper atmosphere, and the results are compared with an independently derived model atmosphere. Dissert. Abstr.

N76-30770# National Science Foundation, Washington, D.C. Office for the International Decade of Ocean Exploration.

COASTAL UPWELLING ECOSYSTEMS ANALYSIS, CUE-1 METEOROLOGICAL ATLAS, VOLUME 2

R. D. Pillsbury, James J. O'Brien, and Andrew Johnson, Jr. Sep. 1974 196 p

(Contract NSF GX-28746)

(PB-251522/9; NSF/IDOE-75-97-Vol-2) Avail: NTIS HC \$7.50 CSCL 04B

The second of two meteorological atlases prepared from data collected in CUE-1 off Oregon during the summer of 1972 is presented. This volume contains the surface streamline analysis on a microscale chart for July and August, time series analysis of buoy gathered winds, and ATS-1 photographs. Mesoscale streamlines for the CUE-1 area were analyzed for August 1972 at 6-hour intervals. Also included are three hourly analyses for the period, 23-25 August, during which time additional sea breeze observations were made. GRA

N76-31610*# 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 Progress Report, Jan. - Mar. 1976

Nicolale Oprescu, Principal Investigator Apr. 1976 32 p refs Sponsored by NASA and Romanian Commission for Space Activities Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10452; NASA-CR-148561; DaDelta-1/1) Avail: NTIS HC \$4.00 CSCL 08F

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

N76-31613*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. 1: INVESTIGATION OF SOIL EROSION IN HOKKAIDO WHICH IS CAUSED BY THAWING OF SOIL WATER IN LATE SPRING Quarterly Progress Report, Apr. - Jun. 1976
Takakazu Maruyasu and Shigechika Hayashi, Principal Investigators (Natl. Agricultural Experiment Station, Hokkaido, Japan) 16 Aug. 1976 6 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10465; NASA-CR-148697) Avail: NTIS HC \$3.50 CSCL 04B

N76-31614*# Zurich Univ. (Switzerland). Dept. of Geography.
NATURAL RESOURCES INVENTORY AND LAND EVALUATION IN SWITZERLAND Quarterly Report
Harold Haefner, Principal Investigator 24 Jun. 1976 12 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10466; NASA-CR-148698; QR-4) Avail: NTIS HC \$3.50 CSCL 08F

The author has identified the following significant results. Using MSS channels 5 and 7 and a supervised classification system with a PPD classification algorithm, it was possible to map the exact areal extent of the snow cover and of the transition zone with melting snow patches and snow free parts of various sizes over a large area under different aspects such as relief, exposure, shadows etc. A correlation of the data from ground control, areal underflights and earth resources satellites provided a very accurate interpretation of the melting procedure of snow in high mountains.

N76-31615*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. INVESTIGATION OF VARIATIONS IN THE PROMINENT OCEANIC CURRENT, KUROSHIO Quarterly Report
Takakazu Maruyasu and Daitaro Shoji, Principal Investigators (Maritime Safety Agency, Tokyo) 1 Aug. 1976 7 p Sponsored by NASA ERTS
(E76-10467; NASA-CR-148699) Avail: NTIS HC \$3.50 CSCL 04B

The author has identified the following significant results. Rias shorelines are interpreted from the fine depiction of their complex features in the image of band 7. Sand beaches are discriminated from their linear nature, and the similarity of sand beaches among the all-band is very good.

N76-31616*# Science Univ. of Tokyo (Japan).
INVESTIGATION OF ENVIRONMENTAL CHANGE PATTERN IN JAPAN. APPLICATION OF LANDSAT-2 DATA TO ENVIRONMENTAL STUDIES IN COASTAL ZONE Quarterly Progress Report, Apr. - Jun. 1976
Takakazu Maruyasu and Hiroaki Ochiai, Principal Investigators (Toba Merchant Marine Coll., Toba City, Japan) 30 Jun. 1976 6 p ref Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10468; NASA-CR-148700) Avail: NTIS HC \$3.50 CSCL 04B

N76-31624*# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
WATER QUALITY MAP OF SAGINAW BAY FROM COMPUTER PROCESSING OF LANDSAT-2 DATA
R. H. Rogers, Principal Investigator and J. B. McKeon Aug. 1976 7 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center,

10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-20942)
(E76-10477; NASA-CR-148784; BSR-4241) Avail: NTIS HC \$3.50 CSCL 08H

N76-31635*# Fairey Surveys Ltd., Maidenhead (England).
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 3: REVIEW OF LAND USE SURVEYS USING ORBITAL IMAGERY IN THE USA
J. L. VanGanderen, Principal Investigator and B. F. Lock Mar. 1976 26 p refs Sponsored by NASA EREP
(E76-10491; NASA-CR-148797) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results: Techniques of preprocessing, interpretation, classification, and ground truth sampling were studied. It has shown the need for a low cost, low level technology, viable, operational methodology to replace the emphasis given in the U.S. to machine processing, which many developing countries cannot afford, understand, nor implement.

N76-31636*# Fairey Surveys Ltd., Maidenhead (England).
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 4: REVIEW OF LAND USE SURVEYS USING ORBITAL IMAGERY OUTSIDE OF THE USA
J. L. VanGanderen, Principal Investigator and B. F. Lock Apr. 1976 18 p refs Sponsored by NASA EREP
(E76-10492; NASA-CR-148798) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. Outside the U.S., various attempts were made to investigate the feasibility of utilizing orbital MSS imagery in the production of small scale land use maps. Overall, these studies are not as elaborate or extensive in their scope as the U.S. ones, and generally the non-U.S. investigators have employed nonsophisticated and less expensive techniques. A representative range of studies is presented to demonstrate the approaches and trends dealing with reprocessing, interpretation, classification, sampling, and ground truth procedures.

N76-31637*# Fairey Surveys Ltd., Maidenhead (England).
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 5: EXPERIMENTAL AND OPERATIONAL TECHNIQUES OF MAPPING LAND USE
J. L. VanGanderen, Principal Investigator and B. F. Lock 1976 58 p refs Sponsored by NASA EREP
(E76-10493; NASA-CR-148799) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. Scope of the preprocessing techniques was restricted to standard material from the EROS Data Center accompanied by some enlarging procedures and the use of the diazo process. Investigation has shown that the most appropriate sampling strategy for this study is the stratified random technique. A viable sampling procedure, together with a method for determining minimum number of sample points in order to test results of any interpretation are presented.

N76-31638*# Fairey Surveys Ltd., Maidenhead (England).
A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 6: A LOW-COST METHOD FOR LAND USE MAPPING USING SIMPLE VISUAL TECHNIQUES OF INTERPRETATION

J. L. VanGanderen, Principal Investigator and B. F. Lock Jun. 1976 32 p refs Sponsored by NASA EREP (E76-10494; NASA-CR-148800) Avail: NTIS HC \$4.00 CSCL 08B

The author has identified the following significant results. It was found that color composite transparencies and monocular magnification provided the best base for land use interpretation. New methods for determining optimum sample sizes and analyzing interpretation accuracy levels were developed. All stages of the methodology were assessed, in the operational sense, during the production of a 1:250,000 rural land use map of Murcia Province, Southeast Spain.

N76-31639*# Fairey Surveys Ltd., Maidenhead (England). **A METHODOLOGY FOR SMALL SCALE RURAL LAND USE MAPPING IN SEMI-ARID DEVELOPING COUNTRIES USING ORBITAL IMAGERY. PART 7: BIBLIOGRAPHY** J. L. VanGanderen, Principal Investigator and B. F. Lock Aug. 1976 41 p refs Sponsored by NASA EREP (E76-10495; NASA-CR-148801) Avail: NTIS HC \$4.00 CSCL 08B

N76-31642*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. **LANDSAT US STANDARD CATALOG, 1-31 MAY 1976** 31 May 1976 125 p (NASA-TM-X-74211; NTISUB/LU-76/005; GSFC/LU-76/005) Avail: NTIS HC \$5.50 CSCL 05B

The U.S. standard catalog lists U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm and frame on which the scene may be found is also given. Author

N76-31643*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. **LANDSAT NON-US STANDARD CATALOG, 1-31 MAY 1976** 31 May 1976 165 p (NASA-TM-X-74210; NTISUB/B/139-76/005; GSFC/LN-76/005) Avail: NTIS HC \$6.75 CSCL 05B

The non-U.S. standard catalog lists non-U.S. imagery acquired by LANDSAT 1 and LANDSAT 2 which has been processed and input to the data files during the referenced month. Data, such as date acquired, cloud cover and image quality are given for each scene. The microfilm roll and frame on which the scene may be found is also given. Author

N76-31645# Physics Lab. RVO-TNO, The Hague (Netherlands). **INFRARED SEA BACKGROUND RADIATION** C. E. vanHaersmaBuma Aug. 1975 111 p refs (PhL-1975-33; TDCK-66798) Avail: NTIS HC \$5.50

A computer model is described for the infrared radiation received by a detector aimed at the sea surface, taking into account emitted and reflected components of this radiation, atmospheric transmission and emission. Parameters involved are temperature, of sea and air, sea state, relative humidity and visibility, wind direction, position of the sun and clouds. The model is designed in order to study theoretically the influence of the respective parameters upon the radiation received. Author (ESA)

N76-31656# Environmental Protection Agency, Cincinnati, Ohio. Storm and Combined Sewer Section. **URBAN RUNOFF POLLUTION CONTROL PROGRAM OVERVIEW FY 1976** Richard Field, Anthony N. Tafuri, and Hugh E. Masters Mar. 1976 77 p (PB-252223/3; EPA-600/2-76-095) Avail: NTIS HC \$5.00 CSCL 13B

The report reviews EPA's Urban Runoff Pollution Control Research, Development, and Demonstration Program for the fiscal year of 1976 -- the basic pollution flood control and soil erosion problems created by urban runoff; governmental administration and incentive problems; EPA R&D organizational structure;

nationwide cost requirements to abate urban runoff pollution; and available abatement technology along with ongoing and perceived developments. General cost comparisons for urban runoff pollution control/treatment are given along with a specific example of a cost-effect solution for urban runoff pollution control by in-line storage in Seattle, Washington, and a simplified hypothetical plan for wet-weather flow pollution abatement for the Des Moines, Iowa area. GRA

N76-31723# European Space Agency, Paris (France). **THE DFVLR LIDAR SYSTEM 5** Christian Werner Apr. 1976 50 p refs Transl. into ENGLISH of 'Das DFVLR-Lidar-System 5', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-Mitt-75-17, 23 Sep. 1975 Original German report available from DFVLR, Cologne DM 16.80 (ESA-TT-278; DLR-Mitt-75-17) Avail: NTIS HC \$4.00

The system developed under contract of the Ministry of Technology of the Federal Republic of Germany is described. It is to be used for environmental protection (aerosol content of the atmosphere). The Lidar system consists of a ruby laser and a Newtonian telescope. It is mounted on a scanning pedestal. Each step in azimuth and elevation can be selected by stepping motors. An automatic data acquisition system is used for storing the data on magnetic tape. Author (ESA)

N76-31850# Royal Netherlands Meteorological Inst., De Bilt. **STUDY ON THE SYSTEM MIX OF RADIOSONDE AIRCRAFT AND SATELLITE OBSERVATIONS IN THE NORTH ATLANTIC REGION. OBSERVATIONAL CHARACTERISTICS AND DATA PROCESSING** H. M. deJong 1976 90 p refs (KNMI-WR-76-5) Avail: NTIS HC \$5.00

The space-based satellite radiance system (NOAA series) and the surface-based radiosonde/rawin and aircraft reporting systems, constituting the mix system are described. Special attention is paid to the monitoring of the performance of the air reporting system. Data processing before preparation of upper air charts and insertion in numerical weather prediction models is dealt with. A method to derive the absolute geopotential height in aircraft locations from all available data in the system mix is discussed. The evaluation of a geopotential theorem requires the introduction of some graph theoretical concepts in the network of available data points. The processed data, when subjected to an additional selection procedure and interpolation to the nearest standard pressure levels, together with updated satellite data, contribute to a better definition of the physical state of the atmosphere. Processing of meteorological data from aircraft equipped with automatic data acquisition units is discussed. Author (ESA)

N76-32054# National Oceanic and Atmospheric Administration, Washington, D.C. Environmental Data Service. **USER'S GUIDE TO ENDEX/OASIS: ENVIRONMENTAL DATA INDEX AND THE OCEANIC AND ATMOSPHERIC SCIENTIFIC INFORMATION SYSTEM** Jan. 1976 79 p (PB-252471/8; KOAIS-1; NOAA-76030204) Avail: NTIS HC \$5.00 CSCL 05B

The ENDEX (Environmental Data Index) and OASIS (Oceanic and Atmospheric Scientific Information System) provide to users a rapid, computerized referral to available environmental data files and published literature in the environmental sciences and marine and coastal resources, respectively. This publication describes the services offered from both ENDEX and OASIS, and how to use them. It gives their data bases for referral to various types of desired information. Sample search results and descriptions of subject index to the ENDEX/OASIS data bases are included. GRA

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

N76-32608*# California State Dept. of Water Resources, Sacramento.

[WATER QUALITY CONDITIONS IN SAN FRANCISCO BAY DELTA] Progress Report

Randall L. Brown, Principal Investigator 22 Sep. 1976 1 p ERTS

(Contract NAS5-20945)

(E76-10486; NASA-CR-148792; PR-5) Avail: NTIS HC \$3.50 CSCL 05B

N76-32617*# Arizona Univ., Tucson. Office of Arid Lands Studies.

APPLICATIONS OF REMOTE SENSING TECHNIQUES TO COUNTY LAND USE AND FLOOD HAZARD MAPPING

Robin B. Clark, Jeffery S. Conn, David A. Miller, and David A. Mouat Nov. 1975 35 p refs

(Grant NGL-03-002-313)

(NASA-CR-147978; Bull-12) Avail: NTIS HC \$4.00 CSCL 08B

The application of remote sensing in Arizona is discussed. Land use and flood hazard mapping completed by the Applied Remote Sensing Program is described. Areas subject to periodic flood inundation are delineated and land use maps monitoring the growth within specific counties are provided. Author

N76-32620*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

REMOTE SENSING IN MICHIGAN FOR LAND RESOURCE MANAGEMENT Annual Report, 1 Jun. 1975 - 31 May 1976

D. S. Lowe, L. B. Istvan, N. E. G. Roller, and V. L. Prentice Sep. 1976 78 p refs Original contains color illustrations

(Grant NGR-23-005-552)

(NASA-CR-148828; ERIM-193400-13-P) Avail: NTIS HC \$5.00 CSCL 08F

The Environmental Research Institute of Michigan is conducting a program whose goal is the large-scale adoption, by both public agencies and private interests in Michigan, of NASA earth-resource survey technology as an important aid in the solution of current problems in resource management and environmental protection. During the period from June 1975 to June 1976, remote sensing techniques to aid Michigan government agencies were used to achieve the following major results: (1) supply justification for public acquisition of land to establish the St. John's Marshland Recreation Area; (2) recommend economical and effective methods for performing a statewide wetlands survey; (3) assist in the enforcement of state laws relating to sand and gravel mining, soil erosion and sedimentation, and shorelands protection; (4) accomplish a variety of regional resource management actions in the East Central Michigan Planning and Development Region. Other tasks on which remote sensing technology was used include industrial and school site selection, ice detachment in the Soo Harbor, grave detection, and data presentation for wastewater management programs.

Author

N76-32632 Waterloo Univ. (Ontario).

REGIONAL MAPPING AND CLIMATIC INFLUENCE IN DATA TRANSFER METHODS

S. I. Solomon *In* WMO Hydrol. Network Design and Inform. Transfer 1976 p 57-62 refs

Copyright.

Regional mapping - the delineation on maps of regions having a common hydrological property - can be used in data transfer and network planning at three levels of sophistication: simple presentation of recorded or processed data; isoline, polygon or digital maps; multiregionalization. The latter - designated as model-homogeneous regions in Canada - are discussed with, in particular, consideration of climatic factors. ESA

N76-32634 World Health Organization, Geneva (Switzerland).

PROBLEMS OF WATER QUALITY MONITORING

R. Helmer *In* WMO Hydrol. Network Design and Inform. Transfer 1976 p 91-98

Copyright.

The major components and methods of water quality monitoring are reviewed and the present state of water quality monitoring is discussed. WMO activities in the water quality monitoring field are summarized. ESA

N76-32724# National Bureau of Standards, Washington, D.C.

FLUORESCENCE MEASUREMENTS OF CARCINOGENIC AND POLYCYCLIC AROMATIC HYDROCARBONS IN WATER Final Report

Frederick P. Schwarz and Stanley P. Wasik 1976 7 p refs Presented at the Intern. Conf. on Environ. Sensing and Assessment, Las Vegas, 14-19 Sep. 1975

(PB-252734/9) Avail: NTIS HC \$3.50 CSCL 07C

The application of spectrofluorimetry to the measurement and identification of polycyclic aromatic hydrocarbons (PAH) in aqueous solutions was investigated. At naperian absorbances < 0.05 , the fluorescence intensities of solutions containing naphthalene, anthracene, pyrene, and fluoranthene in water are a superposition of the component fluorescence spectra. At the higher PAH optical densities of the mg/l level and when viewed perpendicular to the excitation light, the fluorescence spectra vary unpredictably with the concentration. The PAH fluorescence intensity is unaffected by the presence of sodium chloride at sea water concentrations and by the presence of mg/l concentrations of iron, zinc, cobalt, or nickel cations in the water. GRA

N76-32757# Chicago Univ., Ill. Dept. of Geophysical Sciences.

ANALYTICAL SOLUTION OF A MODEL RADIATIVE EQUATION ARISING IN ATMOSPHERIC SOUNDING

Victor Barcilon Mar. 1976 29 p refs

(Contract N00014-76-C-0034; NR Proj. 041-476)

(AD-A023483) Avail: NTIS CSCL 04/2

The problem of inferring the thermal structure of the atmosphere by means of remote sensing is considered within the context of a model transmission function. An analytical solution is derived for a large class of outgoing radiances. The model seems capable of yielding a tropopause. It also yields a formula for the surface temperature. GRA

N76-32759# Colorado State Univ., Fort Collins. Dept. of Earth Resources.

A COMPARISON OF MODELS FOR COMPUTING ATMOSPHERIC INFRARED TRANSMISSION Final Report

David S. Renne May 1975 157 p refs

(Grant NOAA-03-3-022-85)

(PB-253551/6) Avail: NTIS HC \$6.75 CSCL 04A

In 1973 an intensive research effort called SCARP produced a unique set of infrared radiometric data to compare the performance of several atmospheric infrared radiative transfer models. The models were described in detail and were shown to differ primarily in the manner in which the transmissivities for the various gaseous constituents of the atmosphere are computed. The models were compared with observed profiles of apparent surface temperature obtained with airborne radiometers during the SCARP experiment over various test sites in the southern United States. The models were also compared with Skylab infrared spectrometric data. Error and sensitivity analyses showed that the models are quite sensitive to the moisture profile data used as input, and to the selection of surface temperature. In conclusion it was noted that aerosols do not appear to have a significant effect on the computations of infrared transmission in the window region based on SCARP data. GRA

N76-33588# Oak Ridge National Lab., Tenn.
NATIONAL ENVIRONMENTAL SPECIMEN BANK SURVEY
Final Report, Jun. - Jul. 1975
 R. I. VanHook and E. E. Huber Jan. 1976 213 p Sponsored
 in part by NSF, Washington, D. C.
 (PB-251180/6; EPA-600/1-76-006) Avail: NTIS HC \$7.75
 CSCL 05B

The data base developed in the National Environmental Specimen Bank (NESB) Survey is presented. The mailing list consisted of 4500 names and addresses. The 657 environmental specimen collections that were located and documented include the following categories: animal, atmospheric geological, micro-biological, plant and water. The majority of the collections identified are biological in nature. Three indexes of the NESB Survey Data Base are included. GRA

N76-33590*# Kentucky Dept. of Natural Resources and Environmental Protection, Frankfort.
[ENVIRONMENTAL EFFECTS OF STRIP MINING] Quarterly Progress Report, 21 Nov. 1975 - 21 Feb. 1976
 Birny R. Fish, Principal Investigator 21 Feb. 1976 5 p
 Sponsored by NASA ERTS
 (E76-10481; NASA-CR-148788; QPR-4) Avail: NTIS
 HC \$3.50 CSCL 05B

N76-33591*# Army Construction Engineering Research Lab., Champaign, Ill.
EFFECTS OF CONSTRUCTION AND STAGED FILLING OF RESERVOIRS ON THE ENVIRONMENT AND ECOLOGY
Progress Report, 1 Jul. - 30 Sep. 1976
 R. K. Jain, Principal Investigator 21 Oct. 1976 7 p ERTS
 (E76-10498; NASA-CR-148753) Avail: NTIS HC \$3.50 CSCL
 08H

N76-33593# Spangle (William) and Associates, Portola Valley, Calif.
EARTH-SCIENCE INFORMATION IN LAND-USE PLANNING: GUIDELINES FOR EARTH SCIENTISTS AND PLANNERS
 1976 34 p refs Sponsored in part by USGS and HUD Prepared in cooperation with Leighton (F. Beach) and Associates; and Baxter, McDonald and Company
 (USGS-Circ-721) Avail: NTIS HC \$4.00

A set of general guidelines for utilizing earth science information (ESI) in land use planning is presented. The types and sources of ESI available and techniques for applying it to planning are discussed. The requirements of planners and how ESI can be made more useful to them are also defined. D.M.L.

N76-33597*# Geological Survey, Denver, Colo.
APPLICATIONS OF SKYLAB EREP PHOTOGRAPHS TO MAPPING LANDFORMS AND ENVIRONMENTAL GEOMORPHOLOGY IN THE GREAT PLAINS AND MIDWEST
Final Report, 1 Jan. 1974 - 15 Aug. 1975
 Roger B. Morrison, Jerry A. Lineback (Ill. State Geol. Survey), H. Kit Fuller, and Richard K. Rinkenberger 15 Aug. 1975
 125 p refs
 (NASA Order T-4647-B)
 (NASA-CR-144491; EREP-491) Avail: NTIS HC \$5.50 CSCL
 08B

The following evaluations of Skylab photographs were undertaken: (1) the 1290 Skylab S190A and S190B photographs of Illinois, Iowa, Kansas, Missouri, Nebraska, and South Dakota were evaluated in detail in terms of coverage, cloud cover, photographic quality, endlap, detectability of roads and stereorelief,

and utility for geomorphologic mapping, and (2) the utility of the Skylab photos were tested for interpretive analytic mapping of geomorphologic features over large areas representative of different parts of this region. Photointerpretative maps of analytic geomorphology were obtained for various test areas representative of the varied landscapes in the region. These maps are useful for regional land-use planning, ground-water exploration, and other environmental geomorphologic-geologic applications. Compared with LANDSAT-1 MSS images, Skylab photos afford almost as extensive overviews of large areas but in considerably greater detail, and for many SL photos, moderate stereorelief. However, repetitive multiseasonal, cloud-free coverage by high-quality photos is very limited and many areas have no coverage at all. Author

N76-33599*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
MESOSCALE TEMPERATURE AND MOISTURE FIELDS FROM SATELLITE INFRARED SOUNDINGS
 Donald W. Hillger and Thomas H. VonderHaar May 1976
 75 p refs Presented at COSPAR Symp. on Meteorological Observations from Space, Jun. 1976 Sponsored in part by Bureau of Reclamation
 (Grant NGR-06-002-102)
 (NASA-CR-148993; ASP-249) Avail: NTIS HC \$4.50 CSCL
 04A

The combined use of radiosonde and satellite infrared soundings can provide mesoscale temperature and moisture fields at the time of satellite coverage. Radiance data from the vertical temperature profile radiometer on NOAA polar-orbiting satellites can be used along with a radiosonde sounding as an initial guess in an iterative retrieval algorithm. The mesoscale temperature and moisture fields at local 9 - 10 a.m., which are produced by retrieving temperature profiles at each scan spot for the BTPR (every 70 km), can be used for analysis or as a forecasting tool for subsequent weather events during the day. The advantage of better horizontal resolution of satellite soundings can be coupled with the radiosonde temperature and moisture profile both as a best initial guess profile and as a means of eliminating problems due to the limited vertical resolution of satellite soundings. Author

N76-33600# Oak Ridge National Lab., Tenn.
DEFINING OF INDUSTRIAL LOCATION CRITERIA AT THE SITE LEVEL: AN EMPIRICAL ANALYSIS USING AERIAL PHOTOGRAPHY
 R. B. Honea 1975 34 p refs Presented at Proc. of Am. Soc. of Photogrammetry, Phoenix, Ariz., 26 Oct. 1975. Sponsored by ERDA
 (CONF-751064-2) Avail: NTIS HC \$5.00

The advantages of aerial photography in the selection of industrial sites are discussed. Applications in the regional analysis of land use for a 6,500 square mile area in East Tennessee are presented. ERA

N76-33719# Sandia Labs., Albuquerque, N.Mex.
HEAVY METALS IN ESTUARINE BENTHIC ORGANISMS AND SEDIMENTS: DATA AND MODEL
 J. R. Wayland, J. H. Baker, J. T. Ivy, and C. A. Bedinger, Jr. 5 Sep. 1975 32 p refs Presented at 3d ERDA Environ. Protection Conf., Chicago, 23 Sep. 1975 Sponsored by ERDA (SAND-75-5869; Conf-750967-14) Avail: NTIS HC \$4.75
 A dynamic model was developed in close association with a detailed environmental surveillance program of an estuarine ecosystem. The program and model traces the heavy metals from release into the water column and subsequent interactions between the air-water interface, pelagic zone, and sediments. The interaction between phytoplankton, zooplankton, benthic organisms, and predators is accounted for. The results of the calculations are compared to measurements taken in an estuarine ecosystem over a two-year period. Author (ERA)

02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

N76-33751# National Oceanic and Atmospheric Administration, Washington, D.C. Outer Continental Shelf Task Force.
THE ENVIRONMENTAL QUALITY MONITORING REPORT
Feb. 1976 66 p
(PB-254020/1; NOAA-76041305) Avail: NTIS HC \$4.50 CSCL 08J

General requirements for environmental quality monitoring are defined, including strategies, certain general methodologies, management coordination with the program as well as with other programs, necessary research and development, and required resources. The area bounds for monitoring extend from approximately mean high water on the coast, tidal waters of estuaries, across the Continental Shelf, and over the adjacent Continental slope where pollutant transport is likely. GRA

N76-33779*# Kanner (Leo) Associates, Annapolis, Md.
CERTAIN ACTUAL PROBLEMS IN THE THERMAL SOUNDING FROM A SATELLITE
V. A. Golovko Washington NASA Oct. 1976 92 p. refs
Transl. into ENGLISH of "Nekotoryye Aktualnyye Voprosy Termicheskogo Zondirovaniya s ISZ" Moscow, Acad. of Sci. USSR, report, 1976 p 1-108
(Contract NASw-2790)
(NASA-TT-F-17252) Avail: NTIS HC \$5.00 CSCL 04A

The current state of the problem of thermal sounding of the atmosphere from satellites is described. The numerical solution of the reverse problem is discussed within the framework of the statistical approach. Other topics discussed include optimization of conditions of spectroradiometric measurements, problems of the stability of the solution of the reverse problem, investigation of the characteristics of carbon dioxide gas absorption and practical methods of measurement of the spectrum and processing of spectral information allowing restoration of the three-dimensional field of temperature on a global scale. Author

N76-33786# Laboratorio di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio, Frascati (Italy).
ATMOSPHERIC TRANSPARENCE MEASUREMENT IN THE MEDIUM INFRARED [MISURE DI TRASPARENZA ATMOSFERICA NEL MEDIO INFRAROSSO]
V. Pericoli and P. Saraceno Apr. 1975 37 p refs In ITALIAN
(LPS-75-10) Avail: NTIS HC \$4.00

The atmospheric transparency over Frascati in the near and medium infrared range (from 2 to 20 microns) was measured in order to determine the limits of astronomical measurements carried out from the ground in this range of spectrum and to improve the knowledge of the seasonal variation of atmospheric transparency. The experimental equipment is described and the experimental data discussed. ESA

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A76-38512 **Development and experimental work of photogrammetric cadastral survey in Taiwan, Republic of China.** H.-S. Shih (National Cheng Kung University, Tainan, Nationalist China). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 198-206.

Results are presented for a photogrammetric cadastral survey of an 18-hectare small area on southwestern Tainan, Taiwan, to determine how accurate the photogrammetric measurement is on signalized points and what percentage of boundary stones can be identified and measured in the pictures at suburban areas mixed with rice fields and fish ponds. The signalized boundary corners were measured by Zeiss C8 four times for each point in different directions. After all machine coordinates were measured, all of them were transformed by the Helmert transformation formula to terrain coordinates. The results are quite satisfactory, the standard error of distance measurement and area calculation being plus or minus 3.9 cm and 0.902 sq m, respectively. Recommendations for implementation of the whole project are set forth. S.D.

A76-38529 **Landsat-1 data as an added dimension in the mapping of Arctic ecology.** A. Falconer and D. M. Lavigne (Guelph University, Guelph, Ontario, Canada). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 572-581. 10 refs. National Research Council of Canada Grants No. A-9688; No. A-7952.

An investigation is conducted regarding the significance of Landsat as a multidisciplinary data source on a regional and seasonal basis which can add a new and dynamic component to the mapping of Arctic ecology. The sensors on Landsat provide data which can be interpreted for vegetation, hydrology, geological information, ice, and snow conditions. Habitats for aquatic species, large mammals, or a group of species associated with a given vegetation type or biophysical region can be delineated at the appropriate scale. The described study illustrates this for a number of different conditions. Attention is given to the west-coast of Banks Island, the Mackenzie delta, and the Boothia Peninsula. G.R.

A76-38531 **Flood plain mapping - Photogrammetric data for hydrology.** J. T. Dozzi (Mark Hurd Aerial Surveys, Inc., Minneapolis, Minn.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 633-639.

A description is given of investigations which have been conducted in connection with a project that had been undertaken to study the feasibility of an application of current photogrammetric procedures in flood plain management programs. An area including the Baraboo River in Wisconsin was selected for this project. Approaches for obtaining suitable aerial photographs are discussed and the plotting of the flood plain limits is considered. Attention is given to the selection of control points, aspects of aerotriangulation, the aerial mosaic, the cross sections, and the preparation of an orthophotograph. G.R.

A76-39062 **Hot spots on the earth's surface.** K. C. Burke (New York State University, Albany, N.Y.) and J. T. Wilson (Ontario Science Centre, Don Mills, Ontario, Canada). *Scientific American*, vol. 235, Aug. 1976, p. 46-57.

Stationary hot spots, regions of unusual volcanic activity, appear to provide a frame of reference for determining which tectonic plates are stationary and which are moving and may provide or contribute to the mechanism responsible for the fragmentation of continents. The source of a hot spot volcano is thought to be a plume rising from deep within the mantle in a region which is isolated from convection currents. Lavas from hot spot volcanos are basalts, containing higher concentrations of the alkali metals than lavas characteristic of plate-margin volcanism. A lithospheric plate moving over a hot spot leaves a trail of volcanos, the age of which increases with increasing distance from the present site of volcanic activity. Domes, often associated with volcanos, form when a continent remains stationary over hot spots. Rifts tend to develop in the domes in a characteristic three-armed pattern, with two of the arms widening and eventually becoming the basin of an ocean. Africa, which has apparently been stationary over the mantle for 30 million years, bears extensive evidence of rifting and doming, indicating that it may be in the early stages of disintegration. C.K.D.

A76-39075 **The new adjustment of the North American Horizontal Datum.** J. D. Bossler (NOAA, Office of National Geodetic Survey, Washington, D.C.). *EOS*, vol. 57, Aug. 1976, p. 557-562. 15 refs.

The paper describes the main goal and technical features of a project for defining a new datum of horizontal control, called the North American Datum. The new datum will not be related to a single point, as was done in the original North American 1927 Datum, but to numerous stations whose positions have been determined from satellites or other superprecise methods. These stations will be introduced into the adjustment as observed values, assigned appropriate weights, and permitted to accept corrections. A report is given on the status of processing triangulation for the new adjustment, and the enormity of the task of processing several hundred thousand observations is outlined. The problem of determining the accuracy of the observations is discussed along with the nature of planned field operations and international participation. P.T.H.

A76-40780 **Inference of tectonic evolution from Landsat-1 imagery.** N. Spoljarić, R. R. Jordan (U.S. Geological Survey, Newark, Del.), and R. E. Sheridan (Delaware University, Newark, Del.). (*American Society of Photogrammetry, Annual Convention, Washington, D.C., Mar. 9-14, 1975.*) *Photogrammetric Engineering and Remote Sensing*, vol. 42, Aug. 1976, p. 1069-1082. 23 refs.

The paper discusses the tectonic disturbances in the area of the Delmarva Peninsula that occurred during the Holocene and part of Tertiary time on the basis of Landsat-1 imagery, subsurface geology, and geomorphology. Attention is focused on lineaments and basement faults, subsurface tertiary structural features, evidence for vertical movements and the tilt of the Peninsula, Atlantic marginal geosyncline, and tectonic activity and recent earthquakes. Most Landsat-1 lineaments, faults, and other linear features on the Delmarva Peninsula seem to be related to a system of compressional and tensional shear zones. Tectonic activity along these shear zones has been going on at least since Tertiary time. The observed numerous earthquakes suggest that the tectonic evolution of the Peninsula is still in progress. S.D.

A76-42686 **A new method of mapping worldwide potential contours for ground magnetic perturbations - Equivalent ionospheric current representation.** Y. Kamide, M. Kanamitsu (National Center for Atmospheric Research, Boulder, Colo.), and S.-I. Akasofu (Alaska University, Fairbanks, Alaska). *Journal of Geophysical Research*, vol. 81, Aug. 1, 1976, p. 3810-3820. 32 refs. NSF Grant No. DES-74-23832.

A method is proposed for computer mapping of the worldwide potential contours for ground magnetic perturbations. The method includes digitization of the magnetic perturbation values by taking a suitable base level at each observatory, transformation from these coordinates into a common geomagnetic system, interpolation of the field values to provide values at a regular network of points, and computation of the magnetic potential at each grid point to determine the associated current system in the ionosphere. A series of the isopotential contours is also shown in order to examine how the potential pattern changes during polar magnetic substorms. A recurrent feature of the polar magnetic substorm is that a significant part (about one third) of the equivalent current flow originating in the westward auroral jet flows in the evening sector at middle and low latitudes. S.D.

A76-42726 The early history of the earth; Proceedings of the Advanced Study Institute, University of Leicester, Leicester, England, April 5-11, 1975. Institute sponsored by NATO. Edited by B. F. Windley (Leicester, University, Leicester, England). London and New York, Wiley-Interscience, 1976. 628 p. \$45.

The papers collected are devoted to latest findings and theories concerning early earth history in the period 4.5-2.5 billion years ago. The topics discussed include the early earth-moon system, general Archaean tectonics, geological data from high-grade regions, the greenstone belts, tectonic relations between high- and low-grade regions, age and isotope constraints for the evolution of Archaean crust, Archaean thermal regimes, geochemistry of Archaean rocks, paleomagnetic pole positions from West Greenland in the Late Archaean-Early Proterozoic, mineralization in Archaean provinces, Archaean crustal history in different regions of the earth, Archaean atmosphere and evolution of the terrestrial oxygen budget, the evolution of seawater, and evidence of Archaean life. P.T.H.

A76-42999 # Spectral reflectance and the non-uniform topographic surface. R. L. Frederking, S. A. Mundy, and T. R. West (Purdue University, Lafayette, Ind.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 3, Apr. 1976, p. 23-32. 16 refs. U.S. Department of Transportation Contract No. FH-11-7565.

In general, multispectral scanner investigations of the spectral reflectance of the earth surface neglect the influence of the topographic factor, considering it an element of noise. This leads to the assumption of topographic independence which considers the reflecting geomorphic surface as equivalent to a uniform plane in time dependent orientation with respect to the source of radiation (the sun). This paper maintains that the assumption of a uniform plane may be acceptable where local topographic relief and dissection are minimal (e.g., agricultural investigations), but that this assumption may be violated as new data reduction procedures are extended into areas of increasing topographical complexity. Aircraft and Landsat multispectral scanner data from physiographically diverse test sites in California, Colorado and Kansas were regressed on spatially corresponding estimates of topographic variation in a stepwise manner. Findings suggest that the assumption of a uniform plane is valid for Kansas, but seriously violated for California and Colorado. B.J.

A76-43000 # Remote sensing and archaeology - A preliminary bibliography. L. Kruckman (Humboldt State University, Arcata, Calif.). *Remote Sensing of the Electro Magnetic Spectrum*, vol. 3, Apr. 1976, p. 33-45. 199 refs.

A76-43478 Spherical harmonic analysis of the geomagnetic secular variation - A review of methods. D. R. Barraclough (Institute of Geological Sciences, Hailsham, Sussex, England). *Physics of the Earth and Planetary Interiors*, vol. 12, no. 4, Sept. 1976, p. 365-382. 59 refs.

The paper reviews 91 published spherical-harmonic models of the geomagnetic secular-variation field and discusses the methods used in their production. The models refer to epochs extending from 1650 to 1975; 48 are based solely or mainly on observatory annual means, 23 are derived from charts of the geomagnetic field and its secular variation, and 15 are based on survey data (five of these are derived entirely from satellite observations). Three procedures for deriving the secular-variation information are described along with eight methods of spherical-harmonic analysis. Some of the more recent models are examined in detail. It is concluded that: (1) the iterative method and the direct version of Gauss' (1839) method extended to incorporate nonlinear elements seem to be of current usefulness, (2) the major problem involved in producing accurate models is the poor distribution of observatory annual means, and (3) the best way of producing accurate models appears to be a combination of some of the methods described. F.G.M.

A76-43734 Analysis of impact craters from the S-149 Skylab experiment. D. S. Hallgren (Dudley Observatory, Albany, N.Y.) and C. L. Hemenway (New York, State University, Albany, N.Y.). In: *Interplanetary dust and zodiacal light; Proceedings of the Colloquium, 31st, Heidelberg, West Germany, June 10-13, 1975*. Berlin and New York, Springer-Verlag, 1976, p. 270-274. 5 refs.

Analysis of craters found on polished plates exposed during the Skylab mission has provided data for a flux measurement over the mass range from 10 to the -15th to 10 to the -17th power gm. Chemical analysis of residues in the craters shows a high incidence of aluminium. A variety of morphological forms is described. (Author)

A76-43843 # Geodetic equations in a spatial topocentric system of coordinates (Geodezicheskie uravneniia v prostranstvennoi topotsentricheskoj sisteme koordinat). M. M. Mashimov. *Geodeziia i Aerofotos'emka*, no. 1, 1976, p. 41-49. 8 refs. In Russian.

The paper examines geodetic equations in topocentric horizon and equatorial systems of coordinates, and presents a general method for coordinate transformation, taking account of correction of reduction, systematic and random measurement errors. The equations considered refer to the determination of orientation and astronomical azimuth, satellite linear-angular triangulation, and quasar radio interferometry. B.J.

A76-44152 Geodynamics project: USSR programme. Edited by V. V. Belousov, N. A. Belaeviskii, and V. N. Zharkov. Moscow, Soviet Geophysical Committee of the Academy of Sciences, 1976. 164 p.

This book discusses the program to be undertaken by Soviet scientists participating in the International Geodynamical Project, which will investigate the motion of the earth's outer layers, processes occurring within them, and the forces affecting the crust tectonically, magmatically, and metamorphically. The main areas of research in the Soviet program include: the dynamics of the crust and mantle in the western and eastern parts of the Pacific Ocean; the geodynamics and paleogeodynamics of the Alpine-Himalayan folded region within the USSR and adjacent parts of western Europe and southwestern Asia; the geodynamics of continental and oceanic rifts, especially the Baikal Rift Zone; laboratory studies of the physical properties of earth's interior; modeling of internal processes reflected on the surface as tectonic phenomena; the distribution and nature of nonorogenic crustal motions; relations between oceanic and continental crustal structures, primarily in the Kurile-Kamchatka and Benioff zones; interactions among different types of continental endogenous (i.e., tectonic) processes; geomagnetic studies of earth's evolution and the paleotectonic reconstruction of lithospheric plates; and effects of geodynamics on the distribution of useful minerals in earth's crust. F.G.M.

A76-44400 # Relationship between low-energy proton fluxes and variations of the earth's magnetic field (O sviazii potokov maloenergiichnykh protonov s variatsiami magnitnogo polia zemli). S. N. Kuznetsov, Iu. I. Logachev, S. P. Riumin, and S. K. Stolboushkin. *Kosmicheskie Issledovaniia*, vol. 14, July-Aug. 1976, p. 646, 647. 6 refs. In Russian.

An attempt is made to determine the relationship between the magnitude of interplanetary protons with energies ranging from 28 to 120 KeV, measured by the Prognos 3 satellite, and the Dst variations of the geomagnetic field, determined by Sugiura and Poros (1973). The reason for the study is the observation that, during the main phase of a magnetic storm, the energies of particle fluxes in the circular current increase to 300 keV, and that interplanetary protons with energies of about 30 keV passing through the magnetosphere will increase their energy tenfold, contributing thereby to the circular current. The magnitude of the proton flux may then correlate with the magnetic field depression in the equatorial region. The high value of the correlation coefficient obtained from the analysis indicates that low-energy interplanetary protons penetrating the magnetosphere do contribute to the formation of the ring current. V.P.

A76-45078 # The development of remote aerospace techniques for landform mapping in Bulgaria (Razvitiie na distantsionnii aero- i kosmicheski metodi za izsledvane na zemiata u nas). D. N. Mishev. *B'lgarska Akademiia na Naukite, Spisanie*, vol. 22, no. 2, 1976, p. 55-65. 37 refs. In Bulgarian.

Methods and equipment for remote sensing of landforms and land mapping and for utilization of remotely sensed data, developed independently in Bulgaria, are reviewed. Controlled and adaptively controlled systems for utilizing spectral data, spectrophotometers using volume phase holograms, instruments using spectral reflectance characteristics, and photomosaic mapping techniques are mentioned. Land resources inventory missions, numerical mapping, orthoscopic mapping, analytical aerotriangulation, remote tectonic analysis, explorations of gas and oil occurrences by remote means, and remote geomorphostructural analyses are discussed. Examples cited include tracing of faults and arched uplifts, aerospace surveys of earthquake epicenters checked against ground truth, mapping of gravitational and magnetic field distributions, and checking of a canal excavation route. R.D.V.

A76-45217 # Precomputation of accuracy for geometrical landscape models derived from aerial photographs (Predvychislenie tochnosti pri postroenii po aerosnimkam geometricheskikh modelei mestnosti). Iu. S. Tiuflin (Tsentral'nyi Nauchno-Issledovatel'skii Institut Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *Geodeziia, Kartografiia i Aerofotos'emka*, no. 23, 1976, p. 116-122. In Russian.

The paper presents computed rms errors in space coordinates of landmarks and points of geometric landscape models, constructed from overlapping vertical aerial photographs (60% longitudinal overlapping). Error curves are plotted for different variants of aerial surveys. The curves may be used as nomographs for determining rms errors of space coordinates from given values of the focal length and photographic height. S.N.

A76-45532 * New vertical geodesy. J. H. Whitcomb (California Institute of Technology, Pasadena, Calif.). *Journal of Geophysical Research*, vol. 81, Sept. 10, 1976, p. 4937-4944; Comment, p. 4945, 4946. 23 refs. Contract No. JPL-49-681-02081-0-8260.

The paper contains a review of the theoretical difference between orthometric heights and heights labeled geometric which are determined through use of an extraterrestrial frame of reference. The theory is supplemented with examples which portray very long baseline interferometry as a measuring system that will provide estimates of vertical crustal motion which are radically improved in comparison with those obtained from analysis of repeated geodetic levelings. The example of the San Fernando earthquake of 1971 is

used to show how much estimates of orthometric and geometric height change might differ. A comment by another author is appended which takes issue with some of the conclusions of this paper. In particular, an attempt is made in the comment to rebut the conclusion that geodetic leveling is less reliable than VLBI measurements for determining relative elevation change of points separated by more than 56 km. B.J.

A76-45956 # Delineation of active faulting and some tectonic interpretations in eastern Alps - Use of Landsat-1 and 2 imagery. R. P. Gupta and J. Mithack (Deutsche Forschungsgemeinschaft, Zentralstelle für Geo-Photogrammetrie und Fernerkundung, Munich, West Germany). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 61-71. 13 refs. Research supported by the Deutsche Forschungsgemeinschaft.

Based on studies of images obtained by Landsat-1 and 2, several post-Alpine active-movement zones have been delineated in a section of the eastern Alps. A relation between these zones and the present-day central European stress field has been suggested, and a number of extensive lineaments have been observed in the area. Statistically, there are three major lineation sets which appear to have developed cogenetically as a result of shear and tensile failures due to the stress field, with maximum principal stress directed, on the average, toward 15 deg N. Some light has been thrown on the possible cause for the predominance of NE-SW trending sinistral faults in the area and controls over the development of the Giudicaria line. (Author)

A76-46673 # Considerations on practical knowledge of the geoid and its applications in current studies (Rozwazania dotyczace praktycznej znajomosci geoidy i jej stosowania w nowoczesnych pracach). W. Dobaczewska. *Geodezja i Kartografia*, vol. 25, no. 3, 1976, p. 207-211. 10 refs. In Polish.

The paper discusses some problems related to the comparability of different geoids obtained by different methods. The basic differences between the general geoid, the sea level geoid, the astrogeodetic geoid, the isostatic geoid, and the altimetric geoid are examined. P.T.H.

A76-46706 Deep electromagnetic investigations. M. N. Berdichevskii (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR), E. B. Fainberg, N. M. Rotanova (Akademiia Nauk SSSR, Institut Zemnogo Magnetizma, Ionosfery i Rasprostraneniia Radiovoln, Moscow, USSR), J. B. Smirnov (Academy of Sciences, Institute of Geology, Moscow, USSR), and L. L. Vanjan (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR). *Annales de Géophysique*, vol. 32, Apr.-June 1976, p. 143-155. 66 refs.

This review considers the main experimental results of the global, regional and local deep electromagnetic investigations accomplished in the USSR. These investigations are based on the principles of frequency and geometrical sounding and profiling. The fields of external as well as of internal origin have been studied by using the data of not only surface but also satellite observations. A new global deep conductivity distribution has been obtained, and some geological consequences have been drawn. Several regional deep conductivity anomalies were revealed which are in good accordance with heat flow anomalies. Conducting layers in the earth crust and upper mantle have been studied. Some interesting anomalies of the transient geomagnetic field have been detected and investigated. (Author)

A76-46862 Comparative evaluation of recent global representations of earth's gravity field. M. A. Khan. *Geophysical Journal*, vol. 46, no. 3, Sept. 1976, p. 535-553.

03 GEODESY AND CARTOGRAPHY

The paper compares and evaluates recent satellite-determined and combination models of the earth's gravitational field and attempts to select the one which best satisfies specific geophysical and orbital dynamical objectives. A statistical analysis of some of these models indicates that most gravity models are determined to a relative accuracy reflected by an rms of about 2 mgal of the differences between various models for the frequency range from n-2-7. Neither differences between various gravity models nor differences between purely satellite-determined geopotential models and their associated combination models show a consistent relationship with surface gravimetric coverage. B.J.

N76-29676*# Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.

APPLICATION OF LANDSAT DATA TO DELIMITATION OF AVALANCHE HAZARDS IN MONTANE COLORADO Interim Report, Mar. - May 1976

D. H. Knepper, Principal Investigator Jun. 1976 11 p ERTS (Contract NAS5-20914) (E76-10446; NASA-CR-148523; QPR-4) Avail: NTIS HC \$3.50 CSCL 08L

N76-29685*# Geological Survey, Reston, Va.

COMBINED MAGNETIC AND GRAVITY ANALYSIS Final Report

W. J. Hinze (Purdue Univ.), L. W. Braille (Purdue Univ.), V. W. Chandler (Purdue Univ.), and F. E. Mazella (Purdue Univ.) Jun. 1975 89 p refs

(NASA Order S-50029A)

(NASA-CR-144767) Avail: NTIS HC \$5.00 CSCL 08N

Efforts are made to identify methods of decreasing magnetic interpretation ambiguity by combined gravity and magnetic analysis, to evaluate these techniques in a preliminary manner, to consider the geologic and geophysical implications of correlation, and to recommend a course of action to evaluate methods of correlating gravity and magnetic anomalies. The major thrust of the study was a search and review of the literature. The literature of geophysics, geology, geography, and statistics was searched for articles dealing with spatial correlation of independent variables. An annotated bibliography referencing the Germane articles and books is presented. The methods of combined gravity and magnetic analysis techniques are identified and reviewed. A more comprehensive evaluation of two types of techniques is presented. Internal correspondence of anomaly amplitudes is examined and a combined analysis is done utilizing Poisson's theorem. The geologic and geophysical implications of gravity and magnetic correlation based on both theoretical and empirical relationships are discussed. Author

N76-29694# Defense Mapping Agency, Washington, D.C. **GEODETIC SURVEY COORDINATES TO SUPPORT GLOBAL POSITIONING SYSTEM TESTS AT YUMA PROVING GROUNDS ARIZONA** Final Report

Oct. 1975 173 p refs

(AD-A021478; DMA/TR-76-002) Avail: NTIS CSCL 08/5

Geodetic and GEOCEIVER surveys were performed by Defense Mapping Agency personnel at Yuma Proving Grounds Arizona to support positioning requirements for Global Positioning System tests and evaluation. Geodetic field surveys began in November 1974 and ended in February 1975. GEOCEIVER surveys were conducted in March and April of 1975. Upon completion of these surveys, computations were made to determine Adjusted NAD 27 and WGS 72 geodetic coordinates for selected survey sites. Yuma local rectangular as well as Universal Transverse Mercator grid coordinates are also provided. GRA

N76-30521 Kansas Univ., Kansas City.

TERRAIN RESPONSE TO AN ORBITING MICROWAVE RADIOMETER/SCATTEROMETER Ph.D. Thesis

Arun Sobti 1975 703 p

Avail: Univ. Microfilms Order No. 76-16783

The Skylab manned space vehicle carried onboard a composite microwave radiometer/scatterometer (designated along with an altimeter as S-193), operating at 13.9 GHz, as part of the Earth Resources Experiment Package. Data from the radiometer and scatterometer are analyzed to satisfy two objectives: to provide design information for future fine resolution sensors, and, to explore the capabilities and limitations of geoscientific investigation with such gross resolution microwave sensors. Histograms of the distribution of backscatter and radiometric brightness temperature are generated for various angles and polarizations for an ensemble of targets in North America, South America and the ocean. Due to the large spatial averaging involved, the dynamic range of backscatter responses at any angle are smaller than those for fine resolution sensors. These dynamic ranges which are a function of incidence angle are larger for the ocean than for land. Dissert. Abstr.

N76-31620*# Bechtold Satellite Technology, Corp., City of Industry, Calif.

AN EVALUATION OF SKYLAB (EREP) REMOTE SENSING TECHNIQUES APPLIED TO INVESTIGATION OF CRUSTAL STRUCTURE Semiannual Report, 1 Jul. - 31 Dec. 1974

Ira C. Bechtold, Principal Investigator 31 Dec. 1974 17 p EREP

(Contract NAS9-14235)

(E76-10473; NASA-CR-144383; BESTEC-101-SA-6/75) Avail: NTIS HC \$3.50 CSCL 08G

The author has identified the following significant results. A study of Greenwater Valley indicates that the valley is bounded on the north and east by faults, on the south by a basement high, and on the west by the dip slope of the Black Mountains. Movement of ground water from the valley is thus restricted, indicating the valley is a potential water reservoir.

N76-31657# Goodyear Aerospace Corp., Akron, Ohio.

ASSOCIATIVE ARRAY PROCESSING OF RASTER SCANNED DATA FOR AUTOMATED CARTOGRAPHY Final Technical Report, Jan. 1975 - Mar. 1976

R. G. Radosevic, N. J. Adams, J. M. Vocar, and K. Losch Mar. 1976 347 p refs

(Contract DAAK02-75-C-0114)

(AD-A022753; GER-16327; ETL-0046) Avail: NTIS CSCL 08/2

The primary objective for this effort was to develop additional STARAN AAP-raster processing software that would be used to process a variety of actual map data. This would then provide a means to further evaluate the suitability of a STARAN AAP for the processing of raster scanned data. GRA

N76-31786*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

THE ACCURACY OF GODDARD EARTH MODELS

C. A. Wagner Jun. 1976 234 p refs Submitted for publication

(NASA-TM-X-71183; X-921-76-187) Avail: NTIS CSCL 08E

Extensive tests of Goddard geopotential models have been made with observations not used in the solutions. These tests show the accuracy of the satellite derived model (GEM 7, with 400 coefficients) to be about 4.3 m (rms) with respect to the computation of the global geoid surface. The formal precision of this solution is 0.7 m. The corresponding accuracy of the combined satellite surface gravimetry model (GEM 8, with 706 coefficients) is found to be 3.9 m (rms). Independent observations used in this assessment include: 125 lumped coefficients from 35 resonant orbits of 1 and 9 through 15 revolutions per day, two sets of (8,8) fields derived from optical-only and laser-only data, sets of zonal and resonant coefficients derived from largely independent sources and geoid undulations measured by satellite altimetry. In addition, the accuracy of GEM 7 has been judged by the gravimetry in GEM 8. The ratio of estimated to formal error in GEM 7 and 8 ranges from 2 to 5. Author

N76-31787# Royal Netherlands Meteorological Inst., De Bilt.
ON EARTHQUAKE RISK FOR NUCLEAR POWER PLANTS
 A. R. Ritsema, ed. Jan. 1976 188 p refs Partly in FRENCH;
 partly in ENGLISH Proc. of the European Seismological Comm.
 Symp., Luxemburg, 20-22 Oct. 1975
 (KNMI-153) Avail: NTIS HC \$7.50; Roy. Neth. Meteorol. Inst.,
 Dfl. 10

Selected papers in the field of earthquake risk for nuclear power plants in France, Denmark, the U.K., Western Germany, Switzerland, Belgium, Austria, Fennoscandia, Turkey, Spain, Portugal, Israel, and other countries are listed as well as methods for assessing and determining safe shutdown earthquake, soil-structure interactions, etc.

N76-31790 Royal Norwegian Council for Scientific and Industrial Research, Kjeller.

THE SEISMICITY OF FENNOSCANDIA

H. Bungum and E. S. Husebye *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 19-25 refs

The systematic collection of macroseismic data on earthquake occurrence in Fennoscandia began in the 1880's. Prior to that time the macroseismic information is fragmentary and incomplete, although the essential data have been preserved at least for the largest earthquakes. Using the available macroseismic and seismograph data the macroseismicity for Fennoscandia covering the time interval 1497 to 1973 was investigated. The earthquake activity was subdivided in four zones: Telemark-Vaernern, Western Norway, Lappland, and Bothnian, which account for the most of the reported seismic activity. There is some correlation between geological and geophysical information pertinent to the area and earthquake occurrence. The seismic activity of Fennoscandia is discussed in the framework of intraplate tectonics and the driving forces connected with the opening of the North Atlantic Ocean.

Author (ESA)

N76-31792 Institute of Geological Sciences, Edinburgh (Scotland).

THE UK APPROACH TO HAZARD ASSESSMENT

P. L. Willmore and P. W. Burton *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 35-37 refs Sponsored by UK Nat. Environ. Res. Council

This approach takes into account the limitation of total magnitude range for U.K. events, as revealed by Gumbel's Third Distribution, and derives an estimate of the combination of magnitude and distance most likely to produce any given value of intensity. It thereby avoids some of the problems of defining real hazards in terms of historical intensity and of extrapolation to very long return periods.

Author (ESA)

N76-31793 Cologne Univ. (West Germany). Erdbebenstation Bensberg.

FIRST DRAFT OF AN EARTHQUAKE ZONING MAP OF NORTHWEST-GERMANY, BELGIUM, LUXEMBURG AND THE NETHERLANDS

L. Ahorner, J. A. Flick (Lab. Souterrain de Geodyn., Luxemburg), J. M. VanGils (Obs. Roy., Uccle, Belg.), G. Houtgast (Roy. Neth. Meteorol. Inst., De Bilt), and A. R. Ritsema *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants Jan. 1976 p 39-41 refs

International cooperation in planning the earthquake map of northern Germany, Belgium, Luxemburg, and the Netherlands is emphasized.

ESA

N76-31794 Eidgenoessische Technische Hochschule, Zurich (Switzerland). Schweizerischer Erdbebendienst.

SEISMIC RISK MAPS OF SWITZERLAND: DESCRIPTION OF THE PROBABILISTIC METHOD AND DISCUSSION OF SOME INPUT PARAMETERS

D. Mayer-Rosa and H. A. Merz (Basler u. Hofmann) *In* Roy. Neth. Meteorol. Inst. On Earthquake Risk for Nucl. Power Plants

Jan. 1976 p 45-51 refs

The probabilistic model used in a seismic risk mapping project is presented. Some of its advantages and limitations are spelled out. In addition, some earthquake parameters which should be carefully investigated before using them in a seismic risk analysis are discussed.

Author (ESA)

N76-32622*# Geological Survey, Denver, Colo.

SKYLAB-EREP STUDIES IN COMPUTER MAPPING OF TERRAIN IN THE CRIPPLE CREEK-CANON CITY AREA OF COLORADO

Harry W. Smedes, K. Jon Ranson (Colorado State Univ.), and Roland L. Holstrom (Martin Marietta Aerospace Corp., Denver, Col.) [1975] 77 p refs Original contains color illustrations (NASA Order T-9612-B)

(NASA-CR-147844) Avail: NTIS HC \$5.00 CSCL 08B

Multispectral-scanner data from satellites are used as input to computers for automatically mapping terrain classes of ground cover. Some major problems faced in this remote-sensing task include: (1) the effect of mixtures of classes and, primarily because of mixtures, the problem of what constitutes accurate control data, and (2) effects of the atmosphere on spectral responses. The fundamental principles of these problems are presented along with results of studies of them for a test site of Colorado, using LANDSAT-1 data.

Author

N76-33800# National Geodetic Survey, Rockville, Md.

ADJUSTMENT OF GEODETIC FIELD DATA USING A SEQUENTIAL METHOD

Marvin C. Whiting and Allen J. Pope Mar. 1976 17 p refs (PB-253967/4; NOAA-TM-NOS-NGS-3; NOAA-76041401) Avail: NTIS HC \$3.50 CSCL 08E

Using remote terminals, National Geodetic Survey field parties are now able to carry out limited adjustments for the purpose of evaluating their observations. Such an adjustment must be able to handle incomplete networks. The method adopted was developed by Creusen (1965). It is a sequential adjustment using a modified arithmetic which automatically handles all problems of possible singularities, giving for indeterminate parameters their pseudoinverse solution accompanied by appropriate flags. GRA

N76-34107# Laboratorio di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

LATITUDINAL STRUCTURE OF THE SOLAR WIND AND INTERPLANETARY MAGNETIC FIELD

M. Dobrowolny and G. Moreno May 1975 129 p refs (LPS-75-17) Avail: NTIS HC \$6.00

The experimental information on latitude effects in the solar wind plasma, obtained from both direct measurements and, indirectly, from observations of comet tails and radio scintillations, is reviewed. Magnetic field observations, notably of the polar magnetic field and of the semiannual variation of the geomagnetic activity, are reported. Theoretical models of latitudinal effects in the solar wind are outlined; three-dimensional solar wind models and studies of gas-magnetic field interactions are considered. The results of such models are reported in detail for different types of coronal boundary conditions, both uniform and non-uniform. The predictions of the theoretical models are compared with the available experimental knowledge on latitudinal structures of the solar wind plasma and the interplanetary magnetic field.

ESA

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04 GEOLOGY AND MINERAL RESOURCES

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

A76-39247 # Airborne methods in geological investigations (Aerometody pri geologicheskikh issledovaniakh). A. E. Mikhailov and N. S. Ramm. Moscow, Izdatel'stvo Nedra, 1975. 199 p. 35 refs. In Russian.

The apparatuses commonly used to obtain aerial photographs and satellite imagery suitable for use in geological studies are described, and methods of interpreting remotely sensed imagery are discussed. Features which can be used to identify different rock types - effusive, intrusive, sedimentary, metamorphic, etc. - are summarized, together with the distinguishing characteristics of horizontal, inclined, and folded laminar rock masses. Special attention is given to the use of aerial and satellite imagery to locate mineral resources. The construction of geological maps from aerial and satellite imagery is discussed. C.K.D.

A76-39967 Visible and near infrared spectra of minerals and rocks. XI - Sedimentary rocks. XII - Metamorphic rocks. G. R. Hunt and J. W. Salisbury (USAF, Optical Physics Laboratory, Bedford, Mass.). *Modern Geology*, vol. 5, Apr. 1976, p. 211-217, 219-228. 28 refs.

The paper presents bidirectional reflectance spectra of 24 samples of representative sedimentary rocks referred to as shales, sandstones, and limestones, and for 35 metamorphic rocks referred to as marbles, quartzites, gneisses, slates, and schists. Only the spectrum of the particle size range 74-250 microns is presented for the sedimentary rocks, grouped with spectra of similar materials, but the description of each rock includes reflectivities of each size range at two wavelengths. It is shown that the majority of features are caused by hydroxyl, water or carbonate vibrational overtone or combination tones, or by electronic transitions in iron, manganese, or chromium. In most cases the spectral features are only an indirect indication of rock composition. S.D.

A76-40375 Application of Landsat imagery to petroleum and mineral exploration. M. T. Halbouty. *American Association of Petroleum Geologists, Bulletin*, vol. 60, May 1976, p. 745-793. 30 refs.

A review article, copiously illustrated with Landsat imagery, is presented on Landsat petroleum and mineral exploration data. The following applications of Landsat data are discussed: (1) detection of previously unknown geological structures which may contain hydrocarbons, (2) detection of subtle tonal anomalies which may indicate alteration of soils due to miniseeps of gas from hydrocarbon reservoirs, (3) detection of natural marine oil seeps, (4) detection of important minerals and metals on outcrops in hostile environments, (5) monitoring of ice distribution in Arctic areas, and (6) monitoring of oil field development and transport facilities, such as the Alaska pipeline. B.J.

A76-41346 Uranium - Deposits and prospecting (Uran - Lagerstätten und Prospektion). D. Nottmeyer. *Metall*, vol. 30, Aug. 1976, p. 777-781. In German.

The various types of uranium deposits are examined, taking into account deposits in Canada, South Africa, New Mexico, Argentina, South Australia, Utah/Colorado, Wyoming, Texas, and Madagascar.

The geological formations in which the uranium deposits occur are considered and questions of deposit formation are investigated. The methods used in the discovery of the uranium deposits are related to preliminary exploration, survey prospecting studies, and detailed prospecting investigations. G.R.

A76-41622 * Contributions of rock magnetism and paleomagnetism to recent geophysical advances. S. K. Banerjee (Minnesota, University, Minneapolis, Minn.). *IEEE Transactions on Magnetics*, vol. MAG-12, July 1976, p. 266-278. 59 refs. NSF Grants No. GA-43271; No. DES-75-21796; Grant No. NGR-24-005-248.

The origin of natural remanent magnetization (NRM) in rocks is discussed both in terms of types and carriers of NRM. The importance of the concept of pseudo-single domain (PSD) grains as carriers of stable remanences is underscored. Recent advances in rock magnetism and paleomagnetism have helped to understand (1) continental motions which took place in the first 4 billion years of the earth's life, (2) fine details of field fluctuations both during 'normal' times as well as during a geomagnetic field reversal, and (3) indicate the magnitudes of the fields present during the formation of the moon and of the early solar system. (Author)

A76-42969 * Active faults in southeastern Harris County, Texas. U. S. Clanton and D. L. Amsbury (NASA, Johnson Space Center, Houston, Tex.). *Environmental Geology*, vol. 1, 1975, p. 149-154. 14 refs. NASA-supported research.

Aerial color infrared photography was used to investigate active faults in a complex graben in southeastern Harris County, Tex. The graben extends east-west across an oil field and an interstate highway through Ellington Air Force Base (EAFB), into the Clear Lake oil field and on to LaPorte, Tex. It was shown that the fault pattern at EAFB indicates an appreciable horizontal component associated with the failure of buildings, streets, and runways. Another fault system appears to control the shoreline configuration of Clear Lake, with some of the faults associated with tectonic movements and the production of oil and gas, but many related to extensive ground water withdrawal. B.J.

A76-42983 Rockhounding in the space age. II - Earth. H. E. Newell. *Lapidary Journal*, vol. 29, Dec. 1975, p. 1662-1669.

Following a brief description of the use of satellite imagery in such fields as agriculture and meteorology, its application in mineralogical exploration is discussed. Techniques used in constructing and interpreting thematic maps are outlined. The interpretation of Nimbus photographs to locate promising locations for ore deposits in Alaska is described. C.K.D.

A76-43846 # Selection of markings for the recognition of natural objects on the basis of spectral brightness values (O vybore priznakov dlia raspoznavaniia prirodnykh ob'ektov po velichinam spektral'nykh iarkostei). M. B. Averintsev and Iu. L. Biriukov (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR). *Geodeziia i Aerofotos'emka*, no. 1, 1976, p. 73-79. 7 refs. In Russian.

A method is proposed for the optimal selection of markings in the multispectral photography of natural objects of the earth surface, with application to the mapping of agricultural, geological, hydrological, and ocean areas. The method of principal components is used to form the markings, and an information coefficient characterizing the importance of this marking for the recognition of the natural object in question is assigned to each marking. A quadratic method (using hypersurfaces) is used to obtain these coefficients. Sufficient recognition accuracy is achieved by selecting the minimally possible number of markings with the largest values of the information coefficient. B.J.

04 GEOLOGY AND MINERAL RESOURCES

A76-46525 Photogeological sketchmap of the Mediterranean realm - Major structural features determined from Landsat-1 satellite images (Esquisse photogéologique du domaine Méditerranéen - Grands traits structuraux à partir des images du satellite Landsat-1). B. Biju-Duval, J.-C. Rivereau (Institut Français du Pétrole, des Carburants et Lubrifiants, Rueil-Malmaison, Hauts-de-Seine, France), C. Lamperein, and N. Lopez (Centre Nationale pour l'Exploitation des Océans, Paris, France). *Institut Français du Pétrole, Revue*, vol. 31, May-June 1976, p. 365-400. 46 refs. In French.

A76-46667 # The method of parameter determination as a contribution for the solution of the inverse problem in the interpretation of gravimetric and magnetic fields (Die Methode der Parameterbestimmung als Beitrag zur Lösung der umgekehrten Aufgabe bei der Deutung gravimetrischer und magnetischer Felder). H. Lindner and G. Stier (VEB Geophysik, Leipzig, East Germany). *Gerlands Beiträge zur Geophysik*, vol. 85, no. 4, 1976, p. 319-333. 22 refs. In German.

A76-40995 An investigation of a cold eddy on the eastern side of the Gulf Stream using NOAA 2 and NOAA 3 satellite data and ship data. F. M. Vukovich (Research Triangle Institute, Research Triangle Park, N.C.). *Journal of Physical Oceanography*, vol. 6, July 1976, p. 605-612. Contract No. NOAA-3-35402.

A study of a cold eddy on the eastern side of the Gulf Stream was performed combining data from the NOAA 2 and NOAA3 satellites and from the Cape Fear Technical Institute's R/V Advance II. The satellite data were used initially to identify and locate the eddy in real time. The location data obtained from the satellite imagery was used to plan an oceanic field program using the Advance II to collect temperature and salinity data in the perturbation. The analysis of satellite data indicated that the cold eddy was elliptic in shape with the major axis varying from 180 to 120 km and a minor axis varying from 120 to 100 km. The analysis also suggested that the circulation of the eddy was entraining warm Gulf Stream water, strengthening the warm ring around the eddy. The subsurface analysis indicated that the cold eddy was characterized by a very pronounced dome of relatively cold, less saline water below 200 m. Above 200 m, the temperature and salinity were uniform, both vertically and horizontally. (Author)

N76-28593*# Colorado School of Mines, Golden. Dept. of Geology.

GEOLOGIC AND MINERAL AND WATER RESOURCES INVESTIGATIONS IN WESTERN COLORADO, USING SKYLAB EREP DATA Final Report

Keenan Lee, Principal Investigator, Gary L. Prost, Daniel H. Knepper, Don L. Sawatzky, David Huntley, and Robert J. Weimer Dec. 1975 638 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (Contract NAS9-13394)

(E76-10383; NASA-CR-144513; Rept-75-7) Avail: NTIS HC \$16.25 CSCL 08F

The author has identified the following significant results. Skylab photographs are superior to ERTS images for photogeologic interpretation, primarily because of improved resolution. Lithologic contacts can be detected consistently better on Skylab S190A photos than on ERTS images. Color photos are best; red and green band photos are somewhat better than color-infrared photos; infrared band photos are worst. All major geologic structures can be recognized on Skylab imagery. Large folds, even those with very gentle flexures, can be mapped accurately and with confidence. Bedding attitudes of only a few degrees are recognized; vertical exaggeration factor is about 2.5X. Mineral deposits in central Colorado may be indicated on Skylab photos by lineaments and color anomalies, but positive identification of

these features is not possible. S190A stereo color photography is adequate for defining drainage divides that in turn define the boundaries and distribution of ground water recharge and discharge areas within a basin.

N76-28594*# Geological Survey, Denver, Colo.
DISCRIMINATION OF GEOLOGIC MATERIALS USING SKYLAB S-192 DATA, PART 3 Final Report
Howard A. Pohn, Principal Investigator [1975] 6 p refs
Sponsored by NASA EREP
(E76-10405; NASA-CR-148218) Avail: NTIS HC \$3.50 CSCL 08G

N76-28595*# Geological Survey, Reston, Va.
DETECTION AND MAPPING OF MINERALIZED AREAS IN THE CORTEZ-UINTA BELT, UTAH-NEVADA, USING COMPUTER-ENHANCED ERTS IMAGERY Progress Report
Lawrence C. Rowan, Principal Investigator 1 Jun. 1976 3 p ERTS
(E76-10410; NASA-CR-147793) Avail: NTIS HC \$3.50 CSCL 08G

The author has identified the following significant results. An approach to obtain spatial precision utilizes large scale black and white ratio images with high geometric precision. These images have a precision of .005 inch across the diagonals. Evaluation of a color ratio composite image of south central Nevada using ratio images recorded at this scale shows that the respective pixels are registered throughout the scene. Thus reconnaissance mapping can be carried out for the entire scene at 1:300,000 scale and then at larger scales by analyzing photographic enlargements of the original color ratio composite image. The advantages to this approach are elimination of repetitive computer processing and considerable flexibility as to specific scales.

N76-28598*# Geological Survey, Bloomington, Ind.
APPLICATION OF EREP IMAGERY TO FRACTURE-RELATED MINE SAFETY HAZARDS IN COAL MINING AND MINING-ENVIRONMENTAL PROBLEMS IN INDIANA Final Report, Apr. 1973 - Apr. 1975

C. E. Wier, Principal Investigator, Richard L. Powell, Roger V. Amato (Earth Satellite Corp., Washington, D. C.), Orville R. Russell (Earth Satellite Corp., Washington, D. C.), and Kenneth R. Martin (Earth Satellite Corp., Washington, D. C.) Oct. 1975 57 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (Contract NAS9-13358)

(E76-10419; NASA-CR-144495) Avail: NTIS HC \$4.50 CSCL 08I

The author has identified the following significant results. This investigation evaluated the applicability of a variety of sensor types, formats, and resolution capabilities to the study of both fuel and nonfuel mined lands. The image reinforcement provided by stereo viewing of the EREP images proved useful for identifying lineaments and for mined lands mapping. Skylab S190B color and color infrared transparencies were the most useful EREP imagery. New information on lineament and fracture patterns in the bedrock of Indiana and Illinois extracted from analysis of the Skylab imagery has contributed to furthering the geological understanding of this portion of the Illinois basin.

N76-28630*# Scientific Translation Service, Santa Barbara, Calif.
AEROGEOLOGICAL STRUCTURAL STUDY OF THE CARSO MOUNTAINS OF GORIZIA AND TRIEST, OF WESTERN SLOVENIA, AND OF ISTRIA (AND FIRST COMPARISONS WITH THE ERTS-1 AND SKYLAB IMAGES)

Giuliano Piccoli Washington NASA Jul. 1976 56 p refs
Transl. into ENGLISH from Mem. Ist. Geol. Mineral. Univ. Padova

(Padua), v. 31, 1975 p 1-40
(Contract NASw-2791)

(NASA-TT-F-16730) Avail: NTIS HC \$4.50 CSCL 08B

A photogeological structural study of the western Veneto area between the Lake of Garda and the river Brenta is presented. The interferences between the fundamental tectonic directing lines pertinent to the region were observed, and their probable chronological succession was traced. The most important tectonic direction goes under the name of Schio-Vicenza plate and coincides with the principal Dinaric direction (NNE-SSE).

Author

N76-28631*# Geological Survey, Reston, Va.
A SURVEY OF THE UTILITY OF SATELLITE MAGNETOMETER DATA FOR APPLICATION TO SOLID-EARTH GEO-PHYSICAL AND GEOLOGICAL STUDIES Final Report
Sep. 1975 30 p ref

(NASA Order S-500-29A)

(NASA-CR-144786) Avail: NTIS HC \$4.00 CSCL 08G

A survey of potential users of low altitude satellite magnetic measurements for solid-earth and geological studies was conducted. The principal objectives of this survey were to: document the utility and application of the data and resultant products obtained from such a satellite mission, and establish a users committee for the proposed low altitude vector magnetometer satellite.

Author

N76-30627*# Geological Survey, Reston, Va.
EVALUATION OF LANDSAT-1 IMAGE APPLICATIONS TO GEOLOGIC MAPPING, STRUCTURAL ANALYSIS AND MINERAL RESOURCE INVENTORY OF SOUTH AMERICA WITH SPECIAL EMPHASIS ON THE ANDES MOUNTAIN REGION Final Report, Jan. 1973 - Jul. 1974

William D. Carter, Principal Investigator Jun. 1976 114 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

The author has identified the following significant results. The discovery of copper mineralization along a lineament mapped in Area 7 (La Paz) has lent credence to the use of LANDSAT 1 data as a basic step in mineral exploration. In Area 9 (Copiapo Region), a number of lineaments were found to be associated with the largest copper deposits of the region. In Area 12 (Magallanes), the identification of what is believed to be a tertiary basin from LANDSAT 1 data has resulted in a new area for petroleum exploration. Band 7 images, as black and white transparencies, were found to be the most useful for geologic interpretation in both tropical vegetated areas and desert regions. Color composites made by the diazo-chrome process, chromaline process, and from color additive viewers provided additional information. Mosaics of LANDSAT 1 data covering 4 x 6 degrees of latitude and longitude compiled at the 1:1,000,000 scale were found to be an ideal size and format for most users.

N76-30628*# Geological Survey, Reston, Va.
EVALUATION OF LANDSAT-2 (ERTS) IMAGES APPLIED TO GEOLOGIC STRUCTURES AND MINERAL RESOURCES OF SOUTH AMERICA Progress Report, 30 Jun. 1975 - 30 Jun. 1976

William D. Carter, Principal Investigator and William S. Kowalik 1 Jul. 1976 23 p refs Sponsored by NASA ERTS (E76-10460; NASA-CR-148591) Avail: NTIS HC \$3.50 CSCL 08G

The author has identified the following significant results. The Salar of Coposa is located in northern Chile along the frontier with Bolivia. The surface was divided into six general classes of materials. Analysis of LANDSAT image 1243-14001 by use of interactive multispectral computer (Image 100) enabled accurate repetition of these general classes based on reflectance. The Salar of Uyuni is the largest of the South American evaporite deposits. Using image 1243-13595, and parallel piped computer classification of reflectance units, the Salar was divided into nine classes ranging from deep to shallow water, water over salt, salt saturated with water, and several classes of dry salt.

N76-30641# Missouri Univ., Kansas City.
MEASUREMENTS OF SPECTRAL REFLECTANCE AND OPTICAL CONSTANTS OF SELECTED ROCK SAMPLES FOR APPLICATION TO REMOTE SENSING OF SOIL MOISTURE

Wayne E. Holland, Marvin R. Querry, and Raymond M. Coveney 15 Jul. 1975 79 p refs
(Grant NOAA-04-4-158-27)

(PB-252468/4; NOAA-76022603) Avail: NTIS HC \$5.00 CSCL 08H

The feasibility of using infrared satellite sensors to make quantitative measurements of soil moisture was investigated. The primary goal of the program was to compute the necessary basic parameters, including the reflectance and optical constants of rocks, which are constituents of all soils. Specific objectives of the program were: (1) to measure the infrared specular reflectance or ten of more bulk, natural minerals and rocks selected from the silicates, feldspars, carbonates, sulfates, oxides and hydroxides, and (2) to compute the real and imaginary parts of the complex refractive index of the samples by applying the Kramers-Kronig techniques to the spectra. The parameters determined would provide the basis for applying both the thermal and optical approaches to the interpretation of the infrared imagery. The infrared reflectance and optical constants of 11 minerals are given. Initial computations were made of the contrast values for daytime and nighttime remote-sensing of water against a limestone background.

GRA

N76-31640*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

SATELLITE DATA FOR SURFACE-MINE INVENTORY

A. T. Anderson, D. Schultz (GE Co., Beltsville, Md.), N. Buchman (GE Co., Beltsville, Md.), and M. Nock (Maryland Geological Survey) Sep. 1976 19 p refs Submitted for publication
(NASA-TM-X-71187; X-923-76-199) Avail: NTIS HC \$3.50 CSCL 08I

To determine the feasibility of satellite data for surface-mine inventory, particularly as it applies to coal, a case study was conducted in Maryland. A band-ratio method was developed to measure disturbed surface areas, and it proved to be extendible both temporally and geographically. This method was used to measure area changes in the region over three time periods from September 1972 through July 1974 and to map the entire two-county area for 1973. For mines ranging between 31 and 244 acres (12 to 98 hectares) the measurement accuracy of total affected acreage was determined to be 92%. Mines of 120 acres (50 hectares) and larger were measured with greater accuracy, some within one percent of the actual area. The ability to identify, classify, and measure strip-mine surfaces in a two-county area (1.541 square kilometers - 595 square miles) of western Maryland was demonstrated through the use of computer processing. On the basis of these results the use of LANDSAT satellite data and multilevel sampling of aircraft and field verification inspections, multispectral analysis of digital data is shown to be an effective, rapid, and accurate means of monitoring the surface mining cycle.

Author

N76-31663# Bureau of Mines, Dallas, Tex. Div. of Petroleum and Natural Gas.

DEPTH AND PRODUCING RATE CLASSIFICATION

W. D. Dietzman Mar. 1976 29 p refs
(PB-252492/4; BM-IC-8675A) Avail: NTIS HC \$4.00 CSCL 08I

Statistics are presented pertaining to distribution of petroleum reservoirs (or fields), wells, and production by depth and producing rate classification in the United States. Data are presented in tabular form by state for the 18 principal oil-producing states and by subdivision for the two largest oil-producing states, Texas and Louisiana. Also tabular summations and graphical illustrations are presented for the nation.

GRA

04 GEOLOGY AND MINERAL RESOURCES

N76-31835# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

MID-IRRED SPECTRAL BEHAVIOR OF METAMORPHIC ROCKS Environmental Research Papers

Graham R. Hunt and John W. Salisbury 22 Sep. 1976 66 p refs

(AF Proj. 7670)

(AD-A022676; AFCRL-TR-76-0003; AFCRL-ERP-543) Avail: NTIS CSCL 08/7

Mid-infrared (6 to 40 micrometers) spectra of metamorphic rocks and rock-forming minerals are presented, and their molecular vibration bands identified. While igneous and sedimentary rocks are typically composed of a few major rockforming minerals in different proportions, metamorphic rocks may contain many different mineral components, some of which are virtually unique to the metamorphic environment. As a result, metamorphic rocks display a great range in spectral behavior. However, similar metamorphic facies exhibit similar spectral behavior, and this behavior is readily understandable in terms of rock mineralogy. This understanding is aided by the fact that metamorphic recrystallization is usually accompanied by a sharpening of the spectral features. GRA

N76-32621*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

EXCERPTS FROM SELECTED LANDSAT 1 FINAL REPORTS IN GEOLOGY

Nicholas M. Short, A. Smith (GE Space Div., Glendale, Md.), and R. Baker (GE Space Div., Glendale, Md.) Apr. 1976 79 p (NASA-TM-X-71119; X-923-76-74) Avail: NTIS HC \$5.00 CSCL 08G

The standard formats for the summaries of selected LANDSAT geological data are presented as checklists. These include: (1) value of LANDSAT data to geology, (2) geologic benefits, (3) follow up studies, (4) cost benefits, (5) optimistic working scales, (6) statistical analysis, and (7) enhancement effects. F.O.S.

OCEANOGRAPHY AND MARINE RESOURCES

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

A76-41004 A study of oceanic internal waves using satellite imagery and ship data. J. R. Apel, H. M. Byrne, J. R. Proni, and R. Sellers (NOAA, Ocean Remote Sensing Laboratory, Miami, Fla.). *Remote Sensing of Environment*, vol. 5, no. 2, 1976, p. 125-135. 11 refs. ARPA-supported research.

Landsat-1 and -2 data indicate that oceanic internal waves appear as periodic intermittent variations in the surface optical reflectivity. Internal wave packets are visible from spacecraft, aircraft, and surface vehicles under certain circumstances. High-resolution satellite imagery is shown to be useful in studying internal waves on the continental shelf under conditions of clear skies and light winds. In addition, shipboard observations reveal that amplitude information can be obtained from acoustic echo-sounding without recourse to temperature sensors whenever scattering from microstructure or biological material embedded in the internal wave motion is sufficiently intense. These two remote-sensing techniques together constitute a set of new tools for investigating high-frequency internal waves. A summary of wave packet characteristics is included. S.D.

A76-41006 Trophic state analysis of island lakes. C. T. Wezernak, F. J. Tanis, and C. A. Bajza (Michigan, Environmental Research Institute, Ann Arbor, Mich.). *Remote Sensing of Environment*, vol. 5, no. 2, 1976, p. 147-164. 16 refs. NSF Grant No. GI-34809X1.

The formulation of a trophic state index using remote sensing data is discussed. A multivariate analysis technique is applied to the data to formulate a trophic state index which combines selected indicators of eutrophication into a single numerical expression. Results are presented for a group of inland lakes in Southern Michigan. The relationship between phosphorus loading to the lakes and the derived numerical index is examined. The results demonstrate the potential of multispectral remote sensing for use in eutrophication assessment and watershed analysis. (Author)

A76-41404 * Don't waste waterweeds. B. Wolverton and R. C. McDonald (NASA, Marshall Space Flight Center, National Space Technology Laboratories, Bay St. Louis, Miss.). *New Scientist*, vol. 71, Aug. 12, 1976, p. 318-320.

Experiments carried out at the NASA National Space Technology Laboratories indicate that water hyacinths can absorb organic chemicals, heavy metals, nutrients, and other materials from waste water while producing large quantities of biomass, which can be used to produce a gas containing 60-80% methane. When grown in sewage free of toxic materials, the biomass can be used as a potential source of fertilizer or animal feed supplements. The use of hot water from nuclear power plants to grow water hyacinths during the winter months is particularly attractive, since the hyacinths could act as an added safety filtration system for the removal of radioactive elements. C.K.D.

A76-41416 # Glaciation of the North Polar region (Oledenienie Severnoi Poliarnoi oblasti). O. P. Chizhov. Moscow, Izdatel'stvo Nauka, 1976. 240 p. 579 refs. In Russian.

The work reviews present data on the glaciation of sea and land in the Arctic and Subarctic, taking account of investigations in the context of the International Geophysical Year and the International Hydrological Decade. The historical evolution of glaciation is treated, with emphasis on climatic changes and glacio-climatological variations. A theoretical model is constructed for the evolution of glaciation and the earth climate, based on complex air-ocean interactions. The work deals with the glaciation of such places as the Urals, Scandinavia, the Pacific Arctic, the Eurasian Arctic, Greenland, the Canadian Arctic, and the Arctic Ocean. B.J.

A76-42797 Ocean science from space. J. R. Apel (NOAA, Pacific Marine Environmental Laboratory, Seattle, Wash.). *EOS*, vol. 57, Sept. 1976, p. 612-624. 30 refs.

Satellite oceanography is largely confined to surface and near-surface phenomena, with spacecraft data restricted generally to low- and medium-resolution visible and infrared imagery and small amounts of high-resolution Landsat imagery. Data are presented on the various types of sensors available along with their resolution, and various areas of investigation that may possibly be studied with the aid of present and future satellites are discussed. These include sea surface temperature, surface vector wind field, significant wave height, currents, tides, near-surface sediment transport, ice cover, the marine geoid, and water mass properties. P.T.H.

A76-43453 # Temperature deviation of the ocean surface as measured by satellites. T. Takashima. *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper. 7* p. 9 refs.

The deviation of the ocean surface from an effective blackbody temperature is investigated in the window region by the adding method. The model atmosphere contains only aerosols in accordance with the Junge power-law size distribution and the refractive index of liquid water. It was observed that the temperature deviation is small at the vertical direction and increases rapidly with an increase in the nadir angle of observations. The deviation is smaller for a hazy atmosphere than for a clear atmosphere except for the subarctic winter, unlike that of the underlying surface of a perfect blackbody. (Author)

A76-43461 # Sea ice modeling - Its testing with LANDSAT and potential use in FGGE. R. T. Hall, G. A. Maykut, and D. A. Rothrock (Washington, University, Seattle, Wash.). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper. 8* p. 9 refs. NSF Grant No. OPP-71-04031; Contract No. N00014-67-A-0103-0007.

A dynamic/thermodynamic sea ice model under development at Arctic Ice Dynamics Joint Experiment (AIDJEX) and its use are described. The use of LANDSAT data to obtain measurements of ice movement and deformation, and of the thickness distribution, to test assumptions underlying the model is discussed. Formation of stretches of open water, pile-up of thin ice into thick pressure ridges, heat losses to the atmosphere and fast growth in areas where ice is thin or the water surface is exposed, and slow loss of heat over thick patches of ice, are handled by the model. Remotely sensed data acquired are employed indirectly in estimating regional rates of heat and mass exchange (dependent upon the ice thickness distribution) over the polar oceans. The model incorporates a thickness distribution model, a momentum equation, and a stress-strain law for pack ice. R.D.V.

A76-44163 # Sea state and atmospheric moisture determinations from sunglint patterns in polar orbiting satellite data. R. W. Fett (U.S. Navy, Naval Environmental Prediction Research Facility, Monterey, Calif.). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper. 6* p. 9 refs.

05 OCEANOGRAPHY AND MARINE RESOURCES

Sunglint patterns appearing in polar orbiting satellite data extend over a far greater latitudinal range than those appearing in geostationary satellite data. Reflectivity changes in these patterns show pronounced sensitivity to changes in sea state and, for some sensors, in atmospheric moisture. Effects of the Mistral, the Etesian, mountain-gap winds of the world, and island barrier effects on sea state and atmospheric moisture can be immediately noted when the satellite views such areas illuminated in sunglint. Selected examples of such events as viewed by the Defense Meteorological Satellite Program (DMSP) system are the subject matter of this paper.

(Author)

A76-45173 A long-range ocean radar for ocean surface studies using backscatter via the ionosphere. J. F. Ward and P. E. Dexter (North Queensland, University, Townsville, Australia). *Australian Journal of Physics*, vol. 29, June 1976, p. 183-194. 21 refs. Research supported by the Australian Bureau of Meteorology and Radio Research Board.

An HF Doppler radar, designed for use at long range via an ionospheric propagation mode, has been developed primarily for the determination of wave states over large ocean areas. The operating frequency is 21,840 MHz, and the array is physically rotatable through a full 360 deg of azimuth, thus allowing for great flexibility in the choice of target area. The experimental technique utilizes a well-known resonance interaction mechanism for electromagnetic waves backscattered from a moving sea-wave surface to derive sea-state parameters in the scattering region for input to oceanographic and meteorological synoptic data networks. An ultimate angular resolution of less than 1 deg of azimuth, coupled with high operational flexibility, suggests possible utilization of the aerial array for tracking and interrogating free-floating ocean buoys, tracking radio noise associated with tropical cyclones, and investigating aspects of ionospheric dynamics.

(Author)

A76-45215 # Accuracy of unilateral trigonometric leveling above the ocean surface, using a statistical mean of vertical refraction constant ('Tochnost' odnostonnogo trigonometricheskogo nivelirovaniia nad morskoi poverkhnost'iu s ispol'zovaniem srednestatisticheskogo koeffitsienta vertikal'noi refraktsii). B. T. Tlustiak (L'vovskii Politekhnikeskii Institut, Lvov, Ukrainian SSR). *Geodeziia, Kartografiia i Aerofotos'emka*, no. 23, 1976, p. 81-86. 8 refs. In Russian.

A76-46041 # Mesoscale eddy dynamics in the eastern tropical Pacific Ocean as viewed by a satellite infrared sensor. H. G. Stumpf and R. V. Legeckis (NOAA, National Environmental Satellite Service, Suitland, Md.). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-063*. 7 p. 20 refs.

Several large (300 km in diameter) circular anticyclonic gyres in the eastern tropical Pacific Ocean were observed during February 1976 by the thermal infrared sensor aboard the NOAA-4 satellite. They were closely associated with well-defined wind-induced upwellings, and their surface thermal characteristics are described. Their observed westward motion has been partly attributed to entrainment by the Costa Rica Coastal Current (part of the North Equatorial Current System).

(Author)

N76-28604*# Alaska Univ., Fairbanks.
LANDSAT SURVEY OF NEAR-SHORE ICE CONDITIONS ALONG THE ARCTIC COAST OF ALASKA Quarterly Progress Report
William J. Stringer, Principal Investigator [1975] 53 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10428; NASA-CR-148304; QPR-15) Avail: NTIS HC \$4.50 CSCL 08L

N76-29662*# Delaware Univ., Newark. Coll. of Marine Studies.

LANDSAT OBSERVATIONS OF OCEAN DUMP PLUME MOVEMENT AND DISPERSION
V. Klemas, Principal Investigator, G. R. Davis, and R. Henry 26 Jul. 1976 3 p ERTS
(Contract NAS5-20983)
(E76-10415; NASA-CR-148277) Avail: NTIS HC \$3.50 CSCL 13B

The author has identified the following significant results. Eighteen LANDSAT images were analyzed to study the dispersion and movement of ocean dump plumes thirty-eight miles southeast of Cape Henlopen, Delaware, at the disposal site for waste discharged from a plant producing titanium dioxide. Long visual persistence was explained by the formation of a suspended ferric floc. Spectrometric measurements indicate that upon combining with sea water the acid waste develops a strong reflectance peak in the band 0.55 to 0.60 micron region, resulting in a stronger contrast in the MSS band 4 than the other bands. Predominant direction of movement of the waste plumes was to the southeast. Average drift velocity for surface drogues and the waste plumes was about 0.5 knots. The water at the test site was highly stratified and stable in the summer and nearly homogenous in the winter.

N76-29790# Kansas Univ., Lawrence. Remote Sensing Lab.
GROUND WAVE PROPAGATION OVER ARCTIC SEA ICE
Albert W. Biggs Aug. 1970 30 p refs
(Contract N62306-67-C-0044)

(AD-A021394; CRINC-TR-137-3) Avail: NTIS CSCL 20/14
Radio ground wave propagation in the Arctic Ocean occurs over mixed paths. The mixed paths include layered or homogeneous sea ice and sea water. Amplitude and phase variations occurring as 'dropoff' or 'recovery' effects at the ice-sea water boundaries provide a technique for sea ice mapping and an explanation for anomalous radio reception. The phase variations are more sensitive over short distances from the mixed path boundaries. GRA

N76-31612*# Norsk Polarinstittut, Oslo.
SEA ICE STUDIES IN THE SPITSBERGEN, GREENLAND AREA Quarterly Progress Report
Torgny E. Vinje, Principal Investigator Aug. 1976 2 p Sponsored by NASA and Royal Norwegian Council for Sci. and Industrial Res. ERTS
(E76-10464; NASA-CR-148696; QPR-4) Avail: NTIS HC \$3.50 CSCL 08L

N76-31617*# Ecole Practique des Hautes Etudes, Paris (France).
THE FRENCH ATLANTIC LITTORAL Progress Report, Apr. - Jun. 1976
Fernand Verger, Principal Investigator, J. M. Monget, and R. Regrain Jul. 1976 16 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10469; NASA-CR-148701; PR-3) Avail: NTIS HC \$3.50 CSCL 08C

N76-31621*# Alaska Univ., College.
LANDSAT SURVEY OF NEAR-SHORE ICE CONDITIONS ALONG THE ARCTIC COAST OF ALASKA Quarterly Progress Report
William J. Stringer, Principal Investigator, [1975] 39 p Sponsored by NASA ERTS
(E76-10474; NASA-CR-148739; QPR-3) Avail: NTIS

HC \$4.00 CSCL 08L

The author has identified the following significant results. On the basis of analysis of late winter 1973, 1974, and 1975 LANDSAT imagery of the Beaufort Sea coast of Alaska, the following conclusions regarding near-shore ice conditions were made: (1) by March, the seaward limit of contiguous ice is often beyond the 10 fathom contour. (2) During March, shearing can and does take place along a line roughly coincident with the 10 fathom contour. (3) Ice motions during these shearing events are not extremely great, generally on the order of 10 km. (4) Many large ice features have already been formed by late February. (5) Based on look-ahead at later LANDSAT imagery, it seems apparent that Beaufort Seas shore-fast ice was already formed by late February and may well be safe for exploratory activities from this data forward until the melt season.

N76-31633* # Norsk Polarinstittutt. Oslo.
GLACIOLOGICAL AND MARINE BIOLOGICAL STUDIES AT PERIMETER OF DRONNING MAUD LAND, ANTARCTICA
 Quarterly Progress Report
 Olav Orheim, Principal Investigator 27 Aug. 1976 2 p
 Sponsored by NASA ERTS
 (E76-10489; NASA-CR-148795; QPR-4) Avail: NTIS
 HC \$3.50 CSCL 06C

N76-31651# Office of Saline Water, Washington, D.C.
DESALTING PLANTS INVENTORY REPORT NO. 4
 Frank OShaughnessy Apr. 1973 32 p
 (PB-251575/7; W76-06152) Avail: NTIS HC \$4.00 CSCL
 07A

Summary information is provided on location, size, type of process, year construction began or of plant commissioning, and name of process contractor. Also included, are data on type of water feed, product water use, type of fuel used, and whether or not a desalting plant operates in conjunction with an electric power generating plant. According to manufacturers' information, there were 812 land-based desalting plants of 25,000 gallons per day capacity or larger in operation or under construction throughout the world as of January 1, 1972. Distillation is the most widely used, accounting for 93% of total capacity. The balance is almost entirely in membrane processes, with freezing accounting for less than 1%. GRA

N76-31652# Parsons (Ralph M.) Co., Los Angeles, Calif.
THE RALPH M. PARSONS COMPANY CONCEPTUAL DESIGN OF A 50 MGD DESALINATION PLANT Special Report No. 12
 Aug. 1965 267 p
 (Contract DI-14-01-0001-516)
 (PB-251584/9; W76-06151) Avail: NTIS HC \$9.00 CSCL
 07A

A plant design is reported that advances the technology of sea water conversion based on a multistage flash process consisting of 94 heat recovery stages and 4 heat rejection stages with a maximum brine temperature of 273F. The plant consists of three parallel lines each supplying one third the total output, each operating independently of the others to facilitate maintenance and repairs. Vessels are of corrugated metal pipe arch section permitting longitudinal thermal expansion to be absorbed within the vessel walls. Interior surfaces of the vessels exposed to seawater are cupro-nickel clad. 70-30 CuNi is selected for heat exchange surfaces. Cost of product water is \$0.525 per thousand gallons. GRA

N76-32645# Oxy Metal Industries (Intra), Inc., Santa Ana, Calif. Systems Engineering Div.
RESEARCH ON ULTRAFILTRATION SYSTEMS UNDER SEAWATER DESALTING CONDITIONS Final Report, 1 Dec. 1974 - 29 Feb. 1976

John V. Peck, H. Andre Parker-Jones, and John L. Richardson
 Feb. 1976 125 p refs
 (Contract DI-14-30-3295)
 (PB-253210/9; Pub-R-5004; W76-08117; OWRT-S-76-41)
 Avail: NTIS HC \$5.50 CSCL 07B

The tubular ultrafiltration systems under seawater desalting conditions are evaluated. An experimental investigation was made of the feasibility, both technical and economic, of using tubular ultrafiltration membranes for treating seawater prior to desalination by reverse osmosis. Seawater desalination processes employing reverse osmosis membranes demand extensive pretreatment to prevent surface fouling. The ultrafiltration process is a promising alternative method of pretreatment, both in terms of reliability and total operating costs. GRA

N76-33365* # Kanner (Leo) Associates, Redwood City, Calif.
MICROWAVE SENSING OF THE SEA STATE
 W. Alpers Washington NASA Oct. 1976 15 p refs Transl. into ENGLISH of a paper presented at the Symposium on Earth Survey, Porz-Wahn, West Germany, 7-11 Apr. 1975
 (Contract NASw-2790)
 (NASA-TT-F-17244) Avail: NTIS HC \$3.50 CSCL 171

The application of two active microwave systems, the synthetic aperture side-looking radar and the dual frequency scatterometer, to the remote sensing of ocean waves is discussed. A brief description of the application characteristics of other microwave systems, such as the nanosecond radar altimeter, the dual-frequency radar interferometer, and the microwave radiometer, is also given. The economic utility of sea state forecasting is included. Author

N76-33601# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
RADIOGLACIOLOGY: SOUNDINGS NEAR ISUA, SOUTH-WEST GREENLAND
 P. Gudmandsen, N. Skou, and F. Soendergaard Oct. 1974 31 p Sponsored in part by Min. for Greenland, Danish Natl. Sci. Res. Found., and NSF
 (TUD-D-224) Avail: NTIS HC \$4.00

Radio echo sounding data obtained near the iron ore deposit at Isua, Greenland, from 1971 to 1972 are presented. The soundings were carried out in late September, mid-April, and late July, respectively. In the area south and east of Isua, bedrock echoes were obtained. Ice thicknesses in the order of 700 were measured 12 km northeast of the iron ore deposit, while no bedrock echoes were detected in the area northwest of Isua. Further sounding is suggested. At the surface a new low-frequency technique may be useful in the area northwest of Isua. Ice velocity measurements may be carried out using radio echo sounding techniques but other types of measurements may be more direct since reference points on ice free areas are accessible. ESA

N76-33602# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
RADIOGLACIOLOGY Annual Report, 1974
 May 1975 22 p Sponsored in part by Danish Natl. Sci. Res. Council, Min. for Greenland, NSF, and Space Comm. of the Danish Res. Admin.
 (TUD-D-253) Avail: NTIS HC \$3.50

A review of the remote sensing activities in Greenland carried out by the Electromagnetics Institute during the calendar year 1974 is given including radio echo sounding of the ice surface at Dye-3 radar station, airborne sounding, radiometer investigations, and plans for 1975. Future work is discussed. Publications in 1974 are listed. ESA

N76-33603# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
RADIOGLACIOLOGY: SURFACE SOUNDINGS NEAR DYE-3

05. OCEANOGRAPHY AND MARINE RESOURCES

Finn Soendergaard Feb. 1975 32 p refs Sponsored in part by NSF and by Min. for Greenland (TUD-D-258) Avail: NTIS HC \$4.00

As a part of the 1974 Greenland Ice Sheet Program, radioglaciological investigations were carried out from the ice surface in the vicinity of the DYE-3 station (65 deg 11' N and 43 deg 50' W) in the periods May 7 to May 18 and June 11 to June 12. Radio echo soundings from the ice surface along lines in a 25 km vicinity of the DYE station were carried out. A 60 MHz radar system was installed on three sledges and pulled behind a Trackmaster. Continuous bedrock echoes were obtained from which ice thickness profiles were produced. Small echoes were detected from layers in the ice that take the form of bedrock. Soundings along the strain network show correlation between bedrock and the surface topography. Crosspolarization measurements revealed signs of anisotropy in the ice. ESA

N76-33607# Inter-American Tropical Tuna Commission, La Jolla, Calif.

USE OF ERTS (MSS) AND NOAA VHRR DATA IN MARINE RESOURCE ASSESSMENT

Merritt R. Stevenson, Forrest R. Miller, and Robert G. Kirkham Dec. 1975 112 p refs (Grant NOAA-04-5-158-56) (PB-252551/7; NOAA-76022602) Avail: NTIS HC \$5.50 CSCL 08J

Results on the feasibility of using cloud top temperatures from infrared satellite sensors to estimate sea surface temperatures off California and Baja California are described. Findings suggest that statistically significant relations may exist when stratus clouds overlay the surface for periods of several days. Other research in evaluating ERTS-1 MSS imagery for ocean color is also described. Computer programs were developed for a number of purposes, including a procedure to accurately grid MSS digital imagery using an inexpensive line printer method. A statistical analysis of noise characteristics of MSS detectors was made and a method was devised to reduce this noise in the MSS data. Preliminary analysis of ocean color gradients is also discussed. GRA

N76-33821# National Environmental Satellite Service, Washington, D.C.

ATLANTIC TROPICAL AND SUBTROPICAL CYCLONE CLASSIFICATIONS FOR 1975

D. C. Gaby, J. B. Lushine, B. M. Mayfield, S. C. Pearce, and K. O. Poteat Mar. 1976 21 p refs (PB-253968/2; NOAA-TM-NESS-75; NOAA-76042201) Avail: NTIS HC \$3.50 CSCL 04B

Estimates of the locations and maximum sustained winds of all named tropical and subtropical cyclones in the North Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico were made using techniques developed by Dvorak (tropical) and Herbert and Poteat (subtropical). These techniques were applied to pictures from the Synchronous Meteorological Satellite SMS1. The estimates were compared with the National Hurricane Center's 'best tracks' data to establish the measure of accuracy achieved. These results and other information are presented together with an assessment of the capability of the present operational satellite system. GRA

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.

A76-38520 * Landsat - A satellite surface water divining rod. K. J. Hancock (NASA, Johnson Space Center, Earth Observations Div., Houston, Tex.) and E. H. Schlosser (Lockheed Electronics Co., Inc., Aerospace Systems Div., Houston, Tex.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 375-380.

A DAM (Detection and Mapping) package is developed to provide accurate up-to-date economical and properly formatted maps of surface water using Landsat earth resources satellite digital data in order to detect and locate unrecorded water impoundments. The operational procedure is discussed in terms of data acquisition, establishment of the control network, specification of map characteristics, and generation of maps. Preliminary evaluations essentially indicate that the DAM package can be readily used by personnel unfamiliar with computer processing of remote sensing data, that no false detections are encountered, and that detection accuracy of surface water impoundments greater than 4 hectares is between 95-98%. However, terrain shadows present a problem in mountainous areas at low sun angles. A total cost of less than 15 cents per sq mile to compile the inventory is noted. S.D.

A76-38522 Landsat-1 imagery in hydrologic studies. J. E. Colcord (Washington, University, Seattle, Wash.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 413-436. 10 refs.

It was attempted to extract data pertinent to hydrological studies from limited available Landsat-1 imagery on the Nisqually River Basin. Data specifically identified were topographical characteristics, river characteristics, land-use (runoff) characteristics, and atmospherics. Expected accuracies for drainage areas, river lengths, and water surface areas are to within 10%, 3%, and 3%, respectively. The multidata imagery is helpful in snow line variation and in changes of runoff prediction. P.T.H.

A76-39521 A possible forecasting technique for winter snow cover in the Northern Hemisphere and Eurasia. D. R. Wiesnet and M. Matson (NOAA, National Environmental Satellite Service, Washington, D.C.). *Monthly Weather Review*, vol. 104, July 1976, p. 828-835.

Winter-season snow and ice charts of the Northern Hemisphere based on satellite data from 1966 through 1975 were examined to determine the extent and area of snow cover in Eurasia and North America. Graphical analysis indicates no significant overall increase in North American winter snow cover for the 9-year period of data, whereas over the same period, a large fluctuation occurred in Eurasia. Regression analysis yielded several equations with correlation coefficients significant enough to have possible applications for 30-, 60-, and 90-day forecasting of seasonal, hemispheric, and continental snow cover. (Author)

A76-42970 Determination of snow depth and snow extent from NOAA 2 satellite very high resolution radiometer data. D. F. McGinnis, Jr., J. A. Pritchard, and D. R. Wiesnet (NOAA, National Environmental Satellite Service, Washington, D.C.). *Water Resources Research*, vol. 11, Dec. 1975, p. 897-902. 5 refs.

A76-45846 * Snow and ice surfaces measured by the Nimbus 5 microwave spectrometer. K. F. Kunzi, A. D. Fisher, D. H. Staelin (MIT, Cambridge, Mass.), and J. W. Waters (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Journal of Geophysical Research*, vol. 81, Sept. 20, 1976, p. 4965-4980. 20 refs. Contracts No. NAS7-100; No. NAS5-21980.

The 22.2- and 31.4-GHz channels of the microwave spectrometer on board the Nimbus 5 earth observatory satellite provide information about the global distribution and character of various types of snow and ice. Observations for the winter and summer of 1973 are presented for both polar regions. Well-defined spectral signatures are found for snow, sea ice, and land ice in Greenland and Antarctica. A simple model with subsurface temperature gradients in a lossy homogeneous dielectric does not account for the observations; internal scattering effects appear to play a dominant role.

(Author)

A76-47719 # Improving estimates of streamflow characteristics by using Landsat-1 imagery. E. F. Hollyday. *U.S. Geological Survey, Journal of Research*, vol. 4, Sept.-Oct. 1976, p. 517-531. 11 refs.

Imagery from Landsat-1 was used to discriminate physical features of drainage basins in an effort to improve equations used to estimate streamflow characteristics at gaged and ungaged sites. Records of 20 gaged basins in the Delmarva Peninsula of Maryland, Delaware, and Virginia were analyzed for 40 statistical streamflow characteristics. Equations relating these characteristics to basin characteristics were obtained by a technique of multiple linear regression. Characteristics from imagery were forest, riparian (stream-bank) vegetation, water, and combined agricultural and urban land use. These basin characteristics were isolated photographically by techniques of film-density discrimination. Comparison of equations in the control group with corresponding equations in the experimental group reveals that for 12 out of 40 equations the standard error of estimate was reduced by more than 10 percent. (Author)

N76-28589 Kentucky Univ., Lexington.
HYDROLOGIC AND ECONOMIC MODELS IN RESERVOIR DESIGN Ph.D. Thesis

Daniel Irvin Carey 1975 189 p
Avail: Univ. Microfilms Order No. 76-16584

Recent studies have indicated the need for development of surface water supplies in Kentucky. Rising resource costs make economically efficient reservoir designs increasingly important. Some methods in water supply reservoir design that increase system benefits are presented. Two major factors influencing reservoir design were studied: (1) estimated future streamflow into the reservoir and (2) demands placed on the reservoir. To assess the reliability of a design, the use of mathematical models to simulate stream flow was undertaken. Data on rural residential water demand in Kentucky has indicated that a price-demand relationship exists. The value of utilizing price-demand information in reservoir design studies was considered. Three pricing policies were examined and their effect on reservoir design was determined. It was found that the use of the conservation pricing policies substantially reduces storage requirements while providing increased, demonstrable net benefits to the community, and that conservation pricing policies substantially lowered the average price paid for water. Dissert. Abstr.

06 HYDROLOGY AND WATER MANAGEMENT

N76-28596*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.

UTILIZATION OF SATELLITE DATA FOR INVENTORING PRAIRIE PONDS AND LAKES. LANDSAT-1 DATA WERE USED TO DISCRIMINATE PONDS AND LAKES FOR WATERFOWL MANAGEMENT

David S. Gilmer, Principal Investigator and Edgar A. Work, Jr. (ERIM, Ann Arbor, Mich.) [1975] 10 p refs Repr. from Photogrammetric Engr. and Remote Sensing, v. 42, no. 5, May 1976 p 685-694 ERTS

(NASA Order S-70243-AG-4; Contract DI-14-16-0008-75) (E76-10411; NASA-CR-147654) Avail: NTIS HC \$3.50 CSCL 08H

The author has identified the following significant results. The mapping of open water as an indicator of waterfowl habitat quality was carried out by using two different recognition techniques, a single waveband thresholding approach and a multiple waveband approach termed proportion estimation. The single waveband technique has proven simple to implement. Its computer algorithm was rapid and accurately recognized prairie lakes and large ponds. The resultant products of this processing technique were thematic maps and statistical tabulations describing open surface water conditions. The maps served to portray visually the location and frequency of surface water bodies but usually necessitated additional interpretation.

N76-28597*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.

IN SITU SPECTRORADIOMETRIC CALIBRATION OF EREP IMAGERY AND ESTUARINE AND COASTAL OCEANOGRAPHY OF BLOCK ISLAND SOUND AND ADJACENT NEW YORK COASTAL WATERS Final Report

Edward F. Yost, Principal Investigator Dec. 1975 321 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57918 EREP

(Contract NAS9-13308) (E76-10418; NASA-CR-147469) Avail: NTIS HC \$9.75 CSCL 08J

The author has identified the following significant results. The first part of the study resulted in photographic procedures for making multispectral positive images which greatly enhance the color differences in land detail using an additive color viewer. An additive color analysis of the geologic features near Willcox, Arizona using enhanced black and white multispectral positives allowed compilation of a significant number of unmapped geologic units which do not appear on geologic maps of the area. The second part demonstrated the feasibility of utilizing Skylab remote sensor data to monitor and manage the coastal environment by relating physical, chemical, and biological ship sampled data to S190A, S190B, and S192 image characteristics. Photographic reprocessing techniques were developed which greatly enhanced subtle low brightness water detail. Using these photographic contrast-stretch techniques, two water masses having an extinction coefficient difference of only 0.07 measured simultaneously with the acquisition of S190A data were readily differentiated.

N76-28600*# Stockholm Univ. (Sweden).

ACCUMULATION OF BLUE-GREEN ALGAE IN THE SURFACE WATER OF THE NORTHERN BALTIC, 6 AUGUST 1975, GENERATED FROM THE CCT-TAPE MSS 5 (ID 2196-0917200) BY A HERTZ INK-JET PLOTTER CONNECTED TO A APDP 11/40 COMPUTER AT FOA 3 Quarterly Progress Report

Bengt-Owe Jansson and Bo G. Nyqvist, Principal Investigators [1975] 16 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10423; NASA-CR-148299) Avail: NTIS HC \$3.50 CSCL 06C

N76-28626*# Purdue Univ., Lafayette, Ind.

EVALUATION OF SURFACE WATER RESOURCES FROM MACHINE-PROCESSING OF ERTS MULTISPECTRAL DATA

P. W. Mausel, W. J. Todd, M. F. Baumgardner, R. A. Mitchell, and J. P. Cook 1976 7 p

(Contract NAS9-14016)

(NASA-CR-147787; LARS-Inform-Note-030576) Avail: NTIS HC \$3.50 CSCL 08H

The surface water resources of a large metropolitan area, Marion County (Indianapolis), Indiana, are studied in order to assess the potential value of ERTS spectral analysis to water resources problems. The results of the research indicate that all surface water bodies over 0.5 ha were identified accurately from ERTS multispectral analysis. Five distinct classes of water were identified and correlated with parameters which included: degree of water siltiness; depth of water; presence of macro and micro biotic forms in the water; and presence of various chemical concentrations in the water. The machine processing of ERTS spectral data used alone or in conjunction with conventional sources of hydrological information can lead to the monitoring of area of surface water bodies; estimated volume of selected surface water bodies; differences in degree of silt and clay suspended in water and degree of water eutrophication related to chemical concentrations.

Author

N76-28628*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

HYDROGRAPHIC CHARTING FROM LANDSAT SATELLITE: A COMPARISON WITH AIRCRAFT IMAGERY

Elizabeth M. Middleton (Computer Sciences Corp., Silver Spring, Md.) and John L. Barker May 1976 10 p refs Proposed for Presentation at Ocean 76 Conf., Washington, D. C., 14-16 Sept. 1976

(NASA-TM-X-71146; X-923-76-111) Avail: NTIS HC \$3.50 CSCL 08H

The relative capabilities of two remote-sensing systems in measuring depth and, consequently, bottom contours in sandy-bottomed and sediment-laden coastal waters were determined quantitatively. The multispectral scanner (MSS), orbited on the LANDSAT-2 Satellite, and the ocean color scanner (OCS), flown on U-2 aircraft, were used. Analysis of imagery taken simultaneously indicates a potential for hydrographic charting of marine coastal and shallow shelf areas, even when water turbidity is a factor. Several of the eight optical channels examined on the OCS were found to be sensitive to depth or depth-related information. The greatest sensitivity was in OCS-4(0.544 \pm or - 0.012 microns) from which contours corresponding to depths up to 12m were determined. The sharpness of these contours and their spatial stability through time suggests that upwelling radiance is a measure of bottom reflectance and not of water turbidity. The two visible channels on LANDSAT's MSS were less sensitive in the discrimination of contours, with depths up to 8m in the high-gain mode (3x) determined in MSS-4(0.5 to 0.6 microns).

Author

N76-28633*# Bittinger (M. W.) and Associates, Inc., Fort Collins, Colo.

SNOWPACK GROUND TRUTH: RADAR TEST SITE, STEAMBOAT SPRINGS, COLORADO, 8-16 APRIL 1976

Steven Howell, E. Bruce Jones, and Charles F. Leaf Apr. 1976 30 p refs Sponsored in part by AF

(Contract NAS5-22312)

(NASA-CR-144773) Avail: NTIS HC \$4.00 CSCL 08L

Ground-truth data taken at Steamboat Springs, Colorado is presented. Data taken during the period April 8, 1976 - April 16, 1976 included the following: (1) snow depths and densities at selected locations (using a Mount Rose snow tube); (2) snow pits for temperature, density, and liquid water determinations using the freezing calorimetry technique and vertical layer classification; (3) snow walls were also constructed of various cross sections and documented with respect to sizes and snow characteristics; (4) soil moisture at selected locations; and (5) appropriate air temperature and weather data.

Author

N76-29670*# Delaware Univ., Newark. Coll. of Marine Studies.

APPLICATION OF LANDSAT-2 TO THE MANAGEMENT OF DELAWARE'S MARINE AND WETLAND RESOURCES Progress Report, May - Jul, 1976

V. Klemas, Principal Investigator, D. S. Bartlett, W. Philpot, and G. R. Davis 30 Jul. 1976 10 p refs ERTS (Contract NAS5-20983) (E76-10440; NASA-CR-148517) Avail: NTIS HC \$3.50 CSCL 05A

The author has identified the following significant results. Imagery from LANDSAT 1 and 2 proved valuable in determining the location, type, and extent of estuarine fronts under different tidal conditions. Neither ships nor aircraft alone could provide as complete, synoptic, and repetitive an overview as did the satellites.

N76-29671*# Delaware Univ., Newark. Coll. of Marine Studies.

ESTUARINE DENSITY FRONTS AND THEIR EFFECT ON OIL SLICKS

V. Klemas, Principal Investigator, D. Polis, and G. R. Davis 23 Jul. 1976 2 p ERTS (Contract NAS5-20983) (E76-10441; NASA-CR-148518) Avail: NTIS HC \$3.50 CSCL 13B

The author has identified the following significant results. Estuarine fronts represent regions of extremely high gradient or discontinuity in various parameters of physical interest, the most important being the water velocity and density fields. Aircraft and boats were combined to study the behavior of different types of fronts in Delaware Bay and their effect on pollutants in order to provide a basis for improving an oil drift and spreading model. Imagery from the LANDSAT satellites provided the most effective means of determining the location and extent of frontal systems over all portions of the tidal cycle. This data is being used to modify the oil drift and spreading model.

N76-29674*# Delaware Univ., Newark. Center for Remote Sensing.

LOW-COST, AERIAL PHOTOGRAPHIC INVENTORY OF TIDAL WETLANDS Final Report

V. Klemas, Principal Investigator, D. S. Bartlett, O. W. Crichton, and G. R. Davis Jul. 1976 30 p refs ERTS (E76-10444; NASA-CR-148521; CRS-2-76) Avail: NTIS HC \$4.00 CSCL 14E

N76-29678*# Delaware Univ., Newark. Coll. of Marine Studies.

REMOTE SENSING OF COASTAL WETLAND VEGETATION AND ESTUARINE WATER PROPERTIES

Vytautas Klemas, Principal Investigator 1975 38 p refs Presented at 3d Intern. Estuarine Res. Conf., Galveston, Tex., 6-9 Oct. 1975 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10448; NASA-CR-148525) Avail: NTIS HC \$4.00 CSCL 08A

N76-29691# Coastal Engineering Research Center, Fort Belvoir, Va.

AN ERTS-1 STUDY OF COASTAL FEATURES ON THE NORTH CAROLINA COAST

George H. Miller and Dennis W. Berg Jan. 1976 43 p refs (AD-A022336; CERC-MR-76-2) Avail: NTIS CSCL 08/6

Unenhanced imagery recorded by the multispectral scanner (MSS) of the NASA Earth Resources Technology Satellite (ERTS-1)

was analyzed to determine how satellite imagery may be applied to specific coastal engineering problems. The study area is a segment of the North Carolina coast comprising Wrightsville Beach, Masonboro Inlet, Masonboro Beach, Carolina Beach Inlet, and Carolina Beach, which are areas of ongoing research by CERC. Analysis was supplemented by underflight imagery supplied by NASA and ground-truth data. Several significant coastal features are visible in the ERTS-1 imagery. Among those are plumes of suspended sediment emerging from inlets, changes in water coloration possibly due to effects of temperature change, inlet bars, and cape bars. In addition, morphological changes in selected coastal land features were determined by comparing ERTS-1 films obtained about 1 year apart. GRA

N76-29697# Rutgers Univ., New Brunswick, N.J. Water Resources Research Inst.

REORIENTATION OF URBAN WATER RESOURCES RESEARCH Final Report

William Whipple, Jr., Maynard M. Hufschmidt (North Carolina Univ., Chapel Hill), Bernard B. Berger (Univ. of Mass.), David H. Howells (North Carolina Univ., Chapel Hill), L. Douglas James (Ga. Inst. of Tech.), and L. Scott Tucker (Urban Drainage and Flood Control District, Denver) Apr. 1976 58 p Workshop held at Quail Roost, N. C., 24-26 Jul. 1975 (Contract DI-14-31-0001-5134) (PB-251907/2; W76-06553; OWRT-B-062-NJ(1)) Avail: NTIS HC \$4.50 CSCL 13B

The consensus was that the Federal approach to water resources has generally neglected the problems of metropolitan areas. Hydrological, water quality and ecological data are insufficient. Technology to meet many problems is lacking, and existing institutions are ill adapted to the problems now being encountered. Particular emphasis in urban-related research needs to be given to fields of water quality, flood plain management, and interfaces with land-use planning and control. Strategies and basic objectives should be reexamined as well as the problems of planning to meet environmental objectives at reasonable cost. Programs of urban-related water resources research are recommended. Author (GRA)

N76-29698# Rutgers Univ., New Brunswick, N.J.

REORIENTATION OF URBAN WATER RESOURCES RESEARCH

William Whipple, Jr., Maynard M. Hufschmidt (N. Carolina Univ., Chapel Hill), Bernard B. Berger (Mass. Univ.), David H. Howells (N. Carolina Univ., Chapel Hill), L. Douglas James (Ga. Inst. of Tech.), and L. Scott Tucker (Urban Drainage and Flood Control District, Denver) Apr. 1976 19 p Workshop held at Quail Roost, N. C., 24-26 Jul. 1975 (Contract DI-14-31-0001-5134) (PB-251908/0; W76-06554; OWRT-B-062-NJ(1)) Avail: NTIS HC \$3.50 CSCL 13B

Recommendations for urban-related research related to water quality propose development of strategy and methodology to contribute to remedying the various deficiencies, including those in the basic planning goals and approaches, better methods of measuring and evaluating pollution from urban runoff, methods of determining the environmental effects of pollution, alternative water quality enhancement approaches (other than effluent treatment), and a better institutional framework for areawide planning. There is no unified national policy for flood plain management. Goals of economic efficiency, of avoidance of social disruption, of financial aid after a disaster, and of better land use of flood plains are expressed implicitly in various Federal programs. Much state legislation needs modernization to keep pace with new developments. Author (GRA)

N76-29888# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

ANNOTATED BIBLIOGRAPHY ON THE GEOLOGIC, HYDRAULIC, AND ENGINEERING ASPECTS OF TIDAL INLETS Final Report

06 HYDROLOGY AND WATER MANAGEMENT

John H. Barwis Jan. 1976 344 p refs
(AD-A020355; WES-GITI-4) Avail: NTIS CSCL 08/8

Abstracts and annotations are given for about 1,000 published and unpublished reports, dated 1973 and earlier, on the geologic and engineering aspects of tidal inlets. Insofar as they relate to inlets, references are given on tidal hydraulics, engineering structures, littoral processes, stratigraphy and geologic history, coastal aerial photography, and Corps of Engineers reports of investigation of individual inlets. GRA

N76-30624*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF ERTS DATA WITHIN THE SUSQUEHANNA RIVER BASIN Final Report, 1 Jun. 1972 - 30 Apr. 1975

G. J. McMurtry and G. W. Petersen, Principal Investigators Dec. 1975 182 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contract NAS5-23133) (E76-10456; NASA-CR-148587; ORSER-SSEL-TR-21-75) Avail: NTIS HC \$7.50 CSCL 08F

The author has identified the following significant results. The full potential of high quality data is achieved only with the application of efficient and effective interpretation techniques. An excellent operating system for handling, processing, and interpreting ERTS-1 and other MSS data was achieved. Programs for processing digital data are implemented on a large nondedicated general purpose computer. Significant results were attained in mapping land use, agricultural croplands, forest resources, and vegetative cover. Categories of land use classified and mapped depend upon the geographic location, the detail required, and the types of lands use of interest. Physiographic and structural provinces are spectacularly displayed on ERTS-1 MSS image mosaics. Geologic bedrock structures show up well and formation contacts can sometimes be traced for hundreds of kilometers. Large circular structures and regional features, previously obscured by the detail of higher resolution data, can be seen. Environmental monitoring was performed in three areas: coal strip mining, coal refuse problems, and damage to vegetation caused by insects and pollution.

N76-30630*# Corps of Engineers, Waltham, Mass.
THE USE OF LANDSAT DCS AND IMAGERY IN RESERVOIR MANAGEMENT AND OPERATION Progress Report, period ending 1 Jun. 1976

Saul Cooper, Principal Investigator 1 Jun. 1976 6 p Sponsored by NASA (E76-10462; NASA-CR-148593; PR-5) Avail: NTIS HC \$3.50 CSCL 05B

The author has identified the following significant results. A tally of DCP messages received shows that the number of messages increased markedly at the beginning of the year as the downlink went into operation, but dropped off in May due to computer troubles.

N76-30632*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
HYDROGRAPHY SYNTHESIS USING LANDSAT REMOTE SENSING AND THE SCS MODELS

Robert M. Ragan and Thomas J. Jackson (Kentucky Univ., Lexington) Jul. 1976 63 p refs (NASA-TM-X-71175; X-913-76-161) Avail: NTIS HC \$4.50 CSCL 08H

The land cover requirements of the Soil Conservation Service (SCS) Model used for hydrograph synthesis in urban areas were modified to be LANDSAT compatible. The Curve Numbers obtained with these alternate land cover categories compare well with those obtained in published example problems using the conventional categories. Emergency spillway hydrographs and

synthetic flood frequency flows computed for a 21.1 sq. mi. test area showed excellent agreement between the conventional aerial photo-based and the Landsat-based SCS approaches.

Author

N76-30748# Missouri Univ., Rolla. Dept. of Geophysics.
THE DETECTION AND MAPPING OF SUBTERRANEAN WATER BEARING CHANNELS, PHASE 2 Final Report, Jul. 1972 - Jun. 1974

Richard D. Rechten, Larry W. Gardner, Marion Sanders, and Randall Tucker 1 Jun. 1975 52 p refs (Contract DI-14-31-0001-3909; OWRT Proj. B-087-MO(1)) (PB-250459/5; W76-05129) Avail: NTIS HC \$4.50 CSCL 08H

Field experiments were conducted over a near-surface cavern to obtain a spatial definition of the associated Cavity Resonance Phenomenon. A data system consisting of a mobile laboratory housing a minicomputer, its peripherals, and associated test equipment, was assembled to record three-component ground velocity measurements. A very accurate subsurface survey was made of one passage approximately 162 feet below the surface with a uniform shape, a height of about 100 feet, and a width of 51 feet. Strong reflection was obtained from an unexplored arm of one cave. Test drilling showed this to be a mud-filled cavern. GRA

N76-31609*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia).

WATER UTILISATION, EVAPOTRANSPIRATION AND SOIL MOISTURE MONITORING IN THE SOUTH EAST REGION OF SOUTH AUSTRALIA Quarterly Progress Report

K. R. McCloy, Principal Investigator, K. John Shepherd, and J. C. Killick 2 May 1976 11 p refs Sponsored by NASA ERTS (E76-10427; NASA-CR-148303; QPR-2) Avail: NTIS HC \$3.50 CSCL 08H

N76-31622*# Delaware Univ., Newark. Coll. of Marine Studies.

REMOTE SENSING OF ESTUARINE FRONTS AND THEIR EFFECTS ON POLLUTANTS

V. Klemas, Principal Investigator and D. F. Polis [1975] 53 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Contracts NAS5-21937; NAS5-20983; Grant NSF G1-41896) (E76-10475; NASA-CR-148782) Avail: NTIS HC \$4.50 CSCL 08H

The author has identified the following significant results. Imagery from LANDSAT 1 and 2 proved valuable in determining the location, type, and extent of estuarine fronts under different tidal conditions. Neither ships nor aircraft alone could provide as complete, synoptic, and repetitive an overview as did the satellites. Since estuarine fronts influence the movement of oil slicks and dispersion of other pollutants, cleanup operations depending on real time use of oil slick movement prediction models will benefit not only from aircraft tracking the actual slicks but also from real time satellite observations of surface currents and the location of frontal systems.

N76-31627*# Norwegian Water Resources and Electricity Board, Oslo.

HYDROLOGICAL INVESTIGATIONS IN NORWAY Quarterly Report, 1 Nov. 1975 - 1 May 1976

Helge A. Odegaard, Principal Investigator 1 May 1976 6 p Sponsored by NASA ERTS (E76-10480; NASA-CR-148787) Avail: NTIS HC \$3.50 CSCL 08H

N76-31632*# National Oceanic and Atmospheric Administration, Washington, D.C.

EVALUATION OF LANDSAT-2 DATA FOR SELECTED HYDROLOGIC APPLICATIONS Progress Report

Donald R. Wiesnet, David F. McGinnis, Jr., Principal Investigators, Michael C. McMillan, and Michael Matson 15 Sep. 1976 3 p ERTS

(Contract NAS3-5991)

(E76-10487; NASA-CR-148793) Avail: NTIS HC \$3.50 CSCL 05B

N76-31644*# Texas A&M Univ., College Station. Remote Sensing Center.

REMOTE SENSING ANALYSIS OF LAKE LIVINGSTON AQUATIC PLANTS Final Report

Arthur R. Benton, Jr. and Robert M. Newman Mar. 1976 41 p Sponsored in part by Trinity River Authority

(Grant NGL-44-001-001)

(NASA-CR-147975) Avail: NTIS HC \$4.00 CSCL 06C

Results obtained during 1975 to monitor the growth of aquatic plants in the Lake-Livingston area, using remote sensing photographic imagery, were described. Sequential total coverage was provided of the Jungle and White Rock Creek, plus coverage of smaller areas of localized infestation downlake, including Brushy Creek, KOA Kampground/Marina, Penwaugh Slough, Memorial Point Marina, the Beacon Bay marinas and Pine Island. The imagery was generally good, photographic exposure being increased as the season progressed in order to obtain better pictures of the submerged vegetation. Some very significant differences in growth patterns, species interaction, and species dominance were observed when compared to 1974. Observation of the following plants was discussed: water hyacinth, hydrilla, coontail, potamogeton. In general, the level of infestation was lower in 1975 than in 1974, due to the combined effect of more systematic application of herbicides and harsher intervening winter weather conditions. Y.J.A.

N76-31653# Arizona Univ., Tucson. School of Renewable Natural Resources.

PREDICTING SNOWMELT RUNOFF USING A DETERMINISTIC WATERSHED MODEL WITH STOCHASTIC PRECIPITATION INPUTS M.S. Thesis

William Toby Hanes Jan. 1975 94 p refs

(Contract DI-14-31-0001-3858)

(PB-252858/6; W76-07764; OWRT-B-032-ARIZ(22)) Avail: NTIS HC \$5.00 CSCL 08H

The accuracy of currently used long term runoff forecasting techniques, are limited because of their inability to deal with the uncertainty in the amount of precipitation expected to fall after the forecast date. The basis for a simulation based, long term runoff forecasting technique is developed to overcome this problem by simulating future precipitation events. The technique utilizes a deterministic watershed snowmelt model and a sequence, event based stochastic precipitation model to provide daily precipitation data inputs for the watershed model. Author (GRA)

N76-31660# Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev.

DEVELOPMENT OF SNOW WATER EQUIVALENT SURVEY METHODS USING AIRBORNE GAMMA MEASUREMENTS Progress Report, Jan. - Sep. 1975

A. E. Fritzsche and C. Juniper Nov. 1975 30 p refs

(Contract E(29-11)-1183)

(PB-250709/3; EGG-1183-1677; NOAA-76021103) Avail: NTIS HC \$4.00 CSCL 08L

The progress made during the period March 1975 through September 1975 on EG and G's support of NOAA for development of airborne techniques for measurement of the water equivalent of snow and soil moisture is reported. The work included a series of snow and soil moisture surveys and development of a

new detector and data acquisition system. The status is summarized together with a review of plans for the immediate future. In addition, suggestions for other future work are discussed and recommendations made. GRA

N76-31662# Arizona Univ., Tucson. School of Renewable Natural Resources.

DECISION ANALYSIS FOR WATERSHED MANAGEMENT ALTERNATIVES Completion Report

M. M. Fogel, J. L. Thames, L. Duckstein, and D. R. Davis Jan. 1976 20 p refs

(Contract DI-14-31-0001-3858)

(PB-252189/6; OWRT-B-032-ARIZ(23)) Avail: NTIS HC \$3.50 CSCL 13B

A methodology for watershed managers to use in resource development and conservation decision making is reported. Stochastic event based precipitation models were derived to serve as inputs into deterministic watershed models with the result that a time series of hydrologic outputs could be obtained. These outputs, water and sediment yields and peak flow rates, could then be used to reflect the extent of man's activities in modifying the environment, as well as the optimal design and operation of water control facilities. GRA

N76-32609*# Delaware Univ., Newark.

VARIABILITY OF WETLAND REFLECTANCE AND ITS EFFECT ON AUTOMATIC CATERGORIZATION OF SATELLITE IMAGERY

Vytautas Klemas, Principal Investigator, David S. Bartlett, Robert H. Rogers (Bendix Aerospace Systems Div., Ann Arbor, Mich.), and Navinchandra Shah (Bendix Aerospace Systems Div., Ann Arbor, Mich.) 16 Sep. 1976 3 p ERTS

(Contract NAS5-20983)

(E76-10488; NASA-CR-148794) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. A technique for training automated analysis of satellite multispectral data based on in situ measurements of target reflectance was tested and applied in delineating cover communities in Delaware's tidal wetlands. Land cover categorization of data from the same overpass in four test wetland areas was carried out using a four category classification system. The tests indicate that training data based on in situ reflectance measurements and atmospheric correction of LANDSAT data can produce comparable accuracy of categorization to that achieved using more conventional relative radiance training. Analysis of the four wetlands cover categories (salt marsh cordgrass, salt hay, water, and unvegetated tidal flat) produced average categorization accuracies of 82.1% by conventional relative radiance training and 81.4% by use of in situ reflectance measurements.

N76-32611*# Old Dominion Univ. Research Foundation, Norfolk, Va.

CORRELATION OF CHLOROPHYLL, SUSPENDED MATTER, AND RELATED PARAMETERS OF WATERS IN THE LOWER CHESAPEAKE BAY AREA TO LANDSAT-1 IMAGERY Final Report, Aug. 1972 - Nov. 1974

P. Fleischer, Principal Investigator, D. E. Bowker (NASA, Langley Res. Center), W. G. Witte, T. A. Gosink, W. J. Hanna, and J. C. Ludwick Aug. 1976 131 p refs ERTS

(Contract NAS5-21816)

(E76-10497; NASA-CR-148803) Avail: NTIS HC \$6.00 CSCL 08J

The author has identified the following significant results. An effort to relate water parameters of the lower Chesapeake Bay area to multispectral scanner images of LANDSAT 1 has shown that some spectral bands can be correlated to water parameters, and has demonstrated the feasibility of synoptic mapping of estuaries by satellite. Bands 5 and 6 were shown to be useful for monitoring total particles. Band 5 showed high correlation with suspended sediment concentration. Attenuation coefficients monitored continuously by ship along three baselines were cross correlated with radiance values on three days.

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Improved correlations resulted when tidal conditions were taken into consideration. A contouring program was developed to display sediment variation in the lower Chesapeake Bay from the MSS bands.

N76-32614*# Alaska Univ., College.
IDENTIFICATION OF FLOOD HAZARD RESULTING FROM AUFEIS FORMATION IN AN INTERIOR ALASKAN STREAM
W. J. Stringer, Principal Investigator, T. H. George, and R. M. Bell [1976] 15 p refs. Sponsored by NASA and Dept. of Agriculture. Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (Grant NGL-02-001-092) (E76-10501; NASA-CR-148821) Avail: NTIS HC \$3.50 CSCL 08H

N76-32619*# Virginia Inst. of Marine Science, Gloucester Point.
APPLICATIONS OF REMOTE SENSING TO ESTUARINE MANAGEMENT Annual Report
John C. Munday, Jr., Hayden H. Gordon, Christopher S. Welch, and Gaynor Williams Jul. 1976 138 p refs (Grant NGL-47-022-005) (NASA-CR-148826; AR-4) Avail: NTIS HC \$6.00 CSCL 08C
Projects for sewage outfall siting for pollution control in the lower Chesapeake Bay wetlands are reported. A dye-buoy/photogrammetry and remote sensing technique was employed to gather circulation data used in outfall siting. This technique is greatly favored over alternate methods because it is inexpensive, produces results quickly, and reveals Lagrangian current paths which are preferred in making siting decisions. Wetlands data were obtained by interpretation of color and color infrared photographic imagery from several altitudes. Historical sequences of photographs are shown that were used to document wetlands changes. Sequential infrared photography of inlet basins was employed to determine tidal prisms, which were input to mathematical models to be used by state agencies in pollution control. A direct and crucial link between remote sensing and management decisions was demonstrated in the various projects. Author

N76-32626# World Meteorological Organization, Geneva (Switzerland).
HYDROLOGICAL NETWORK DESIGN AND INFORMATION TRANSFER
1976 190 p refs. Proc. of the WMO Intern. Seminar held at Newcastle-upon-Tyne, UK, 19-23 Aug. 1974; sponsored in part by Intern. Assoc. of Hydrol. Sci. (WMO-433; OHR-8; ISBN-92-63-10433-6) Avail: NTIS HC \$7.50; WMO, Geneva, Sw. Fr. 30

The seminar consisted of two parts - an open forum comprising seven sessions each dealing with a distinct topic in hydrological network design followed by discussions; and a workshop consisting of six sessions dealing with network design problems related to streamflow, precipitation and evaporation gages. Each session consisted of a brief introduction to the topic in question, followed by a classroom exercise, based on a real case study.

N76-32627 Geological Survey, Reston, Va.
OBJECTIVES AND APPROACHES IN HYDROLOGICAL NETWORK PLANNING AND DESIGN
W. Hofmann /n WMO Hydrol. Network Design and Inform. Transfer 1976 p 9-14 refs

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General remarks are made concerning networks for hydrometeorological data acquisition. The uses for hydrometeorological data which influence the network requirements are reviewed and other factors having a bearing on the design, such as costs, benefits, and length of observation time are also noted. ESA

N76-32628 Southern Water Authority, Worthing (England).
DATA TIME INTERVALS IN HYDROLOGY
P. W. Herbertson /n WMO Hydrol. Network Design and Inform. Transfer 1976 p 17-19 refs

Copyright.

The uses of hydrological data are reviewed and the need for and effect of various data time intervals on the accuracy of the data are discussed, based on results of surveys in the U.S.A. and Great Britain. The data recording systems are described and fixed-time and fixed-interval recording is briefly considered. ESA

N76-32639 State Hydrological Inst. (USSR).
GENERAL PRINCIPLES OF HYDROLOGICAL NETWORK DESIGN
W. Kupriianov /n WMO Hydrol. Network Design and Inform. Transfer 1976 p 151-165

Copyright.

The requirements that should be met by the number of observation points, the program of observation and the accuracy of measurements in a hydrological network are listed. The general principles to be followed in selecting sites for the distribution of hydrological observation points are set forth. The possibilities offered by mathematical analysis and statistics with regard to regionalization and network planning are considered and the question of observation duration addressed. The selection of water bodies (lakes, reservoirs etc.) for research is discussed together with observational site location. ESA

N76-32640 Newcastle-upon-Tyne Univ. (England).
NETWORK DESIGN AND DATA USE
P. Johnson /n WMO Hydrol. Network Design and Inform. Transfer 1976 p 167-180 refs

Copyright.

The analysis of data from a streamflow gaging network in the region of the Northumbrian Water Authority, England, related particularly to the estimation of the yield-storage characteristics of a planned reservoir, site is discussed. The network of gaging stations and the relevant aspects of each are summarized. The basic data sets and error in estimate of storage are analyzed together with time sampling error and total error in estimated storage. ESA

N76-32643# Utah Univ., Salt Lake City.
METHODOLOGIES FOR THE DETERMINATION OF STREAM RESOURCE FLOW REQUIREMENTS: AN ASSESSMENT
C. B. Stalnaker and J. L. Arnette Apr. 1976 207 p refs (Contract D1-14-16-008-915) (PB-253152/3; FWS/OBS-76/03) Avail: NTIS HC \$7.75 CSCL 08H

Standard nomenclature is presented, together with an overview of hydrologic techniques, the calculation of essential hydraulic parameters, and determination of other quantitative relationships, including a summary of applicable modeling approaches. Methods are discussed for assessing instream flow needs for fish, terrestrial wildlife, and water quality. Problems of determining the impact of stream flow changes on recreational activities and aesthetic values are considered. GRA

N76-32644# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Earth Sciences.

LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION. REPORT 17-6: APPLICATION OF THREE-DIMENSIONAL HYDRODYNAMIC MODEL TO STUDY EFFECTS OF PROPOSED JETPORT ISLAND ON THERMOCLINE STRUCTURE IN LAKE ERIE

John F. Paul and Wilbert J. Lick Mar. 1976 86 p refs (Contract DACW39-74-C-0080) (AD-A022588; WES-CR-H-75-1-6) Avail: NTIS CSCL 08/8

A previously developed three-dimensional, variable-density hydrodynamic model was applied to the Lake Erie area about Cleveland. This application was to investigate the effect of a proposed jetport island on the summer stratification pattern in the nearshore lake area and on the flushing characteristics of the Cuyahoga River outflow into the lake. Initial results obtained from the application of the model are presented. Author (GRA)

N76-33587# National Oceanic and Atmospheric Administration, Rockville, Md.

INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES. Feb. 1976 108 p refs (PB-253928/6; IFYGL-Bull-17; NOAA-76030306) Avail: NTIS HC \$5.50 CSCL 08H

A bibliography of articles, project reports, abstracts, and program tasks published by scientists from the United States and Canada whose studies are based on environmental research in the Great Lakes is presented. GRA

N76-33592*# Northern Prairie Wildlife Research Center, Jamestown, N. Dak.

APPLICATION OF LANDSAT SYSTEM FOR IMPROVING METHODOLOGY FOR INVENTORY AND CLASSIFICATION OF WETLANDS Progress Report, 1 Jul. - 30 Sep. 1976

David S. Gilmer, Principal Investigator and Edgar A. Work, Jr. 8 Oct. 1976 8 p ref ERTS (NASA Order S-54049-A) (E76-10503; NASA-CR-148823) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. Thematic maps were produced for surface water in stratum 46. The presence of large amounts of surface water, particularly during the May period, is readily apparent in the photoreduced thematic maps. Sheet water comprises much of the water detected in the May scene. Spring sheet water tends to be ephemeral and occurs as a result of an ice seal which exists within the underlying soil, temporarily preventing the percolation of water. The abundance of water in the May scene is also a result of unusually heavy precipitation which occurred during the spring and the previous fall. A qualitative analysis of the July map indicates surface water is less abundant than during the previous May; however, surface water present in the July 1975 LANDSAT scene was unusually abundant compared to other midsummer LANDSAT scenes obtained since 1972. This condition was particularly apparent for the drift plain.

N76-33609# Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.

PROCEEDINGS OF CONFERENCE ON WATER CONSERVATION AND SEWAGE FLOW REDUCTION WITH WATER-SAVING DEVICES

William E. Sharpe and Peter W. Fletcher Jul. 1975 212 p refs Held at Pa. State Univ., 8-10 Apr. 1975 (Contract DI-14-31-0001-4038) (PB-250999/0; Information-74; W76-05602; OWRT-A-038-PA(1)) Avail: NTIS HC \$7.75 CSCL 13B

These proceedings are a current state-of-the-art assessment of water-saving device technology in the United States. The papers address themselves to the major questions associated with water-saving device development and use. The gaps in current knowledge are enumerated and the information necessary to fill these gaps is identified. The information contained in these

proceedings will be of benefit to a broad spectrum of concerned individuals from the researchers to the facilities manager. Water conservation will be a definite part of America's future and water-saving devices have already begun to take their place in this conservation effort. GRA

N76-33613# Kellogg (M. W.) Co., Piscataway, N.J. **SALINE WATER CONVERSION ENGINEERING DATA BOOK, 1976**

Oct. 1975 717 p refs (Contract DI-14-30-3121) (PB-250907/3; OWRT-S-76-1; W76-05347) Avail: NTIS HC \$18.75 CSCL 07A

Information is presented on physical properties of chemicals and selected materials, derived thermodynamic data, phase equilibria, equipment cost and economic factors, design methods, and standards for saline water conversion. Sample calculations on pressure drop in two phase flow, and process flow diagrams for distillation, freezing, reverse osmosis, and electro dialysis are included. Design of seawater deaerators, liquid-liquid spray towers, and seawater chemistry are discussed. GRA

N76-33616# National Academy of Sciences - National Research Council, Washington, D.C.

NUCLEAR TECHNIQUES IN HYDROLOGY: CURRENT STATUS AND PROSPECTIVE USES. A REPORT OF THE WORK GROUP ON NUCLEAR TECHNIQUES IN HYDROLOGY OF THE US NATIONAL COMMITTEE FOR THE INTERNATIONAL HYDROLOGICAL DECADE Final Report

1975 53 p refs (Contract NSF C-310) (PB-253154/9; LC-75-27456) Avail: NTIS HC \$4.50 CSCL 08H

Nuclear techniques are underutilized in hydrology because the use of non-nuclear techniques is well established, and many hydrologists are unfamiliar with nuclear techniques and their possibilities. The preparation and wide distribution of an authoritative reference and the establishment of a scheduled program of short courses are suggested to correct this situation. Applications of nuclear techniques (radioactive isotopes) to hydrology are discussed in terms of available techniques, the hydrological problems to which the techniques can be applied, and some professional problems. GRA

N76-33617# National Academy of Sciences - National Research Council, Washington, D.C.

CATALOG OF UNITED STATES CONTRIBUTIONS TO THE INTERNATIONAL HYDROLOGICAL DECADE, 1965 - 1974 Final Report

1975 274 p refs (PB-253155/6; LC-75-21873) Avail: NTIS HC \$9.00 CSCL 08H

The contributions of U.S. scientists and agencies to the International Hydrological Program in 39 major categories of hydrological activities are summarized. A total of 159 projects are described. Information on projects generally provides name, investigating organization, principle investigator, objectives, results achieved, and list of publically available reports. The report also is indexed by subject, principal investigator, and organization. GRA

N76-33618*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

SATELLITE SNOW OBSERVATIONS AND SEASONAL STREAMFLOW FORECASTS Final Report

A. Rango and V. V. Salomonson Jan. 1976 26 p refs (Contract NOAA-NA-776-74) (NASA-TM-X-73009; PB-254251/2; NOAA-76031501) Avail: NTIS HC \$4.00 CSCL 08H

Relatively low spatial resolution (about 4 km) environmental satellite and high spatial resolution (80m) earth resources satellite data were used to map snow covered areas occurring in the

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upper Indus River Basin in Pakistan and the Wind River Mountains in Wyoming. For the Indus River, early Spring snow covered area measurements were obtained and compared to April through June total stream flow during the years 1967-1971. A linear regression equation quantitatively expressing the relationship had an (r squared) = 0.91. Prediction of the April-June 1972 stream flow using this equation produced an estimate that was within three percent of the actual total. GRA

N76-33619# Kentucky Water Resources Inst., Lexington.
SUPPLY AND DEMAND IN WATER PLANNING: STREAM-FLOW ESTIMATION AND CONSERVATIONAL WATER PRICING

D. I. Carey and C. T. Haan Jan. 1976 190 p refs
(Contracts DI-14-31-0001-4017; DI-14-31-0001-5017)
(PB-251159/0; RR-92; W76-05607; OWRT-A-052-KY(2))
Avail: NTIS HC \$7.50 CSCL 13B

Methods in water supply reservoir design that increase system benefits were provided. Two major factors influencing reservoir design were studied: estimated future streamflow into the reservoir, and demands placed on the reservoir. A methodology was presented to evaluate the ability of a parametric model to improve the stochastic model parameter estimates. A modified Markov Chain model was proposed which used continuous distributions to present the process when rainfall actually occurred. A two parameter gamma distribution fit the data. GRA

N76-33620# Virginia Polytechnic Inst. and State Univ., Blacksburg. Virginia Water Resources Research Center.
VERTICAL ELECTRICAL RESISTIVITY SOUNDINGS TO LOCATE GROUND WATER RESOURCES: A FEASIBILITY STUDY

Mohamed A. Sabet (Old Dominion Univ.) Nov. 1975 67 p refs
(PB-251393/5; VPI-VWRRRC-Bull-73; W76-05835) Avail:
NTIS HC \$4.50 CSCL 08H

The occurrence of ground water in the coastal plain region of southeastern Virginia and northeastern North Carolina, as indicated by the results of 45 vertical resistivity soundings (VES) is discussed. Soundings were taken with Schlumberger array with a maximum separation of 8,000 feet between the current electrodes. The VES data were interpreted through an automatic computer interpretation program, and by the curve-matching method. GRA

N76-33621# Wyoming Univ., Laramie. Water Resources Research Inst.
HYDROLOGY OF THE MADISON FORMATION AND ITS POTENTIAL USE FOR WATER SUPPLY FOR ENERGY DEVELOPMENT

Peter W. Huntoon Apr. 1976 44 p refs
(Contracts DI-14-31-0001-4051; DI-14-31-0001-5051; DI-14-31-0001-6053)
(PB-254543/2; W76-09757; OWRT-A-019-WYO(2)) Avail:
NTIS HC \$4.00 CSCL 08H

The amount and sources of precipitation on the Bighorn Mountains in Wyoming was studied. It is shown that approximately 400,000 ac ft/yr of recharge water is provided to the Madison aquifer in the Powder River Basin. Recharge takes place through outcrops primarily along fractures such as joints, partings along bedding, and secondary fractures associated with faults and folds. The fractures along faults and folds produce zones of large secondary permeability that parallel the trends of the structures. These zones are important in the recharge process only where they trend from the flanks of the Bighorn range into the Powder River Basin. The average annual recharge to the Madison aquifer along the 145 mi of outcrop examined in Wyoming is 2,800 ac ft/mi. GRA

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A76-38502 **Block adjustment with photos and independent models.** G. Erio (Geometric Computer Services, Rancho Cordova, Calif.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1976, p. 2-17. 6 refs.

Simultaneous block adjustment may incorporate both photos and independent models. Collinearity equations are used for the photo observations, and three-dimensional projective equations are used for the independent model observations. Both types of observations contribute to the same set of reduced normal equations, and the solution for all the unknown parameters for the block is performed simultaneously. Added parameters for the removal of systematic errors in the block may be included in the adjustment. The practical importance of combining bundle and independent model adjustment is in an environment where comparators and stereoplotters may both be used to perform measurements for aerotriangulation. In such an environment, the simultaneous adjustment of photos and independent models is the most accurate method of block adjustment available today. (Author)

A76-38503 **Analytic aerotriangulation utilizing Skylab earth terrain camera /S-190B/ photography.** M. Keller (NOAA, Photogrammetric Research Branch, Rockville, Md.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1976, p. 35-50.

The feasibility of using Skylab earth terrain camera photography in analytic aerotriangulation procedures to provide low-order high-density control suitable for small-scale mapping operations is examined. The exposed film is returned after each Skylab emission for processing and analysis on ground. The coordinates of pertinent images on each photograph are observed on comparators, and the resulting data are processed through an established analytic aerotriangulation system of computer programs. Computer processing is discussed in terms of image coordinate refinement and three-photo orientation, strip adjustment to ground control, secant plane coordinate transformation, block adjustment, and accuracy analysis. A horizontal position rms error of 15 m is attained, and the maximum observed error in position at a control point is 25 m. S.D.

A76-38505 **Extended on-board, real time, preprocessing of multispectral scanner data.** G. E. Murine (McDonnell Douglas Corp., Actron Div., Monrovia, Calif.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1976, p. 70-81.

The paper examines several on-board preprocessing functions which might be accomplished in the preprocessing of multispectral scanner data. The net effect is to provide a reduced set of data amenable to a real-time system. Data separation and formatting is discussed on the example of a nine-track magnetic tape recording system for a conical multispectral point scanner. Data are separated both in a recording sense (formatting) and by using discard criteria

(filtering). Data modification algorithms are developed to include geometric corrections (roll, pitch, yaw), atmospheric attenuations, and basic data filtering (thresholding, queuing). S.D.

A76-38508 **Synthetic stereo and Landsat pictures.** R. M. Batson, K. Edwards, and E. M. Eliason (U.S. Geological Survey Center of Astrogeology, Flagstaff, Ariz.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1976, p. 131-137. 7 refs. Research sponsored by the U.S. Department of the Interior.

The paper shows how stereoscopic parallax can be introduced into Landsat pictures by displacing image details by varying amounts as a function of their known relative elevations. This stereoscopic effect can be introduced in identical amounts into each band so that stereoscopic color composites can be made. The introduction of stereoscopic parallax into a monoscopic image requires a digital array of brightness values and a digital array of terrain elevations. Although the effect is useful in interpreting any color scene, its usefulness in color-ratioed images is particularly important as the ratioing technique removes shading due to relief. It is only by stereopsis that the three-dimensional context of the color ratios can be examined. Problems to be solved in order to simplify the method and make it acceptable for routine production of stereoscopic Landsat images are discussed. S.D.

A76-38509 **Basic differences in the quality of analog and digital imagery from photographic and solid-state array remote sensing systems.** P. N. Slater (Arizona, University, Tucson, Ariz.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1976, p. 139-153. 12 refs. Research supported by the U.S. Geological Survey; Contracts No. F04695-67-C-0197; No. F04701-75-C-0248.

Results are presented for a comparative study on the imagery from a solid-state array camera and a photographic film camera operating under the same conditions. The cameras are of the same size and yield digital imagery of the same effective instantaneous field of view. A quantitative description is presented of various atmospheres as typified by various meteorological ranges. A comparison of the performance of the systems operating in both digital and analog modes is made as a function of atmospheric conditions for imaging objects having very small reflectance differences from their surroundings, high-contrast objects such as cartographic control points, and low-contrast man-made objects. A comparison of SNR and visual resolution limit for both systems indicates that the array camera imagery is preferred for automated scene classification and that the film camera is preferred for cartography and mensuration. S.D.

A76-38510 **Information system for aerial photographs.** J. D. McLaurin (U.S. Geological Survey, National Cartographic Information Center, Reston, Va.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings.

Falls Church, Va., American Society of Photogrammetry, 1976, p. 154-161.

A computer-based summary record information system for aerial photographs is developed as a data management tool which provides information only on the geographical extent and general characteristics of a photo project rather than identifying individual frames. It is possible to enter the system with data formatted by grid cell or by county. Output from the summary record takes three forms: a computer-printed graphic, a listing of the detailed summary record for each quadrangle represented on the graphic, and geographic catalogs of the summary records for all agencies. Other standard graphics are presently being designed that would serve most users. S.D.

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A76-38515 * Application of Landsat imagery to metallic mineral exploration in Utah. A. T. Anderson (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.) and A. F. Smith (General Electric Co., Space Systems Div., Beltsville, Md.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 286-297. 5 refs.

Standard interpretive techniques were used to study the mosaic of two Landsat images of north central Utah including several major mining districts. Correlation of major Landsat-identified lineaments with the major metallic mining districts suggests that the Landsat-identified lineaments are fractures and that their distribution may be a valuable guide for identifying other mineralized areas. The imagery provides a more complete understanding of the geological information for identifying major tectonic and structural trends in the area. Several of the major mines are located on or closely adjacent to the intersections of at least two major lineaments. Landsat data should therefore be used to complement current mineral exploration programs. S.D.

A76-38521 Associative array processing of raster scan data for automated cartography. R. A. Clark (U.S. Army, Engineer Topographic Laboratories, Fort Belvoir, Va.), R. G. Radosevic (Goodyear Aerospace Corp., Akron, Ohio), and W. E. Schmidt (U.S. Geological Survey, Topographic Div., Reston, Va.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 381-411.

The paper describes some of the techniques, status and results for application of an associative array processor (AAP) to raster processing tasks in an automated cartographic system. Particular attention is devoted to AAP raster processing techniques for line symbol generations (single lines, double lines, and broken lines), area fill symbol generation, points symbol (school, church, etc.) generation, line separation by thickness, and vectorization (line following). The discussion includes a summary of the AAP performance for the above tasks and some AAP cartographic system considerations. Processing times on the AAP are dramatically lower than those on a conventional computer that processes data sequentially. It is concluded that raster-scanned data can be successfully processed and that a raster scanner linked to an associative array processing device may replace current digitizing techniques. S.D.

A76-38528 Correlation of dual-channel airborne IR data with soil moisture measurements. L. A. LeSchack (Development and Resources Transportation Co., Silver Spring, Md.), N. K. Del Grande (California, University, Livermore, Calif.), S. I. Outcalt (Michigan, University, Ann Arbor, Mich.), J. Lewis (McGill University, Montreal, Canada), and C. Jenner (Colorado, University, Boulder, Colo.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 530-566. 30 refs. Grant No. NOAA-4-35308.

The soil moisture data used in the study have been collected near Scipio Center, New York. The airborne IR data have been recorded at an altitude of 2000 m, taking into account the wavelength regions from 4.5 to 5.5 and from 8 to 12 micrometers. A visual examination of the data revealed no obvious correlation of radiant emittance with soil moisture. A statistical analysis was, therefore, conducted. An investigation involving the simulation of thermal response was also carried out. On the basis of the study results, it appears that it is feasible to measure soil moisture quantitatively by means of airborne IR data. G.R.

A76-39034 * A demonstration of a transportable radio interferometric surveying system with 3-cm accuracy on a 307-m base line. K. M. Ong, P. F. MacDoran, J. B. Thomas, H. F. Fliegel, L. J. Skjerve, D. J. Spitzmesser, P. D. Batelaan, S. R. Paine (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and M. G. Newsted (Trend Western Engineering Corp., Los Angeles, Calif.). *Journal of Geophysical Research*, vol. 81, July 10, 1976, p. 3587-3593. 18 refs. Contract No. NAS7-100.

A precision geodetic measurement system (Aries, for Astronomical Radio Interferometric Earth Surveying) based on the technique of very long base line interferometry has been designed and implemented through the use of a 9-m transportable antenna and the NASA 64-m antenna of the Deep Space Communications Complex at Goldstone, California. A series of experiments designed to demonstrate the inherent accuracy of a transportable interferometer was performed on a 307-m base line during the period from December 1973 to June 1974. This short base line was chosen in order to obtain a comparison with a conventional survey with a few-centimeter accuracy and to minimize Aries errors due to transmission media effects, source locations, and earth orientation parameters. The base-line vector derived from a weighted average of the measurements, representing approximately 24 h of data, possessed a formal uncertainty of about 3 cm in all components. This average interferometry base-line vector was in good agreement with the conventional survey vector within the statistical range allowed by the combined uncertainties (3-4 cm) of the two techniques. (Author)

A76-39035 * Tests and comparisons of satellite-derived geoids with Skylab altimeter data. J. G. Marsh (NASA, Goddard Space Flight Center, Greenbelt, Md.), B. C. Douglas (NOAA, National Ocean Survey, Rockville, Md.), S. Vincent, and D. M. Walls (Wolf Research and Development Corp., Riverdale, Md.). *Journal of Geophysical Research*, vol. 81, July 10, 1976, p. 3594-3598. 10 refs.

During the Skylab 4 mission, the S-193 radar altimeter was operated nearly continuously for a revolution around the world on Jan. 31, 1974. This direct measurement to the sea surface has provided an independent basis for the evaluation of the precision of global geoids computed from satellite-derived earth gravity models. This paper presents comparisons between the Skylab data and several recent gravity models published by Goddard Space Flight Center, the Smithsonian Astrophysical Observatory, and the National Oceanic and Atmospheric Administration. The differences between the altimeter geoid and the satellite geoids were as large as 20 m, rms values ranging from 8 to 10 m. These differences also indicated a systematic long-wavelength variation (about 100 deg) not related to error in the Skylab orbits. Truncation of the models to degree and order 8 did not eliminate the long-wavelength variation, but in every case the rms agreement between the satellite geoids and the altimeter geoid was slightly improved. Orbits computed with the truncated models were found to be inferior to those computed with the complete models. (Author)

A76-39301 Laser 75 opto-electronics; Proceedings of the Conference, Munich, West Germany, June 24-27, 1975. Edited by W. Waidelich (Darmstadt, Technische Hochschule, Darmstadt, West Germany). Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1976. 293 p. \$39.30. In English and German.

The use of lasers in nuclear energy technology, in material processing (welding, metal cutting, etc.), in medicine, in optical communications systems, in data processing, in environmental monitoring, and in metrology and testing is considered. Also examined are opto-electronic components (solar cells and photo-diodes), television systems, opto-electronic displays (electrochromic, electrophoretic, and plasma displays) and infrared and ultraviolet techniques (infrared radiometry of the atmosphere, thermal imagery, semiconductor detectors of UV radiation, etc.).

B.J.

A76-39590 * Remote sensing of soil moisture by a 21-cm passive radiometer. J. R. Eagleman and W. C. Lin (Kansas, University, Lawrence, Kan.). *Journal of Geophysical Research*, vol. 81, July 20, 1976, p. 3660-3666. 16 refs. Contract No. NAS9-13273.

Microwave sensors on Skylab collected data as part of the Earth Resources Experiment Package. An investigation was designed to obtain field observations of soil moisture content for comparison with data from Skylab. The 21-cm radiometer has been shown to be highly responsive to the moisture content of the upper 2.5-cm layer of soil. A composite relationship between the radiometric temperature and soil moisture content has been determined from five data sets obtained over Kansas and Texas. This relationship, having a correlation index of -0.96, has been used as a basis for calculating the soil moisture content of large areas across the United States.

(Author)

A76-39677 # A four-dimensional histogram approach to the clustering of Landsat data. M. Goldberg and S. Shlien (Canada Centre for Remote Sensing, Ottawa, Canada). (*Canadian Aeronautics and Space Institute, Aerospace Electronics Symposium, Halifax, Nova Scotia, Canada, Feb. 4, 5, 1975.*) *Canadian Journal of Remote Sensing*, vol. 2, May 1976, p. 1-11. 18 refs.

This paper describes an unsupervised classification scheme for the production of thematic maps from Landsat imagery. In this method, spectrally separable classes are identified from a four-dimensional histogram generated from a portion of a Landsat image. The scheme is very rapid, memory requirements are modest, and it can be implemented in an interactive mode on a timesharing computer system. Test results from an agricultural area near Melfort, Saskatchewan, exhibit accuracies of the classifications comparable to those obtained by supervised methods.

(Author)

A76-39679 # IMAGE 100 classification methods for ERTS scanner data. D. Goodenough (Canada Centre for Remote Sensing, Ottawa, Canada). (*Canadian Aeronautics and Space Institute, Aerospace Electronics Symposium, Halifax, Nova Scotia, Canada, Feb. 4, 5, 1975.*) *Canadian Journal of Remote Sensing*, vol. 2, May 1976, p. 18-29. 8 refs.

The primary purpose of the CCRS IMAGE 100 is to permit investigators across Canada to be able to analyze easily and rapidly the multispectral scanner data of ERTS. This paper describes the mathematical methods and system procedures used to classify scanner data with the IMAGE 100. The system is capable of supervised or unsupervised classification for five channel input data with parametric or nonparametric distributions. Advantage is taken of the multi-level classification system to reduce the number of interclass decisions, and thus speed the classification process. Results of classifications for the various methods are presented for a typical scene.

(Author)

A76-39765 Radiative transfer - A technique for simulating the ocean in satellite remote sensing calculations. H. R. Gordon (Miami, University, Coral Gables; NOAA, Physical Oceanography Laboratory, Miami, Fla.). *Applied Optics*, vol. 15, Aug. 1976, p. 1974-1979. 18 refs.

A method is presented for computing the radiative transfer in the ocean-atmosphere system which does not require detailed knowledge of the optical properties of the ocean. The calculation scheme is based on the observation that the upwelling radiance just beneath the sea surface is approximately uniform, which implies that the effect of the ocean can be simulated by a Lambertian reflector just beneath the sea surface. It is further shown that for aerosol concentrations up to ten times the normal concentration, the radiative transfer in homogeneous and vertically stratified atmospheres (of the same optical thickness) is nearly identical. Examples indicating the applicability of these results to the remote sensing of ocean color from space are discussed in detail.

(Author)

A76-40318 An airborne infra-red survey of the Tauhara geothermal field, New Zealand. D. J. Dickinson. (*United Nations, Geothermal Symposium, San Francisco, Calif., May 1975.*) *Geothermal Energy*, vol. 4, Mar. 1976, p. 32-37, 39, 40. 12 refs.

A76-40551 Reduction of sea surveillance data using binary matrices. P. L. Smith (Aerospace Corp., El Segundo, Calif.). *IEEE Transactions on Systems, Man, and Cybernetics*, vol. SMC-6, Aug. 1976, p. 531-538. 15 refs.

A new approach is described for assembling feasible ship trajectories from ship position sightings. The ship may or may not be identified on a particular sighting. The proposed algorithm does not attempt to resolve sighting-trajectory assignment ambiguities. No a priori ship motion model is used except for a bound on the maximum speed. The feasible relative ship motion and identity information are encoded into binary matrices. These binary matrices are computed recursively using logical AND and OR operations. The algorithm is analogous to the Kalman filter.

(Author)

A76-41002 Multispectral aerial photography as exploration tool. IV-V - An application in the Khomas Trough region, South West Africa; and cost effectiveness analysis and conclusions. B. Gilbertson, T. G. Longshaw (Spectral Africa /Pty./, Ltd., Randfontein, Republic of South Africa), and R. P. Viljoen (Johannesburg Consolidated Investment Co., Ltd., Randfontein, Republic of South Africa). *Remote Sensing of Environment*, vol. 5, no. 2, 1976, p. 93-107.

Results are presented for a survey in which textbook multispectral aerial photography (TMSAP) was used as an exploration tool to identify gossaniferous outcrops which are the surface expression of certain massive sulfide bodies. Conventional color and false color infrared photography was carried out for comparison purposes. The multispectral technique is found to give the best discrimination between the gossaniferous outcrop and the background rock types. In addition, the paper summarizes results of all the multispectral surveys in terms of a cost-benefit analysis. Although TMSAP enhances spectral differences between object categories, these differences generally can also be detected by conventional photography. The cost of a TMSAP survey is typically an order of magnitude greater than that of a conventional photography survey, so that TMSAP is ruled out as an exploration tool.

S.D.

A76-41005 Thermal scanner measurement of canopy temperatures to estimate evapotranspiration. J. L. Heilman, E. T. Kanemasu, N. J. Rosenberg, and B. L. Blad (Kansas State University of Agriculture and Applied Science, Manhattan, Kan.; Nebraska University, Lincoln, Neb.). *Remote Sensing of Environment*, vol. 5, no. 2, 1976, p. 137-145. 12 refs.

A76-41221 # Attitude reference and avionics systems in the remote sensing Skyservant. H. Hoffmann. *Dornier-Post* (English Edition), no. 1, 1976, p. 30, 31.

The attitude reference and avionics systems discussed were designed to meet the requirements of a special-mission sensing aircraft used in the earth resources program of the DFVLR to collect and store on tape data of scientific and economic interest. In addition to Doppler operation of the navigation computer, IRF and geodesy operation is provided through an integrated airborne data system. The pilot's work is further simplified by an integral flight director and an autopilot with multiple radio connections. The electric power supply and flight data recording systems are described. Electromagnetic compatibility is provided for all systems.

V.P.

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A76-41227 Interactive computing and graphics in the interpretation of geomagnetic spectra. A. J. Surkan, R. Hermes (Nebraska, University, Lincoln, Neb.), L. J. Lanzerotti, and C. G. MacLennan (Bell Telephone Laboratories, Inc., Murray Hill, N.J.). (*International Union of Geodesy and Geophysics, Symposium on Analysis, Processing and Interpretation of Geophysical Data, Grenoble, France, Sept. 1, 2, 1975.*) *Physics of the Earth and Planetary Interiors*, vol. 12, no. 2-3, Aug. 1976, p. 93-102. 9 refs.

Exploratory data analysis was performed on geomagnetic data, digitally recorded at four separate, three-component, flux-gate magnetometer stations operating near 3 degrees W geomagnetic longitude during December 1971 and January 1972. The analysis was performed by visual inspection of multi-dimensional displays created on graphic recording devices and the storage tube of a graphics terminal. Simple keyboard commands executed by interactive programs expedited the selection and interpretation of transformed data. A number of signal selection and transformation programs were implemented, including a post-whitening transform and a number of smoothing and nonlinear amplitude normalization transforms. B.J.

A76-41586 # Some uses of high resolution GOES imagery in the mesoscale forecasting of convection and its behavior. J. F. W. Purdom (NOAA, National Environmental Satellite Service, Washington, D.C.). In: Conference on Weather Forecasting and Analysis, 6th, Albany, N.Y., May 10-13, 1976, Preprints.

Boston, American Meteorological Society, 1976, p. 260-267.

Phenomena of importance in the initiation of low level convergence which may eventuate in thunderstorms are scrutinized, with attention to features influencing the behavior of more mature thunderstorms, and utilizing GOES (Geostationary Operational Environmental Satellite) high-resolution imagery. Motion pictures constructed from GOES imagery are also utilized. Terrain-induced convective lines, convective cloud mergers, and convective line intersections are among the factors strongly influencing the initiation and sustenance of thunderstorms. Detailed discussion is presented of terrain effects due to land-water interfaces, convective area mergers and intersections, interactions of tornadic thunderstorms and other convective boundaries, and cloud mergers. Many mesoscale processes important in the initiation and maintenance of convection are readily evident in the satellite imagery without special enhancement. R.D.V.

A76-41782 # Automatic data processing for non mathematicians. G. Preston (Aston, University, Birmingham, England). In: Remote sensing data processing. Sheffield, University of Sheffield, 1975, p. 53-71. 13 refs.

The paper explains in a nonmathematical way some aspects of automated data processing related to the analysis of multispectral scanner and photographic data. Attention is paid to supervised and unsupervised classification methods, to adaptive/nonadaptive improvements, to image registration, and to field vs point classification. Unsupervised analysis was performed on four-band multispectral photographs obtained at a scale of 1:15,000 over a test area in Sedgwick, England, as an experimental examples. B.J.

A76-41785 # Digital processing for side looking airborne radar. J. H. Blythe (GEC-Marconi Electronics, Ltd., Chelmsford, Essex, England). In: Remote sensing data processing.

Sheffield, University of Sheffield, 1975, p. 115-127. 5 refs. Research supported by the Ministry of Defence (Procurement Executive).

The paper is concerned with the design of a digital processor for synthetic aperture sideways looking airborne radar. Early design studies have shown the most important factor in equipment cost to be the size of store required. It is therefore important that data are stored using the minimum number of bits, and the paper devotes particular attention to the trade-offs between the number of bits at each stage of processing and the overall performance. Criteria for

assessing performance are discussed and attention is concentrated on sensitivity and dynamic range. A prime tool in the study has been a comprehensive suite of simulation routines, of which a brief description is given. Results are presented showing how performance depends upon the following aspects of system design: initial A-D conversion, presuming and subsequent clipping, design of reference waveform, and number of bits in final output. (Author)

A76-42226 Technology of scientific space experiments; International Conference, Paris, France, May 26-30, 1975, Reports (Technologie des expériences scientifiques spatiales; Colloque International, Paris, France, May 26-30, 1975, Communications). Conference sponsored by the Centre National d'Etudes Spatiales. Toulouse, Centre National d'Etudes Spatiales, 1975. 669 p. In French and English.

Space experiment planning is discussed, giving attention to project management, development, and organization methods. The technical design of experiments and their utilization are considered, along with tests and simulations in the context of space experimentation. Emphasis is on ESA programs, and particular attention is paid to the COS-B experiment, the Atlas S 183 experiment on Skylab, the S 300 experiment on Geos, Spacelab experiments, the ARAKS project, the AMPS project, and experiments on OSO-I and D2B.

B.J.

A76-42273 # The technology of optomechanical experiments planned, studied, and realized by Crouzet, S.A. (Technologie des expériences optico-mécaniques embarquées, étudiées et réalisées par la Société Crouzet). L. Alessio, Mr. Binder, Mr. Costet, and Mr. Forster (Crouzet, S.A., Valence, Drôme, France). In: Technology of scientific space experiments; International Conference, Paris, France, May 26-30, 1975, Reports. Toulouse, Centre National d'Etudes Spatiales, 1975, p. 543-551. In French.

Some aspects of the contributions made by Crouzet, S.A. to the projects of the Faust sounding rocket, the D2B satellite, and Skylab are examined. The discussion is centered on the technological problems encountered and the solutions developed for the film feed system of the Faust experiment, the atomizer of the zodiacal light experiment carried by the D2B satellite, and the camera devised for the Atlas spectrometer on board the Skylab. V.P.

A76-42367 # The two-frequencies-microwave-scatterometer for measuring of ocean waves. W. Alpers (Hamburg, Universität; Max-Planck-Institut für Meteorologie, Hamburg, West Germany) and G. Bommas (Dornier-System GmbH, Friedrichshafen, West Germany). *American Astronautical Society and Deutsche Gesellschaft für Luft- und Raumfahrt, International Meeting on Utilization of Space Shuttle and Spacelab, Bonn, West Germany, June 2-4, 1976, Paper, 8 p, 7 refs.*

The considered technique appears to be suitable for a determination of the two-dimensional ocean wave spectrum from a space platform. The technique makes use of the coupling effect between microwaves and short surface waves. A description of the dual-frequency technique is presented, taking into account the emitted microwave signal, the characteristics of the backscattered signal, and the determination of the sea-surface spectrum. Attention is also given to aspects of instrument design and technical instrument data. G.R.

A76-42369 # Scientific objectives of SL optical radar systems (Wissenschaftliche Zielsetzung von SL Lidarsystemen). W. Renger (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphäre, Oberpfaffenhofen, West Germany). *American Astronautical Society and Deutsche Gesellschaft für Luft- und Raumfahrt, International Meeting on Utilization of Space Shuttle and Spacelab, Bonn, West Germany, June 2-4, 1976, Paper, 9 p.* In German.

The principles of operation of optical radar are considered,

taking into account measurements of back scattering, transmission measurements, and the determination of the Doppler effect. Typical applications of optical radar are also discussed, giving attention to atmospheric aerosol, clouds, resonance scattering experiments, absorption measurements, and geodetic and oceanographic applications. G.R.

A76-42833 * The geostationary operational environmental satellite /GOES/ imaging communication system. W. L. Baker and J. Savides (Aeronutronic Ford Corp., Palo Alto, Calif.). In: International Telemetry Conference, Washington, D.C., October 14-16, 1975, Proceedings. Pittsburgh, Pa., Instrument Society of America, 1975, p. 464-471. Contracts No. NAS5-21575; No. NAS5-20750.

The SMS/GOES Satellite obtains day and night weather information from synchronous geostationary orbit by means of (1) earth imaging, (2) collection of environmental data from ground based sensors, platforms, and (3) monitoring of the space environment. SMS-1 and SMS-2 have been in orbit for 17 months and 8 months, respectively, and are presently taking full earth disk images in the visible and infrared every 30 minutes. SMS-1 is positioned to cover the eastern portion of the U.S. while SMS-2 is positioned to cover the western portion. This paper provides a general overview of the imaging communication portions of the SMS/GOES, related to the image data encoding and transmission as well as the method of the data time multiplexing and the manner in which the scan line to line synchronization is achieved. (Author)

A76-41001 Multispectral aerial photography as exploration tool. III - Two applications in the North-Western Cape Province, South Africa. T. G. Longshaw and B. Gilbertson (Spectral Africa /Pty./, Ltd., Randfontein, Republic of South Africa). *Remote Sensing of Environment*, vol. 5, no. 2, 1976, p. 79-92. 5 refs.

Results are presented for two experiments intended to evaluate textbook multispectral aerial photography (TMSAP) as an exploration tool. The first experiment aimed at identifying lithological units associated with copper-lead-zinc mineralization, while the second one aimed at identifying discrete noritoid bodies which often contain copper mineralization. For comparison purposes, color and false color infrared aerial photography was carried out. Practical limitations of TMSAP are revealed. In the first experiment, multispectral photography enhanced the identification of certain horizons but was unable to spectrally discriminate between several similar rocks. In the second, experiment, spatial detail of the imagery was not as important since the aim was to enhance surface discoloration introduced by the plug-like noritoid bodies. The conventional aerial photographic methods generally gave results that were equal to and often more satisfactory than those obtained by multispectral photography. S.D.

A76-44571 Line-of-sight determination from digitized imagery. M. A. Crombie and D. L. Ackerman (U.S. Army, Engineer Topographic Laboratories, Fort Belvoir, Va.). *Photogrammetric Engineering and Remote Sensing*, vol. 42, Sept. 1976, p. 1151-1156.

The basic notion of regarding the photograph as the primary data base is used to develop three single-model techniques for determining whether line-of-sight exists between any two points within a stereo model. Two of the techniques use digital imagery. Only one of the methods is analyzed numerically. Matching processes using correlation methods are applied to a pair of digital images to determine the line-of-sight of two points 1,200 meters apart. A microdensitometer with comparator capabilities created the digital gray shade data. The third technique, a visual one, requires that the model be set up in a stereoscopic device. (Author)

A76-44573 Multivariate system analysis of multispectral imagery. E. L. Maxwell (Colorado State University, Fort Collins, Colo.). *Photogrammetric Engineering and Remote Sensing*, vol. 42, Sept. 1976, p. 1173-1186. 8 refs.

Several noise sources responsible for random fluctuations of radiance values were identified as degrading the quality of Landsat data. These sources included scene noise, atmospheric propagation changes, radiometric errors, electronic system noise, data processing noise, and data analysis errors. Several data preprocessing methods to improve data quality including cleaning of data, ratioing of variables, transformation of variables and filtering, were developed. Multivariate system analysis methods were used to evaluate variables, preprocessing results and classification accuracy. B.J.

A76-44926 Electro-optical Systems Design Conference and International Laser Exposition, Anaheim, Calif., November 11-13, 1975, Proceedings of the Technical Program. Chicago, Industrial and Scientific Conference Management, Inc., 1975. 853 p. \$40.

The present collection of papers is concerned mainly with advances in electro-optical systems for use in computing, imaging, data processing and recording/reproduction, and solar energy production. Other areas of interest include laser isotope separation, integrated and fiber optics components, glass fiber waveguides, and laser ranging, tracking and guidance. Particular attention is devoted to power supplies and energy storage systems for electro-optics and lasers, along with the use of lasers in the graphics industry. S.D.

A76-44959 MINI-FLIR - A new dimension in night vision. J. P. DeLangre (Ford Motor Co., Newport Beach, Calif.). In: Electro-optical Systems Design Conference and International Laser Exposition, Anaheim, Calif., November 11-13, 1975, Proceedings of the Technical Program. Chicago, Industrial and Scientific Conference Management, Inc., 1975, p. 547-551.

A description is given of thermal imaging devices designed to provide night time reconnaissance from an unmanned aircraft or RPV. A MINI-FLIR which is to be used aboard a helicopter is also discussed. The MINI-FLIR is to be employed as a navigation aid for detecting forest fires and for surveying the fire area and its perimeter. The total sensor package unit weighs 47 pounds and may be rapidly and easily installed on the U.S. Forest Service Bell 204 helicopter. G.R.

A76-45721 Mathematical models and procedures for the geometrical evaluation of scanner images (Mathematische Modelle und Verfahren zur geometrischen Auswertung von Zeilenabtaster-Aufnahmen). G. Konecny (Hannover, Technische Universität, Hanover, West Germany). *Bildmessung und Luftbildwesen*, vol. 44, Sept. 15, 1976, p. 188-197. 15 refs. In German.

Mathematical imaging models are examined, taking into account approximate relations between image coordinates and terrain coordinates, differential relations between orientation elements, and collineation equations. Mathematical models for evaluation applications are also discussed, giving attention to polynomial interpolation, interpolation methods using spline functions, polynomials as models for platform changes, parameter models with orientation changes, and aspects of interpolation in a stochastic field. Accuracy analyses are considered along with questions of digital rectification and image correlation. G.R.

A76-45812 Optical heterodyne detection of incoherent sources - Current status and future applications. S. R. King (Aerospace Corp., Electronics Research Laboratory, Los Angeles, Calif.). In: Modern utilization of infrared technology: Civilian and military; Proceedings of the Seminar, San Diego, Calif., August 19, 20, 1975. Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers, 1975, p. 122-128. 32 refs.

This paper presents a brief history of optical heterodyne

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detection of incoherent sources followed by a discussion of the current status of the field as well as possible future applications. Attributes of optical heterodyne detection such as high spectral resolution, high sensitivity, and preservation of the signal phase are discussed. Current applications of optical heterodyne detection of incoherent sources include stellar interferometry, solar radiometry, and the measurement of atmospheric absorption of laser radiation. Each of these experiments is described, particularly the absorption measurements along the earth-space path for HF, DF, and CO₂ lasers. Experimental data are presented to verify the usefulness of these techniques as well as to compare their performance against theoretical predictions. Possible future applications of optical heterodyne detection of incoherent sources are discussed, including remote detection, monitoring, and tracking of atmospheric pollutants on a local or global scale. (Author)

A76-45832 * Joint pattern recognition/data compression concept for ERTS multispectral imaging. E. E. Hilbert (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Efficient transmission of pictorial information; Proceedings of the Seminar, San Diego, Calif., August 21, 22, 1975. Palos Verdes Estate, Calif., Society of Photo-Optical Instrumentation Engineers, 1975, p. 122-137, 13 refs. Contract No. NAS7-100.

This paper describes a new technique which jointly applies clustering and source encoding concepts to obtain data compression. The cluster compression technique basically uses clustering to extract features from the measurement data set which are used to describe characteristics of the entire data set. In addition, the features may be used to approximate each individual measurement vector by forming a sequence of scalar numbers which define each measurement vector in terms of the cluster features. This sequence, called the feature map, is then efficiently represented by using source encoding concepts. A description of a practical cluster compression algorithm is given and experimental results are presented to show trade-offs and characteristics of various implementations. Examples are provided which demonstrate the application of cluster compression to multispectral image data of the Earth Resources Technology Satellite. (Author)

A76-45953 # Some data compression methods for processing the images received from earth resource satellites. V. Cappellini (CNR, Istituto di Ricerca sulle Onde Elettromagnetiche, Firenze, Università, Florence, Italy), A. Chini (Firenze, Università, Florence, Italy), and F. Lotti (CNR, Istituto di Ricerca sulle Onde Elettromagnetiche, Florence, Italy). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 33-43, 9 refs.

Some data-compression methods are described for processing the images received from earth-resource satellites in order to solve, at least in part, the problem posed by the large amount of data to be used. Prediction-interpolation algorithms and methods employing the Fast Walsh Transform with variable length coding of the transformed values are considered in particular. Results obtained by processing some images received from the ERTS-1 satellite are reported. (Author)

A76-45955 # Evidence offered by Landsat-1 imagery of tectonic lineaments in the Vosges Mountains /Eastern France/. J. L. F. Tricart (Strasbourg I, Université, Strasbourg, France). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 53-59.

An evaluation of Landsat imagery has been made in a geologically well-known region and tested by an intensive ground-truth survey. In the Vosges crystalline massif, dissection is deep enough to enhance an important net of tectonic lineations, either

under the form of oriented valleys or through the localization of glacial cirques. Two main tectonic systems can be easily recognized: one consists of 'hercynian' accidents SW-NE and, secondarily, NW-SE; the other of 'rhinian' accidents, mainly N-S. It is possible, using differences in the grey tones of various bands at appropriate seasons, to trace a connection between the tectonic lineations of the Vosges and the horizontal faults of the Northern Jura Mountains, in spite of thick tertiary sediments in the 'Porte de Bourgogne' region. This is an argument in favor of an interpretation that these lineations are a result of plate tectonics. (Author)

A76-45957 # Study about recording and interpretation of change in landscape proved by satellite images by use of an ISI-image-analyser. U. Wiczorek (München, Universität, Munich, West Germany). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 73-84.

It is shown how with aid of an analog ISI image analyzer the change in landscape, detected by two satellite images taken at different time, can be recorded. It turned out that for the interpretation of the differences between both satellite images a detailed landscape classification and identification of individual landscape classes is necessary. In this way not only the changes could be explained but disturbing factors could be eliminated by correlation of the changes in landscape with certain landscape classes. (Author)

A76-45988 # Synoptic mapping of sea-state and precipitation by a space-borne delay-Doppler-radar. E. Schanda (Bern, Universität, Berne, Switzerland). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 469-479, 6 refs.

In both oceanography and shipping there is a strong demand for synoptic mapping of velocity fields at a high range resolution. It is shown that simultaneous analysis of pulse delay (at a resolution of 30 nsec) and of the Doppler shift and Doppler broadening (at a resolution of approximately 100 Hz) can be effectively used to study precipitations above land and water, sea wave motions, and characteristic land-surface structuring with satisfactory accuracies. The characteristics of the application of the delay/Doppler technique from a satellite in a low orbit and from a geostationary satellite are examined. V.P.

A76-46003 Remote sensing satellites - What do they actually measure and how sensitive is the information. L. W. Morley (Department of Energy, Mines, and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: Legal implications of remote sensing from outer space; Proceedings of the Symposium, Montreal, Canada, October 16, 17, 1975. Leiden, A. W. Sijthoff, 1976, p. 13-18.

The paper defines satellite remote sensing, examines what information can be obtained from remote sensing satellites and the extent to which this information is proprietary. The application of remote sensing satellites to the following areas is discussed along with corresponding sensitivities: agriculture, cartography and photogrammetry, forestry and wildlands, geology, mineral and petroleum exploration, sea ice and glaciology, water resources, ocean information and management, land use mapping, and military information. B.J.

A76-46144 # Digital processing of NOAA's very high resolution radiometer /VHRR/ data. R. Koffler (NOAA, National Environmental Satellite Service, Washington, D.C.). *International Astronautical Federation; International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976; Paper 76-209.* 7 p. 9 refs.

The Very High Resolution Radiometer (VHRR) flown on board NOAA's operational, polar orbiting environmental satellite is a two-channel radiometer with a ground resolution at subpoint of 1 km. Data from this sensor are digitized at the receiving stations and computer compatible digital tapes containing these data are available for further processing. Several techniques for processing the digital data for display include gray-scale enhancement, digital false color, and the removal of geometric distortions. The method for deriving quantitative data is also discussed and such topics as data calibration, corrections for atmospheric attenuation and computer output microfilm products are included. (Author)

A76-46221 # The observation of /433/ Eros by Tokyo PZT. Y. Niimi, K. HuruKawa, and K. Nakajima. *Tokyo Astronomical Observatory, Tokyo Astronomical Bulletin, Second Series*, no. 239, Sept. 6, 1975, p. 2011-2017.

Results are presented for an observation of Eros that was performed with a photographic zenith telescope (PZT) on January 14, 1975. The procedure for reducing PZT observations is described in detail, and daily geocentric changes in the right ascension and declination of the asteroid are obtained from apparent positions over seven days by means of numerical differentiation. A mean clock correction and the mean observed latitude are computed along with the apparent topocentric position of Eros at the epoch of January 14.62477235, 1975 UT, with reference to the Tokyo PZT star system. The topocentric mean position of Eros referred to the standard equinox of 1950.0 is then determined. F.G.M.

A76-47201 Engineering in a changing economy; Proceedings of the Southeast Region 3 Conference, Clemson, S.C., April 5-7, 1976. Conference sponsored by the Institute of Electrical and Electronics Engineers. New York, Institute of Electrical and Electronics Engineers, Inc., 1976. 400 p. Members, \$21; nonmembers, \$28.

A variety of topics are treated including power technology, digital systems, computer applications, electromagnetic fields, semiconductor technologies, solar electric energy, digital signal processing, control theory, radar, solid state applications, and microprocessor computer systems. Attention is also given to microprocessor computer systems, biological pattern processing, microelectronics, laser inertial navigators, communication systems, control computers, aerospace electronics and systems, large scale systems, bioinstrumentation, communication signal processing, and noise in semiconductor devices.

B.J.

N76-28333*# Alabama Univ., Huntsville. Center for Environmental and Energy Studies.

INTEGRATED REAL TIME CONTAMINATION MONITOR IRTCM Final Report, 11 Mar. 1975 - 10 Mar. 1976

W. E. Luttgies May 1976 56 p refs

(Contract NAS8-31174)

(NASA-CR-149946) Avail: NTIS HC \$4.50 CSCL 22B

Engineering and design work was performed on a monitoring device for particulate and gas contamination to be used in the space shuttle cargo area during launch at altitudes up to 50 km and during return phases of the flight. The gas sampling device consists of ampules filled with specific absorber materials which are opened and/or sealed at preprogrammed intervals. The design eliminates the use of valves which, according to experiments, are never sealing properly at hard vacuum. Methods of analysis including in-flight measuring possibilities are discussed. Author

N76-28599*# Utah Univ., Salt Lake City.

SUMMARY OF SPACE IMAGERY STUDIES IN UTAH AND NEVADA

M. LeRoy Jensen, Principal Investigator [1975] 45 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP

(Contract NAS9-13322)

(E76-10420; NASA-CR-147818) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. An enhanced enlargement of a S190B color image at a scale of 1/19,200 of the Bingham porphyry copper deposit has compared a geological map of the area with the space imagery map as fair for the intrusion boundaries and total lack of quality for mapping the sediments. Hydrothermal alteration is only slightly evident on space imagery at Bingham, but in the Tintic mining district and the volcanic piles of the Keg and Thomas ranges, Utah, hydrothermal alteration is readily mapped on color enlargements of S190B. Several sites of calderas were recognized and new ones located on space imagery. One of the tools developed is a mercury soil-gas analyzer, that is becoming significant as an aid in locating hidden mineralized zones which were suggested from space imagery. In addition, this tool is a prime aid in locating and better delineating geothermal sites.

N76-28613*# Battelle Columbus Labs., Ohio.

FEASIBILITY OF SATELLITE INTERFEROMETRY FOR SURVEILLANCE, NAVIGATION, AND TRAFFIC CONTROL Final Report

S. Gopalapillai, G. T. Ruck, and A. G. Mourad Feb. 1976 165 p refs

(Contract NASw-2800)

(NASA-CR-148471; BCL-OA-TFR-76-2)

Avail: NTIS

HC \$6.75 CSCL 17G

The feasibility of using a satellite borne interferometry system for surveillance, navigation, and traffic control applications was investigated. The evaluation was comprised of: (1) a two part systems analysis (software and hardware); (2) a survey of competitive navigation systems (both experimental and planned); (3) a comparison of their characteristics and capabilities with those of an interferometry system; and (4) a limited survey of potential users to determine the variety of possible applications for the interferometry system and the requirements which it would have to meet. Five candidate or 'strawman' interferometry systems for various applications with various capabilities were configured (on a preliminary basis) and were evaluated. It is concluded that interferometry in conjunction with a geostationary satellite has an inherent ability to provide both a means for navigation/position location and communication. It offers a very high potential for meeting a large number of user applications and requirements for navigation and related functions. Author

N76-29689*# Kanner (Leo) Associates, Redwood City, Calif. **REMOTE PERCEPTION PROJECT. REPORT ON ACTIVITIES AND ACHIEVEMENTS: STAGE ZERO**

Adolfo Guzman Washington NASA Aug. 1976 80 p refs Transl. into ENGLISH of "Proyecto Pr. Informe de Actividades y Logros Etapa Cero", Rept. PR-75-2A Centro de Invest. en Math. Apl. y en Sistemas, Mexico, 1975 p 1-85

(Contract NASw-2790)

(NASA-TT-F-17168; PR-75-2A) Avail: NTIS HC \$5.00 CSCL 05B

The purpose of the Remote Perception Project is the study and development of computer techniques and procedures for analysis of multispectral images from flight platforms (artificial satellites and aircraft). The purpose is to determine automatically, different items in the area photographed, such as crops, pastures, bodies of water, estuaries, urban areas, etc., and the changes occurring in time. The foundation of the Remote Perception Project, whose nature is multidisciplinary, is the computer sciences, especially in the recognition of shapes, numerical analysis, and the digital processing of images. Author

N76-29690*# Scientific Translation Service, Santa Barbara, Calif. **REMOTE SENSING BY COMPUTER: EQUIPMENT, PROGRAMS, AND APPLICATIONS**

Adolfo Guzman Washington NASA 13 Aug. 1976 53 p refs Transl. into ENGLISH from Technical Report (Mexico), v. 3, p 1-62

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

(Contract NASw-2791)

(NASA-TT-F-17167) Avail: NTIS HC \$4.50 CSCL 05B

The computer programs and associated equipment necessary or suitable for carrying out work on classification, identification of crops, mapping soil utilization, and in general remote sensing activities which may be carried out with the help of a digital computer are described. The hierarchy of resources necessary for developing related complementary activities, such as printing negatives, altered photographs, digitalization of photographic negatives, etc., which a computer carries out in the support of remote sensing activities and pattern recognition, is also mentioned. Applications in Mexico and abroad are mentioned.

Author

N76-29693# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.

USE OF RADAR IMAGES IN TERRAIN ANALYSIS: AN ANNOTATED BIBLIOGRAPHY

L. F. Dellwig, B. C. Hanson, N. E. Hardy, P. L. Hulén, and J. R. McCauley Sep. 1975 338 p

(Contract DAAK02-75-C-0145)

(AD-A020598; RSL-TR-288-2; ETL-0024) Avail: NTIS CSCL 08/6

An annotated bibliography of articles, papers and reports dealing with the application of imaging radar systems to the geosciences has been prepared to meet the needs of both the potential user of radar imagery and the researcher in the field of tactical terrain analysis. The principles of imaging radars are described in an introductory section. Following are bibliographic entries which have been prepared for those pertinent publications produced since the earliest days of imaging radars up to the present time (May, 1975).

GRA

N76-29696*# Aerospace Corp., El Segundo, Calif. Lab. Operation.

THE 90 GHz RADIOMETRIC IMAGING Final Report

H. E. King, J. D. White, W. J. Wilson, T. T. Mori, J. P. Hollinger (NRL, Washington, D. C.), B. E. Troy (NRL, Washington, D. C.), J. E. Kenney (NRL, Washington, D. C.), and J. T. McGoogan (NASA, Wallops Station) 19 Feb. 1976 55 p refs Sponsored in part by NASA

(Contract F04701-75-C-0076)

(NASA-CR-148581; AD-A022241; SAMSO-TR-76-37) Avail: NTIS CSCL 14/2

A 90-GHz (3 mm wavelength) radiometer with a noise output fluctuation of 0.22 K (RMS), with a scanning antenna beam mirror, and the data processing system are described. Real-time radiometric imaging of terrain and man-made objects are shown. Flying at an altitude of 1500 ft a radiometer antenna with a 2 degrees halfpower beamwidth can distinguish landforms, waterways, roads, runways, bridges, ships at sea and their wakes, aircraft on runways, and athletic fields. A flight taken at an altitude of 3000 ft with approximately 2000 ft of clouds below the radiometer demonstrates the ability to distinguish bridges, rivers, marshland and other landforms even though the clouds are optically opaque. The radiometric images of a few representative scenes along with photographs of the corresponding scenes are presented to demonstrate the resolution of the imager system.

GRA

N76-29866# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.

DEVELOPMENT OF A PORTABLE ACOUSTIC ECHO SOUNDER

Edward J. Owens May 1974 49 p refs Sponsored in part by RADC

(AD-A021244; NOAA-TR-ERL-298; WPL-31) Avail: NTIS CSCL 04/2

The report describes the design and construction of an inexpensive, portable, monostatic acoustic echo sounder called the Suitcase Sounder. The sounder is used for monitoring atmospheric temperature fluctuations by measuring backscattered echoes of acoustic tone bursts.

GRA

N76-30325# Aeronutronic Ford Corp., Newport Beach, Calif. **VERSATILE GAS FILTER CORRELATION SPECTROMETER Final Report, Jun. 1973 - Jun. 1975**

D. E. Burch, F. J. Gates, D. A. Gryvnak, and J. D. Pembroke Aug. 1975 75 p refs

(Contract EPA-68-02-1227)

(PB-251577/3; U-6201; EPA-600/2-75-024) Avail: NTIS HC \$4.50 CSCL 14B

A versatile infrared analyzer employing gas filter correlation techniques has been designed and constructed to measure concentrations of pollutant gases from a variety of sources. By interchanging cell windows, radiant energy sources, gratings, interference filters, and detectors, nearly any desired spectral bandpass between 0.3 micrometers and 11 micrometers can be obtained. Spectral curves of transmittance can also be scanned. A multiple-pass sample cell provides sample paths between approximately 4 m and 40 m. An H₂O monitor measures the concentration of H₂O in the multiple-pass sample cell and automatically accounts for interference by H₂O in the measurement of other gas concentrations. Tests have been performed on the measurement of formaldehyde, vinyl chloride and ammonia. The minimum detectable concentration of formaldehyde in automotive exhaust is approximately 0.05 ppm.

GRA

N76-30623*# Corps of Engineers, Waltham, Mass. **OPERATION OF LANDSAT AUTOMATIC TRACKING SYSTEM**

Saul Cooper, Principal Investigator and Timothy D. Buckelew Mar. 1976 73 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS

(E76-10455; NASA-CR-148586) Avail: NTIS HC \$4.50 CSCL 171

N76-30636*# Itek Corp., Lexington, Mass. Optical Systems Div.

REQUIREMENTS AND CONCEPT DESIGN FOR LARGE EARTH SURVEY TELESCOPE FOR SEOS Final Report, Apr. 1974 - Apr. 1975

Paul Mailhot and John Bisbee Apr. 1975 219 p refs

(Contract NAS5-20074)

(NASA-CR-144796; Itek-75-9510-1) Avail: NTIS HC \$7.75 CSCL 20F

The efforts of a one year program of Requirements Analysis and Conceptual Design for the Large Earth Survey Telescope for the Synchronous Earth Observatory Satellite is summarized. A 1.4 meter aperture Cassegrain telescope with 0.6 deg field of view is shown to do an excellent job in satisfying the observational requirements for a wide range of earth resources and meteorological applications. The telescope provides imagery or thermal mapping in ten spectral bands at one time in a field sharing grouping of linear detector arrays. Pushbroom scanning is accomplished by spacecraft slew.

Author

N76-30646# Central Intelligence Agency, Washington, D.C. Office of Geographic and Cartographic Research.

CARTOGRAPHIC AUTOMATIC MAPPING (CAM), PROGRAM DOCUMENTATION. VERSION 4: USER'S GUIDE P. Frederick Stepler and Warren Schmidt Mar. 1975 119 p (PB-251390/1; OGCR-CD-75-1) Avail: NTIS HC \$5.50 CSCL 08B

An IBM Systems 360 FORTRAN program that performs a wide variety of cartographic plotting tasks is described. It will connect points with straight lines or great circles and draw line grids, range rings, ellipses, cones, azimuths, and a host of other map features. The structure of CAM is modular to permit the easy addition of new features or subroutines to read data in a different format. New features included in Version 4 of CAM are the Polyconic projection, UTM grids and ticks, longitude and latitude ticks, legend box blackout, a route and corridor option,

and twelve new line symbols. The sample plot instructions have been combined with the projection descriptions, which have been rewritten to be understandable to the noncartographer. GRA

N76-31618*# Army Construction Engineering Research Lab., Champaign, Ill.

USE OF SKYLAB S190B IMAGERY

R. K. Jain, Principal Investigator Jul. 1975 16 p ref Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (NASA Order T-4643) (E76-10471; NASA-CR-144419) Avail: NTIS HC \$3.50 CSCL 05B

N76-31619*# Department of Industry, London (England).

THE USE OF ERTS/LANDSAT IMAGERY IN RELATION TO AIRBORNE REMOTE SENSING FOR TERRAIN ANALYSIS IN WESTERN QUEENSLAND, AUSTRALIA Quarterly Report

Monica M. Cole and Stewart Wen-Jones, Principal Investigators 21 Jul. 1976 7 p Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10472; NASA-CR-148726) Avail: NTIS HC \$3.50 CSCL 08B

The author has identified the following significant results. Series of linears were identified on the March imagery of Lady Annie-Mt. Gordon fault zone area. The series with a WSW-ENE orientation which is normal to the major structural units and also several linears with NNW-SSE orientation appears to be particularly important. Copper mineralization is known at several localities where these linears are intersected by faults. Automated outputs using supervised methods involving the selection of training sets selected by visual recognition of spectral signatures on the color composites obtained from combinations of MSS bands 4, 5 and 7 projected through appropriate filters, were generated.

N76-31623*# National Oceanic and Atmospheric Administration, Rockville, Md. Office of Aeronautical Charting and Cartography.

ERTS IMAGERY AS DATA SOURCE FOR UPDATING AERONAUTICAL CHARTS Final Report

Joë F. Wilson, Principal Investigator Jul. 1976 27 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (NASA Order S-70246-AG) (E76-10476; NASA-CR-148783) Avail: NTIS HC \$4.00 CSCL 08B

N76-31634*# Maden Tetkik ve Arma Enstitüsü, Ankara (Turkey). **NATIONAL PROJECT FOR THE EVALUATION OF ERTS IMAGERY APPLICATIONS TO VARIOUS EARTH RESOURCES PROBLEMS IN TURKEY Progress Report, 1 Apr. - 1 Jul. 1976**

Sadrettin Alpan, Principal Investigator 1 Jul. 1976 10 p Sponsored by NASA ERTS (E76-10490; NASA-CR-148796; PR-3) Avail: NTIS HC \$3.50 CSCL 08F

N76-31654# Utah Water Research Lab., Logan.

CAPABILITY OF INTEGER PROGRAMMING ALGORITHMS IN SOLVING WATER RESOURCE PLANNING PROBLEMS

Treavor C. Hughes, William J. Grenney, A. Bruce Bishop, Calvin G. Clyde, and Rangesan Narayanan Jan. 1976 105 p refs (Contract DI-14-34-0001-6127)

(PB-250499/1; PRWG-175-1; W76-05183; OWRT-B-125-UTAH (1)) Avail: NTIS HC \$5.50 CSCL 13B

The feasibility of optimizing large regional water resource planning problems by means of integer programming algorithms is analyzed. Two types of integer programming models are developed: (1) A water supply model including 23 separate but geographically related community systems; and (2) a river basin water quality model including 15 point sources of waste water, 4 types of pollutants, 6 surveillance points, and 7 alternative treatment processes. The water supply model was structured as a mixed integer problem (some continuous variables included) while the water quality model was an all integer problem. Four integer programming algorithms were tested on the sample problems as follows: (1) MXINT - The Burroughs B6700 TEMPO package algorithm; (2) FMPS-MIP-The UNIVAC 1108 MPS package algorithm; (3) GMINT - A proprietary algorithm authored by A.M. Geoffrion and R.D. McBride; and (4) AIP - A 0, 1 algorithm which uses the Balas additive concept. GRA

N76-31719# Battelle Pacific Northwest Labs., Richland, Wash. **COMPUTER SYSTEM FOR ENVIRONMENTAL SAMPLE ANALYSIS AND DATA STORAGE AND ANALYSIS**

F. P. Brauer and J. E. Fager 15 Sep. 1975 24 p refs Presented at Nucl. Sci. Symp., San Francisco, 17 Nov. 1975 (Contract E(45-1)-1830)

(BNWL-SA-5421; Conf-751116-27) Avail: NTIS HC \$4.50

A minicomputer based environmental sample analysis and data storage system has been developed. The system is used for analytical data acquisition, computation, storage of analytical results, and tabulation of selected or derived results for data analysis, interpretation and reporting. This paper discusses the structure, performance and applications of the system.

Author (NSA)

N76-31722# Helsinki Univ. of Technology, Otaniemi (Finland). Radio Lab.

REMOTE SENSING OF OIL SLICKS WITH MICROWAVE RADIOMETER

Kimmo Kaski and Antti Laeaeperi 1976 18 p refs (Rept-S-83; ISBN-951-750-634-1) Avail: NTIS HC \$3.50

The microwave radiometer was used to detect the oil slick on the surface of the sea, to map the volume, thickness and total area of the oil slick, and to identify the oil type. Its performance is assessed using experimental results from helicopter flight over the Baltic Sea with flying altitudes from 10 to 30 m at speeds from 10 sea miles/h to 30 sea miles/h. ESA

N76-32607*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

[PHOTOINTERPRETATION OF SKYLAB IMAGERY] Final Report, 1 Jun. 1975 - 31 May 1976

D. A. Landgrebe, Principal Investigator 1976 278 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP (Contract NAS9-14016)

(E76-10470; NASA-CR-147856) Avail: NTIS HC \$9.25 CSCL 05B

07 DATA PROCESSING AND DISTRIBUTION SYSTEMS

N76-32616*# Instituto Geofisico del Peru, Lima.
DIGITAL PROCESSING OF SATELLITE IMAGERY APPLICATION TO JUNGLE AREAS OF PERU Final Report, 1973 - 1975

Jose C. Pomalaza, Principal Investigator, Carlos A. Pomalaza, and Jorge Espinoza 24 Feb. 1976 84 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS (E76-10504; NASA-CR-148824; IGP-ARSI-76) Avail: NTIS HC \$5.00 CSCL 05B

The author has identified the following significant results. The use of clustering methods permits the development of relatively fast classification algorithms that could be implemented in an inexpensive computer system with limited amount of memory. Analysis of CCTs using these techniques can provide a great deal of detail permitting the use of the maximum resolution of LANDSAT imagery. Potential cases were detected in which the use of other techniques for classification using a Gaussian approximation for the distribution functions can be used with advantage. For jungle areas, channels 5 and 7 can provide enough information to delineate drainage patterns, swamp and wet areas, and make a reasonable broad classification of forest types.

N76-32624*# Caspan Corp., Houston, Tex.
[SELECTED IMAGERY FROM EARTH RESOURCES SURVEY PROGRAM] Final Report

1976 23 p
(Contract NAS9-14702)
(NASA-CR-150990) Avail: NTIS HC \$3.50 CSCL 05B

Preparation of LACIE documents for data base entry and indexing of imagery from selected Earth Resources Survey Program sources is described. J.M.S.

N76-32905 Purdue Univ., Lafayette, Ind.
WEB GRAMMARS AND THEIR APPLICATION TO PATTERN RECOGNITION Ph.D. Thesis

John Marvin Brayer 1975 292 p
Avail: Univ. Microfilms Order No. 76-21089

The hierarchy of web grammars is defined. Regular and regular-linear web grammars are defined for the first time. The properties of regular-linear and context free web grammars are studied. Web grammars are compared to other existing grammatical formalisms such as plex grammars, graph grammars and push-out constructions. The string grammar hierarchy is shown to be a compatible, topologically restricted subclass of web grammars. Regular-linear web grammars are proved equivalent to regular string grammars. Automata for these languages are studied. Existing grammatical inference procedures are also reviewed and where appropriate, extended to apply to web grammars. Web grammars are then applied to model the land use pattern in an ERTS picture of Indianapolis, Indiana. A web grammar model is developed and used to improve the accuracy of the classification and to detect some new classes. One example of the proposed grammatical inference approach is demonstrated. Dissert. Abstr.

N76-33484*# Computer Sciences Corp., Huntsville, Ala.
DIGITAL COMPUTER PROCESSING OF PEACH ORCHARD MULTISPECTRAL AERIAL PHOTOGRAPHY

Robert J. Atkinson Oct. 1976 103 p refs
(Contract NAS8-21805)
(NASA-CR-149998) Avail: NTIS HC \$5.50 CSCL 14E

Several methods of analysis using digital computers applicable to digitized multispectral aerial photography, are described, with particular application to peach orchard test sites. This effort was stimulated by the recent premature death of peach trees in the Southeastern United States. The techniques discussed are: (1) correction of intensity variations by digital filtering, (2) automatic detection and enumeration of trees in five size categories, (3) determination of unhealthy foliage by infrared

reflectances, and (4) four band multispectral classification into healthy and declining categories. Author

N76-33465*# Westinghouse Defense and Electronic Systems Center, Baltimore, Md.
BREADBOARD LINEAR ARRAY SCAN IMAGER USING LSI SOLID-STATE TECHNOLOGY Final Report, Jul. 1972 - May 1976

Richard A. Tracy, John A. Brennan, David G. Frankel, and Robert E. Noll 31 May 1976 191 p refs
(Contract NAS5-21806)

(NASA-CR-144814) Avail: NTIS HC \$7.50 CSCL 14B

The performance of large scale integration photodiode arrays in a linear array scan (pushbroom) breadboard was evaluated for application to multispectral remote sensing of the earth's resources. The technical approach, implementation, and test results of the program are described. Several self scanned linear array visible photodetector focal plane arrays were fabricated and evaluated in an optical bench configuration. A 1728-detector array operating in four bands (0.5 - 1.1 micrometer) was evaluated for noise, spectral response, dynamic range, crosstalk, MTF, noise equivalent irradiance, linearity, and image quality. Other results include image artifact data, temporal characteristics, radiometric accuracy, calibration experience, chip alignment, and array fabrication experience. Special studies and experimentation were included in long array fabrication and real-time image processing for low-cost ground stations, including the use of computer image processing. High quality images were produced and all objectives of the program were attained. Author

N76-33472*# Oceanic Society, San Francisco, Calif.
DEVELOPMENT AND FIELD TESTING OF A LIGHT AIRCRAFT OIL SURVEILLANCE SYSTEM (LAOSS) Final Report

William Burns and Michael J. Herz Washington NASA Oct. 1976 28 p refs Sponsored by NASA and Coast Guard
(NASA-CR-2739; CG-D-1-76) Avail: NTIS HC \$4.00 CSCL 14B

An experimental device consisting of a conventional TV camera with a low light level photo image tube and motor driven polarized filter arrangement was constructed to provide a remote means of discriminating the presence of oil on water surfaces. This polarized light filtering system permitted a series of successive, rapid changes between the vertical and horizontal components of reflected polarized skylight and caused the oil based substances to be more easily observed and identified as a flashing image against a relatively static water surface background. This instrument was flight tested, and the results, with targets of opportunity and more systematic test site data, indicate the potential usefulness of this airborne remote sensing instrument. Author

N76-33480*# Laboratorio di Ricerca e Tecnologia per lo Studio del Plasma nello Spazio, Frascati (Italy).

BENCH TEST PROCEDURES FOR S 331 (EM)
M. Candidi, M. J. Garvin (ESTEC, Noordwijk, Neth.), and R. Orfei Jul. 1974 58 p refs
(LPS-74-21) Avail: NTIS HC \$4.50

The procedure for bench-testing the experimental breadboard magnetometer model, prior to integration, is presented. Before connection of the package to the test equipment, a preliminary mechanical inspection and electrical check was performed to ensure that damage was not sustained during handling. A detailed functional test program covering all stages of the experimental check-out, together with the expected standard outputs from such tests, is given. The following topics are dealt with: stimuli-simuli equipment, ground support equipment operation, line printer output format, preliminary checks prior to bench testing, and manual bench test sequence. Author (ESA)

N76-33598*# Kansas Univ. Center for Research, Inc., Lawrence.
Remote Sensing Lab.

**DOCUMENTATION OF PROCEDURES FOR TEXTURAL/
SPATIAL PATTERN RECOGNITION TECHNIQUES Final
Report**

Robert M. Haralick and William F. Bryant 15 Apr. 1976
219 p refs

(Contract NAS9-14453)

(NASA-CR-150995; RSL-TR-278-1) Avail: NTIS HC \$7.75
CSCL 02F

A C-130 aircraft was flown over the Sam Houston National Forest on March 21, 1973 at 10,000 feet altitude to collect multispectral scanner (MSS) data. Existing textural and spatial automatic processing techniques were used to classify the MSS imagery into specified timber categories. Several classification experiments were performed on this data using features selected from the spectral bands and a textural transform band. The results indicate that (1) spatial post-processing a classified image can cut the classification error to 1/2 or 1/3 of its initial value, (2) spatial post-processing the classified image using combined spectral and textural features produces a resulting image with less error than post-processing a classified image using only spectral features and (3) classification without spatial post processing using the combined spectral textural features tends to produce about the same error rate as a classification without spatial post processing using only spectral features. Author

N76-33605# Naval Research Lab., Washington, D.C.

**A PROGRAM TO PLOT AN ANNOTATED TRACK OR A
TRACK AND BATHYMETRY OR MAGNETIC PROFILE ON
A MERCATOR PROJECTION Final Report**

Marilyn L. Blodgett and James V. Massingill 27 Feb. 1976
42 p

(ARPA Order 1787; NRL Proj. S01-47; ZF52552001)

(AD-A022031; NRL-7930) Avail: NTIS CSCL 09/2

A program has been written for plotting an annotated track or for plotting a track and the superimposed bathymetry or magnetic profile on a Mercator projection. The program reads the data (navigation, bathymetry, or magnetics) from a magnetic tape in BCD form. The program will annotate every point or every nth point. Navigation is annotated with fix numbers, bathymetry with uncorrected fathoms, meters, or corrected meters, and magnetics with the residual magnetic intensity. The profile series is plotted perpendicular to the track, using uncorrected fathoms or meters for bathymetry and residual magnetic intensity for magnetics. The program was written in FORTRAN IV for use on a CDC 3800 computer; however, the program can be converted to run on other systems with little difficulty.

Author (GRA)

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INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A76-38501 American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976. 903 p. Members, \$5.00; nonmembers, \$10.00.

The present collection of papers deals with advances in analytical photogrammetry, nonconventional photogrammetry, image processing, photography and photogrammetric surveys, remote sensing and photointerpretation, and applications of Landsat imagery. Particular attention is given to block adjustment, computerized image processing in terrestrial and planetary geology, space photography in the shuttle era, advances in off-line orthophotography, and remote sensing of natural resources with cost-effective techniques. Featured topics include improvement of analytical aerial triangulation by field calibration, analysis and removal of geometric distortion from Viking Lander camera images, Mercury stereo coverage, and orthophotos from high oblique lunar orbital photographs. Utilization of multispectral photography in remote sensing is discussed.

S.D.

A76-38504 Improvement of analytical aerial triangulation by field calibration. G. Kupfer (Bonn, Universität, Bonn, West Germany). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 51-67: 15 refs.

The paper reviews possible procedures for detection and/or elimination of systematic errors in camera-film imaging systems, with particular reference to their advantages and shortcomings. Attention is focused on field calibration under real flight conditions. With a fairly dense ground control within the test area, parameters for systematic image coordinate errors can be obtained with considerable accuracy. The choice of a certain set of parameters is arbitrary to some extent as in the case of self-calibration. Whereas certain typical systematic error patterns cannot be detected by self-calibration, this can be done readily by field calibration using sufficient ground control. Improvement of aerial triangulation has so far been achieved using a test area with high-precision geodetic control. It is shown that field calibration can be incorporated into actual flight missions with lesser effort. Recommendations are set forth for practical applications.

S.D.

A76-38511 The Casa Grande Photogrammetric Test Range. D. D. Byars (Defense Mapping Agency, Washington, D.C.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 162-176.

The Casa Grande Photogrammetric Test Range was established in the mid-sixties to test the dynamic performance of aerial cartographic cameras. A discussion of the test range design and the field surveys required to establish it is presented. In addition, the photogrammetric procedures normally used to test aerial mapping cameras using the range are presented. (Author)

A76-38523 Multispectral approach to urban neighborhood analysis and delineation. G. K. Higgs (Nebraska, University, Omaha, Neb.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 444-465. 7 refs.

In the reported study Landsat imagery is used to measure spectral radiance (histograms) in the four imaging Landsat-1 bands for four typical urban sites including the central business district, the interior commercial zone, the interior residential zone, and the new suburban residential zone. The radiances for each category of site are developed and evaluated as an indicator of site type. The histogram values are related to photographically derived density measures for the four types of sites. G.R.

A76-38530 Remote sensing, water quality and land use - From the obvious to the insidious. T. M. Lillesand and W. P. Tully (New York, State University, Syracuse, N.Y.). In: American Society of Photogrammetry and American Congress on Surveying and Mapping, Fall Convention, Phoenix, Ariz., October 26-31, 1975, Proceedings. Falls Church, Va., American Society of Photogrammetry, 1976, p. 582-618. 36 refs. Research supported by the Cogar Foundation and Calspan Corp.

The influence land use exerts on water quality ranges from the obvious to the insidious. Two case study examples are presented which demonstrate the utility of remote sensing in monitoring land use and water quality in 'obvious' and 'insidious' scenarios, respectively. The former is typified by a photographic and thermal study of Onondaga Lake in Syracuse, New York. The shoreline of this highly polluted lake is urbanized, and industrialized and these shoreline land uses dominate the water quality of Onondaga Lake. The later scenario is exemplified by Chaumont Bay, located along the Eastern Lake Ontario shoreline. Non-point sources of pollution associated with upland land use characterize this region. In such cases, improved land use planning and control, in the context of water quality preservation and restoration, entails increased linkage and synthesis of land use, water quality and hydrologic data. The role remote sensing can play in providing this linkage and synthesis is presented conceptually. (Author)

A76-38699 # 1980-2000 - Raising our sights for advanced space systems. I. Bekey and H. Mayer (Aerospace Corp., El Segundo, Calif.). *Astronautics and Aeronautics*, vol. 14, July-Aug. 1976, p. 34-63.

A group of possible applications of space technology suitable for implementation in the 1980-2000 time frame is discussed. Among the microwave applications presented are a wrist-radio system, and all-nation 'hot-line' network, systems for electronic transmission of mail, border violation and intrusion alarm systems, nuclear fuel locators, and energy delivery systems. The combined use of large, high-quality optics for fire detection, meteorology, resource surveys, and pollution detection is considered, together with potential applications of laser arrays and very large thin-film reflectors from a space platform. Support systems and technology needs for delivery and maintenance of the proposed space systems are discussed. C.K.D.

A76-39340 Satellite remote sensing of the atmosphere with a laser (Satelliten-Fernanalyse der Atmosphäre mit Laser). W. Englisch (Battelle-Institut, Frankfurt am Main, West Germany). In: *Laser 75* opto-electronics; Proceedings of the Conference, Munich, West Germany, June 24-27, 1975. Guildford, Surrey, England, IPC Science and Technology Press, Ltd., 1976, p. 275-279. In German. Research supported by the Bundesministerium für Forschung und Technologie.

A tunable CW IR molecular laser together with a heterodyne-detection system can be used to measure the concentration of several air pollutants and natural constituents of the atmosphere from an

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orbiting satellite. The technique involves differential absorption measurement using the diffusely reflecting earth's surface to provide a return signal. Calculations show that the signal-to-noise ratio is sufficient using a system well within the present state of the art.

(Author)

A76-39372. Long-path infrared spectroscopic investigation at ambient concentrations of the 2% neutral buffered potassium iodide method for determination of ozone. J. N. Pitts, Jr., J. M. McAfee, W. D. Long, and A. M. Winer (California, University, Riverside, Calif.). *Environmental Science and Technology*, vol. 10, Aug. 1976, p. 787-793. 34 refs. Research supported by the California Air Resources Board; NSF Grant No. GI-41051.

The stoichiometry of the 2% neutral buffered potassium iodide (NBKI) method for ozone calibration was investigated at ambient concentrations using long-path infrared spectroscopy. Absolute ozone concentrations were obtained from the 9.48 micrometer R-branch absorption of ozone using an absorptivity of .00043/ppm/m. The stoichiometry was found to range from 1.12 to 1.25, depending on the relative humidity; the 2% NBKI method yields ozone concentrations 12-14% higher than the absolute spectroscopic determinations at low relative humidities, and 23-25% higher at high relative humidities.

C.K.D.

A76-39594 * Remote sensing of the surface emissivity at 9 microns over the globe. C. Prabhakara and G. Dalu (NASA, Goddard Space Flight Center, Greenbelt, Md.). *Journal of Geophysical Research*, vol. 81, July 20, 1976, p. 3719-3724. 19 refs.

The infrared spectral measurements made by the Nimbus 4 infrared interferometer spectrometer (Iris) for a period of about 10 months are used to study the surface emissivity properties over the globe. It is found that the surface emissivity at 9 microns, as measured by Iris with a circular field of view of about 100-km diameter, is significantly less than unity over arid and semiarid areas. The spectral features in the 8-12-micron window observed over these lands reveal emissivity characteristics essentially due to quartz (SiO₂). It is found that these emissivity features are significantly weakened by the presence of clay, -clay horizons, or pedogenic horizons in the soil. Low emissivity is observed over sandy or sandy loam areas (psamments) with no clay or pedogenic horizons.

(Author)

A76-39678 # Remote sensing of earth resources sounding rocket capabilities. B. R. Payne and J. L. Baird (Bristol Aerospace, Ltd., Winnipeg, Canada). (*Canadian Aeronautics and Space Institute, Aerospace Electronics Symposium, Halifax, Nova Scotia, Canada, Feb. 4, 5, 1975.*) *Canadian Journal of Remote Sensing*, vol. 2, May 1976, p. 12-17. 7 refs.

The potential of the Black Brant Sounding Rocket for an employment in remote-sensing studies of earth resources is discussed. The systems considered for the studies are examined, taking into account Black Brant VC, Black Brant IIIB, and Black Brant VI. It is pointed out that the sounding rocket systems offer considerable potential for resource surveys in Northern Manitoba.

G.R.

A76-39682 # The application of remote spectral measurements to water quality monitoring. W. R. McNeil (McNeil and Associates, Inc.), K. P. B. Thomson (Canada Centre for Remote Sensing, Ottawa, Canada), and J. Jerome (Canada Centre for Inland Waters, Burlington, Ontario, Canada). *Canadian Journal of Remote Sensing*, vol. 2, May 1976, p. 48-58. 19 refs.

The apparent spectral reflectance over a water body measured by some remote means, such as an airborne spectrograph, consists of three basic components. These are: the volume reflectance of the water, a reflected component from the water surface, and a component due to atmospheric backscatter. However, it is only the volume reflectance which contains information which can be related

to the in situ properties of the water body. A model is presented which defines in detail these principal components. Essentially the model illustrates the methodology whereby the volume reflectance function can be extracted from the apparent reflectance data. The volume reflectance function can then be expressed in terms of color indices that display and quantify the subtle color characteristics of a water mass. These quantified color indices are intrinsic optical parameters which may be directly related to the water quality.

(Author)

A76-39966 Application of an analytical approach to field spectroscopy in geological remote sensing. T. G. Longshaw (Spectral Africa /Pty/, Ltd., Randfontein, Republic of South Africa). *Modern Geology*, vol. 5, Apr. 1976, p. 201-210. 16 refs.

The paper discusses reflectance data gathered in the field during several geological investigations using the multispectral technique and compares the data to laboratory spectrophotometer studies of prepared mineral and rock samples selected from two comprehensive surveys. From this comparison it is apparent that the use of laboratory reflectance data for terrestrial multispectral photography anticipates reflectance features which in most cases are not displayed in the reflectance characteristics of rock outcrop observed in the natural environment. In addition, the use of in situ data can be equally inappropriate if one tries to extrapolate the reflectance of a particular rock type from one climatic environment to another. It is concluded that if reflectance data are to play a role in multispectral filter selection it is only meaningful to use bivariate reflectance factors measured on selected rock outcrop in the field which is local to the proposed photographic survey area.

S.D.

A76-40642 EASCON '75; Electronics and Aerospace Systems Convention, Washington, D.C., September 29-October 1, 1975, Record. Convention sponsored by the Institute of Electrical and Electronics Engineers et al. New York, Institute of Electrical and Electronics Engineers, Inc., 1975. 845 p. \$32.

Topics considered were telecommunications and the expanding urban environment, mobile communications via satellite, (MARI-SAT, MARAD, AEROSAT), communications satellite systems and technology, and modular spacecraft. Also examined were domestic satellite systems, multiple user satellite systems, earth resources monitoring, safety-related engineering and development activities of the FAA, PSK modems for satellite communications, and technical highlights of the ATS-6. New energy systems (fusion, wind power, solar, geothermal), new applications of acoustics, radar systems, computer networking, advanced solid state devices, environmental monitoring data collection and processing, optical communications, digital signal processing, and space tracking and data network development from the Apollo-Soyuz mission to 1990 were also considered.

B.J.

A76-40676 * Health education telecommunications experiment. A. A. Whalen (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: EASCON '75; Electronics and Aerospace Systems Convention, Washington, D.C., September 29-October 1, 1975, Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 154-A to 154-C.

The Health/Education Telecommunications Experiment (HET) was conducted jointly by NASA and HEW on NASA's ATS-6 communications satellite. This experiment actually consisted of six experiments testing health and education applications of a communication spacecraft producing a broadcast of color television directly from space to over 120 low-cost receivers located in remote rural areas throughout the U.S. (including Alaska). The experiments were conducted over the period from 2 July 1974 to 20 May 1975 and operated on an almost daily basis. The overall telecommunications system to support these experiments consisted of many elements: The ATS-6 spacecraft; five different types of earth stations consisting of 120 video receive terminals, 51 telephony trancivers

and eight video originating terminals of three different types. Actual performance of the equipment as measured in the field was shown to equal or exceed predicted values. (Author)

A76-40726 Electromagnetic compatibility; Proceedings of the First Symposium and Technical Exhibition, Montreux, Switzerland, May 20-22, 1975. Symposium sponsored by IEEE, URSI, CISPR, SEP, SAE, and NTG. Edited by T. Dvorak (Eidgenössische Technische Hochschule, Zurich, Switzerland). New York, Institute of Electrical and Electronics Engineers, Inc., 1975. 564 p. Members, \$27.; nonmembers, \$36.

Papers are presented on EMC requirements for digital data transmission systems, solid-state relays for interference suppression, EMC testing of the ATS-6 satellite, and the effects of microwave radiation on biological systems. Also considered are a typical EMC test program for an aircraft engine temperature control system, a deterministic model for radio propagation over the rough earth, crosstalk analysis and design rules for wiring installation in the Saab 37 Viggen aircraft, and the EMC of adaptive communication systems. Signal transmission avionics, EMI in radio astronomy, the attenuation of TV broadcasting by steel-reinforced buildings, and an EMI survey of an L-band shipboard terminal for maritime satellites are also considered.

B.J.

A76-40736 Electromagnetic compatibility assurance tests for airborne systems controls in an RF-polluted environment. C. J. Hanover (General Motors Corp., Detroit Diesel Allison Div., Indianapolis, Ind.). In: Electromagnetic compatibility; Proceedings of the First Symposium and Technical Exhibition, Montreux, Switzerland, May 20-22, 1975. New York, Institute of Electrical and Electronics Engineers, Inc., 1975, p. 191-196.

A typical EMC test program is described and applied to an aircraft turbine engine temperature control system. The temperature control system was subjected to high and low frequency susceptibility testing, with the test kit attached to an amplifier in the aircraft. Attention is paid to bonding, shielding, and grounding of the equipment, and circuit isolation techniques are discussed. (Author)

B.J.

A76-40776 * Side-looking radar mosaicking experiment. F. Leberl (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), H. Jensen, and J. Kaplan (Aero Service, Philadelphia, Pa.). (International Society for Photogrammetry, Congress, 13th, Helsinki, Finland, July 11-23, 1976.) *Photogrammetric Engineering and Remote Sensing*, vol. 42, Aug. 1976, p. 1035-1042. 8 refs.

A block of 24 overlapping synthetic aperture side-looking radar images flown over a well mapped area of about 90,000 sq km provided an opportunity to evaluate the mapping accuracy achieved in current radar mosaicking projects. The maps of scale 1:24,000 that are available in the imaged area permitted the study of the geometric errors of the radar mosaics and of individual radar strips. An estimate was obtained for the effect of the distribution and density of ground control points and for the accuracy of different mosaicking methods that are currently employed with synthetic aperture radar images. It is shown that a successful radar mosaicking process requires the elimination of image errors of up to several kilometers. These errors are introduced as a result of the limited precision of the inertial aircraft navigation. An example of a radar mapping effort in which the navigation errors could be eliminated is presented. The resulting radar mosaics have residual RMS mapping errors of planimetry of about plus or minus 150 m. (Author)

(Author)

A76-40779 Skylab S-190B ETC photo quality. R. Welch (Georgia, University, Athens, Ga.). *Photogrammetric Engineering and Remote Sensing*, vol. 42, Aug. 1976, p. 1057-1060. 10 refs.

Analyses of S-190B photographs recorded on high-resolution reconnaissance films during the Skylab missions confirm the excellent performance of the ETC (Earth Terrain Camera) system. Low-contrast resolution values of 30 to 70 lpr/mm, corresponding to ground resolutions of 30 to 15 m, are estimated for second-generation photographs distributed to investigators, and maximum scales of 1:50,000 to 1:100,000 are recommended for photomaps prepared from ETC photographs. (Author)

(Author)

A76-41779 Remote sensing data processing. Edited by J. L. van Genderen (Sheffield, University, Sheffield, England) and W. G. Collins (Aston, University, Birmingham, England). Sheffield, University of Sheffield, 1975. 145 p.

Papers are presented on the use of photographic materials in remote sensing, the visual interpretation of remote sensing data and electronic image enhancement techniques, and a nonmathematical account of automated processing of remote sensor data. Also considered are supervised and unsupervised pattern classification of agricultural areas and noncultivated natural terrain, digital processing for side-looking airborne radar, and a system for scanning remote sensor data when recorded on photographic emulsions.

B.J.

A76-41781 # Visual interpretation of remote sensing data and electronic image enhancement techniques. J. L. van Genderen (Sheffield, University, Sheffield, England). In: Remote sensing data processing. Sheffield, University of Sheffield, 1975, p. 19-51. 62 refs.

This paper outlines some of the principles and techniques of visual interpretation of the various types of remote sensing data such as camera products, thermal infrared linescan imagery, side looking airborne radar, and orbital imagery for the various earth sciences. Emphasis is placed on the various image characteristics of tone, texture, structure, pattern, size, shape, shadow, and associated features. The effect of scale on these characteristics is discussed. Some examples are given of stereo SLAR and stereo SKYLAB imagery. The following methods of electronic image enhancement are treated: dodging, microdensitometry, image quantizing and density slicing. Applications of these techniques in the fields of land-use studies, drainage pattern analysis, geomorphology and structural geology are discussed to illustrate how these methods may supplement the data obtainable from remote sensing imagery. (Author)

(Author)

A76-41882 * Optoacoustic measurements of water vapor absorption at selected CO laser wavelengths in the 5-micron region. R. T. Menzies and M. S. Shumate (California Institute of Technology Jet Propulsion Laboratory, Pasadena, Calif.). *Applied Optics*, vol. 15, Sept. 1976, p. 2025-2027. 15 refs. Contract No. NAS7-100.

Measurements of water vapor absorption were taken with a resonant optoacoustical detector (cylindrical pyrex detector, two BaF2 windows fitted into end plates at slight tilt to suppress Fabry-Pérot resonances), for lack of confidence in existing spectral tabular data for the 5-7 micron region, as line shapes in the wing regions of water vapor lines are difficult to characterize. The measurements are required for air pollution studies using a CO laser, to find the differential absorption at the wavelengths in question due to atmospheric constituents other than water vapor. The design and performance of the optoacoustical detector are presented. Effects of absorption by ambient NO are considered, and the fixed-frequency discretely tunable CO laser is found suitable for monitoring urban NO concentrations in a fairly dry climate, using the water vapor absorption data obtained in the study. R.D.V.

R.D.V.

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A76-42232 # Earth resources survey using stratospheric balloons. G. Joseph and N. V. M. Unni (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India). In: Technology of scientific space experiments; International Conference, Paris, France, May 26-30, 1975, Reports.

Toulouse, Centre National d'Etudes Spatiales, 1975, p. 63-69.

The feasibility of using stratospheric balloons for the photographic survey of earth resources was conducted by the Space Applications Centre, ISRO, Ahmedabad, in February 1975. Experimental details are considered, with attention given the payload and launch operations. Attention is also given the effects of drift direction and speed, the rotation of the balloon and the geographical location of the frames. Problems of an operational balloon survey are considered, together with aspects of the photographic coverage of a desired area, and tracking, recovery and ground truth collection. It is found that balloon-borne photography provides wider synoptic coverage by a single frame than photography from high-flying aircraft, and provides ground truth information for satellite imagery.

B.J.

A76-42248 # Design concepts for earth resources optical remote sensing equipment (Conception d'équipements pour la télédétection optique des ressources terrestres). M. Hebert and F. X. Doittau (SODERN-Société Anonyme d'Etudes et Réalisations Nucléaires, Limeil-Brévannes, Val-de-Marne, France). In: Technology of scientific space experiments; International Conference, Paris, France, May 26-30, 1975, Reports.

Toulouse, Centre National d'Etudes Spatiales, 1975, p. 233-245. In French.

Mission requirements, capabilities and performance of components, development of techniques and fabrication technology, and technological problems for user and manufacturer are considered in relation to a satellite-mounted multispectral remote-sensing camera, an image dissector for processing remotely sensed imagery, and other remote-sensing equipment. Technological, design, and cost solutions are compared. Compromises to be arrived at between mission project heads and manufacturers are discussed. Initial data furnished by the physicist or engineer in charge of the mission project for the equipment manufacturer, initial data for the overall project, and design and performance data for the types of remote-sensing equipment discussed are characterized.

R.D.V.

A76-42362 # Looking homeward - Uses of the STS/Spacelab to view the earth. C. E. Cheeseman (General Electric Co., Space Div., Valley Forge, Pa.). *American Astronautical Society and Deutsche Gesellschaft für Luft- und Raumfahrt, International Meeting on Utilization of Space Shuttle and Spacelab, Bonn, West Germany, June 2-4, 1976, Paper, 14 p.*

STS/Spacelab will be used as an earth viewing platform for the purposes of technique development, sensor development, applications development, and missions for operational applications. High priority earth viewing missions are considered, including remote sensing of soil moisture, synthetic aperture radar development, timber volume inventory, mineral exploration, urban and regional planning, crustal motion monitoring, and stratospheric environmental quality. A number of earth viewing program payloads are described, giving attention to the Atmospheric Cloud Physics Laboratory, the Earth Viewing Applications Laboratory, Shuttle Imaging Radar, and the Microwave Multiple Application Payload.

B.J.

A76-42371 # Remote sensing techniques and their utilization from a European point of view (Fernerkundungstechniken und ihre Nutzung aus europäischer Sicht). P. Hartl (Berlin, Technische Universität, Berlin, West Germany), J. Bodechtel (Zentralstelle für Geo-Photogrammetrie und Fernerkundung, Munich, West Germany), D. Davidts (Messerschmitt-Bölkow-Blohm GmbH, Ottobrunn, West Germany), R. Mühlfeld (Bundesanstalt für Geowissenschaften und Rohstoffe, Hanover, West Germany), H. Sax (Deutsche Forschungs-

und Versuchsanstalt für Luft- und Raumfahrt, Porz-Wahn, West Germany), S. Schneider (Bundesforschungsanstalt für Landeskunde und Raumordnung, Bonn, West Germany), and E. Velten (Dornier-System GmbH, Friedrichshafen, West Germany). *American Astronautical Society and Deutsche Gesellschaft für Luft- und Raumfahrt, International Meeting on Utilization of Space Shuttle and Spacelab, Bonn, West Germany, June 2-4, 1976, Paper, 25 p.* In German.

The particular needs concerning an employment of remote sensing techniques in the case of European countries are not necessarily identical with those of the developing countries or of countries which occupy a large area. A description is given of a number of examples which demonstrate suitable European applications of remote sensing techniques. The characteristics of the required operational system are determined by the considered objectives. Microwave techniques are needed to assure weather independence. Attention is given to the role of Spacelab in the development and testing of appropriate remote sensing systems. G.R.

A76-42820 Application of the Landsat data collection system in Alaska. D. M. Anderson and H. L. McKim (U.S. Army, Cold Regions Research and Engineering Laboratory, Alaska). In: International Telemetering Conference, Washington, D.C., October 14-16, 1975, Proceedings. Pittsburgh, Pa., Instrument Society of America, 1975, p. 315-322.

The Landsat data collection system was tested for performance, reliability, and versatility at a number of locations within the contiguous United States and Alaska under conditions in which probability and unattended operation were stressed. The Landsat data collection platforms were interfaced with a variety of environmental and water quality sensors. In addition to the Landsat multispectral satellite imagery, the data collection system (DCS) provides a means of taking the first step in assembling large-scale regional, national, and international inventories of environmental and natural resources data. It is found that the DCPs, the satellite data relay, the ground receiving station, and ground data handling portions of the system performed extremely well. Overall system reliability is found to be dependent on the sensor and signal conditioning interface unit performance. It is concluded that automated data platforms with satellite relay to a central data processing and dissemination center are immediately practicable.

S.D.

A76-42968 Trends in aerial photography at the state level - Perspective '76. K. R. Martin. *Functional Photography*, vol. 11, July 1976, p. 18-22, 34.

A slowdown in reliance on satellite remote-sensing (RS) imagery by U.S. state agencies is predicted after years of expanded use of RS by various states. Economic pressure is seen taking its toll. Some state-level programs are sketched: an inventory of gob piles (coal refuse banks) by Indiana, surveying of coastal wetlands and littoral resources by New Jersey, mapping of underground mine subsidence by Pennsylvania, and land use mapping by Maryland. A trend toward regional and multistate ventures in the use of aerial photography and satellite imagery is noted, in addition to the development of use of multiple graphics toward automated information systems. Small-scale low-altitude aerial coverage will increasingly supplement satellite repetitive large-scale RS coverage.

R.D.V.

A76-43089 # Dynamical constraints in satellite photogrammetry. J. N. Blanton and J. L. Junkins (Virginia, University, Charlottesville, Va.). *American Institute of Aeronautics and Astronautics and American Astronautical Society, Astrodynamics Conference, San Diego, Calif., Aug. 18-20, 1976, AIAA Paper 76-824, 14 p.* 7 refs.

The feasibility of including rotational dynamical constraints in the process of satellite photogrammetric triangulation is demonstrated. An analytical solution and the corresponding analytical expressions for the partial derivatives with respect to initial conditions are given for the idealized case of the torque-free motion of a

rigid triaxial satellite. The development of a state transition matrix solution for the direction cosines is included. This state transition matrix allows the satellite principal axes to be tracked relative to any arbitrary inertial reference frame. It also enables essential uncoupling of the partial derivatives with respect to initial Euler angles from these with respect to initial angular velocities. Comparative computer results for various sets of dynamical constraints are summarized.

(Author)

A76-43143 # Selective radiometer for remote sensing of gaseous pollutants. A. Girard and J. Laurent (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France). (*International Union of Pure and Applied Physics, Conférence sur la Physique dans l'Industrie, Dublin, Ireland, Mar. 9-13, 1976.*) ONERA, TP no. 1976-5, 1976: 6 P.

The construction and operating principle for a new type of remote sensing device, the selective modulation radiometer, is described. The device uses four cells filled with the gas to be detected to measure the optical absorption of the gas in the atmosphere. A detection limit of 3 ppm meter has been achieved in determining total vertical amount of SO₂ and NO₂ with a blue cloudless sky as a light source. The device can be applied to study the influence of the meteorological conditions on the natural dispersion of pollutants, in order to forecast pollution hazards. S.N.

A76-43300 Results of studies on gravimeter calibration (Rezultaty issledovaniy po etalonirovaniyu gravimetrov). Edited by Iu. D. Bulanzhe. Moscow, Izdatel'stvo Sovetskoe Radio, 1976. 76 p. In Russian.

Experiments on calibrating geodetic astaticized quartz gravimeters of the Sharpe CG-2 type and GAK gravimeters by the tilt method are described. The experiments were performed at locations with significantly different values of the acceleration due to gravity, different altitudes above sea level, and different temperatures. Gravity increments in a given test area were measured, and the temperature dependence of the scale value was studied. Calibration studies with automatic sea gravimeters were also conducted. A study of the perturbing effect of a small load on geophysical bases was made. P.T.H.

A76-43454 # An automated technique of determining the surface characteristics in terms of VHRR data. T. Takashima and E. G. Morrissey (Department of the Environment, Atmospheric Environment Service, Toronto, Canada). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper.* 9 p. 9 refs.

An automated technique for determining surface characteristics from VHRR data suitable for near-real-time application is discussed. The method uses data from one channel in the visible and one in the infrared window regions. The diffuse reflected radiation from the atmosphere-ground system is computed over a smooth ice field and employed as a reference level. In this paper, the ice field is assumed to reflect light in accordance with Lambert's law with an albedo of 0.7. The surface characteristics are separated into classes such as land covered with snow and floating ice. These are identified using the difference between the radiation from the surface and that reflected from an ice field, and are determined in terms of brightness, temperature, and spatial variance. It is found that the surface characteristics may be reasonably determined with a subsatellite resolution of 5 km. (Author)

A76-44078 An integrated airborne particle-measuring facility and its preliminary use in atmospheric aerosol studies. P. V. Hobbs, L. F. Radke (Washington, University, Seattle, Wash.), and E. E. Hindman, II (U.S. Naval Weapons Center, China Lake, Calif.). *Journal of Aerosol Science*, vol. 7, May 1976, p. 195-211. 29 refs. Research supported by the Electric Power Research Institute; NSF Grant No. GI-31759.

An integrated airborne system for studying aerosol particles and

their effects on the atmosphere is described. Particles from 0.01 to 30 micrometers in maximum dimensions, covering concentrations from 10 to the 7th to 10 to the -6th/cu cm, can be measured and the measurements displayed in the aircraft. Particles from 5 to 100 micrometer are collected by impaction and their deliquescent nature and elemental compositions are determined in post-analysis. Also measured are the light scattering coefficient of the aerosol, Aitken nuclei concentrations, cloud condensation nuclei, and ice nuclei. Examples of data collected with this system over the Pacific Ocean, in the western and eastern regions of Washington State, and in the plume from a paper mill are presented. (Author)

A76-44572 Compilation base orientation by graticule. R. H. Duncan (U.S. Defense Mapping Agency, Aerospace Center, St. Louis, Mo.). *Photogrammetric Engineering and Remote Sensing*, vol. 42, Sept. 1976, p. 1157-1159.

Compilation base to stereomodel orientation classically requires locating control points with respect to a graticule and stereoplotter operator judgment in aligning the compilation base with the stereomodels. Methods may be developed for analytical plotters such that a compilation base may be oriented to a stereomodel by model coordinates of graticule intersections. Such methods eliminate the requirement and expense of plotted control and reduce human error in compilation base orientation and other facets of compilation. (Author)

A76-44948 * Airborne laser bathymeter. P. O. Cervenka, C. B. Lankford (Computer Sciences Corp., Wallops Island, Va.), and H. H. Kim (NASA, Wallops Flight Center, Wallops Island, Va.). In: *Electro-optical Systems Design Conference and International Laser Exposition, Anaheim, Calif., November 11-13, 1975, Proceedings of the Technical Program.* Chicago, Industrial and Scientific Conference Management, Inc., 1975, p. 361-367.

A description is given of a program concerned with the development and the evaluation of techniques for the measurement of water depth with a pulsed laser. Airborne laser bathymetry makes use of a light pulse which is sent downward. Information concerning the water depth is provided by the time interval observed between the arrival of the light pulse reflected from the water surface and the arrival of the pulse coming from the ocean floor. Details concerning the instrumentation used for the developed measurement method are discussed. Attention is also given to field experiments and aspects of system performance. G.R.

A76-45077 # Remote sensing, international collaboration, and global control (Distantsionno sondirane, mezhdunarodnoto s'trudnichestvo i globalniiat kontrol). K. B. Serafimov. *B'lgarska Akademiia na Naukite, Spisanie*, vol. 22, no. 2, 1976, p. 48-55. In Bulgarian.

Progress in remote sensing (RS) techniques, the need for international collaboration in using RS to best advantage, and international controls for preventing abuse of RS in espionage are discussed. Costs of RS programs undertaken by developing nations, applications of RS in geology, geomorphology, geodesy, geophysics, cartography, hydrology, meteorology, soil sciences, oceanology, ecology, plant husbandry, forestry, forest fire patrols, transportation planning, exploration of mineral resources, and land use mapping are mentioned. The quality of multispectral imagery of military arenas in the October 1973 Middle East war, the possibility of applying RS techniques to large-scale espionage, and USSR-Bulgaria UN proposals on curtailing such use, are discussed. Assessment of ecological damage by one state to another state with the aid of RS is also mentioned. R.D.V.

08 INSTRUMENTATION AND SENSORS

A76-45720 A branched classification system offering additional possibilities in multispectral data analysis. F. Quiel (Karlsruhe, Universität, Karlsruhe, West Germany). *Bildmessung und Luftbildwesen*, vol. 44, Sept. 15, 1976, p. 182-188.

A description is presented of a new classification system which combines the advantages of preprocessing techniques with a detailed classification approach. The system is also useful in the study of spectral properties on the basis of multispectral scanner data. The objectives of the system are considered, taking into account the short time required for a classification, a great flexibility regarding criteria selection, the possibility to use additional features, and the feasibility of general-purpose computer use. The classification system has a branched, tree-like structure. The employment of the classification system is illustrated with the aid of a specific example involving aircraft scanner data obtained in Southern Germany. G.R.

A76-45801 Modern utilization of infrared technology: Civilian and military; Proceedings of the Seminar, San Diego, Calif., August 19, 20, 1975. Seminar sponsored by the Society of Photo-Optical Instrumentation Engineers. Edited by I. J. Spiro (Aerospace Corp., El Segundo, Calif.), Palos Verdes Estates, Calif., Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings, Volume 62), 1975. 312 p. \$34.

Papers are presented on infrared mosaic detector technology, the use of charge coupled devices in infrared sensor systems, advanced (Hg, Cd)Te photodiodes for infrared applications, and the satellite-borne RM-20B mosaic measurement experiment and the RM-20A radiometric measurements experiment. Also considered are the uses of meteorological data to support infrared measurement systems, new techniques in Fourier transform spectroscopy, the design of a large aperture infrared optical system, and the infrared observation of earth from a geostationary orbit. Large sections are presented on pyroelectric detectors and on the technology of thermal imaging systems. B.J.

A76-45826 Efficient transmission of pictorial information; Proceedings of the Seminar, San Diego, Calif., August 21, 22, 1975. Seminar sponsored by the Society of Photo-Optical Instrumentation Engineers. Edited by A. G. Tescher (Aerospace Corp., El Segundo, Calif.), Palos Verdes Estate, Calif., Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings, Volume 66), 1975. 240 p. \$34.

Papers are presented on the fundamentals and impacts of image data compression. In particular, attention is given to the technology of charge coupled devices for video bandwidth reduction, a real time compression algorithm for Hadamard transform processing, an advanced imaging communication system for planetary exploration, and an operational video data compression system for ATS and ITOS. A joint pattern recognition data compression concept for Landsat imagery, a dual mode nonlinear compressor for synthetic aperture radar images, and DPCM quantization error reduction for image coding are also considered. B.J.

A76-45927 # Experiences in the use of VTPR 'direct readout' radiances. W. H. Hand, B. R. May, and F. Rawlins (Meteorological Office, Bracknell, Berks., England). *COSPAR, Plenary Meeting, 19th, Philadelphia, Pa., June 8-19, 1976, Paper. 7 p. 6 refs.*

Since September 1975, the High Atmosphere Branch of the UK Meteorological Office at Bracknell has been using radiances measured by the Vertical Temperature Profile Radiometer (VTPR) on the NOAA operational meteorological spacecraft to deduce vertical profiles of temperature and thickness, and also cloud-cover information, for an area of the northeastern Atlantic. The radiances have been obtained from VTPR telemetry provided by the spacecraft

'direct-readout' transmission covering an area of radius about 4000 km. A brief description is given of the methods used to retrieve atmospheric parameters from these radiances, and some examples are given of comparison with conventional soundings and analyses. (Author)

A76-45952 # The Landsat earth resources ground receiving and processing station at Fucino, Italy. G. Bressanin (Telespazio S.p.A., Rome, Italy). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 21-32.

The paper describes the two major subsystems - the Acquisition and Monitoring Subsystem (AMS) and the Acquisition and Processing Subsystem (APS) - of the TERRA Information Processing System of the Landsat ground station at Fucino, Italy. The function of the AMS is to record the MSS data stream from the Landsat downlink on High Density Digital Tape, while providing a simultaneous monitoring and test facility. The data is played back at 1:8 speed for processing by APS. APS has two main functions: the conversion of the digital tape data into output products such as 70 mm black and white or color film and Computer Compatible Tapes, and the conversion of remote sensing data into an information form required for the management of natural resources. B.J.

A76-45954 # Use of Landsat-1 standard data products for multispectral radiometric analysis of sedimentation in Kainji reservoir. D. C. Nduaguba (Food and Agriculture Organization of the United Nations, Rome, Italy). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 45-52. 6 refs.

A76-45958 # Interpretability of the phenomena of littoral zones from panchromatic aerial photographs (Zur Interpretierbarkeit von Phänomenen der Litoralzone aus dem panchromatischen Luftbild). K. Stöckhuber (München, Universität, Munich, West Germany). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings.

Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 85-94. 10 refs.

The paper considers the interpretation of vegetation from panchromatic aerial photographs with particular reference to photographs of the littoral of a lake (Tegernsee) in the Bavarian Lower Alps. The vegetation examined includes submerged algae, water lilies, reeds and strew meadows. A table for the interpretation of objects in littorals is presented. B.J.

A76-45961 # The utilization of remote sensing in land use investigations (L'uso del telerilevamento per indagini sulla destinazione di uso del suolo). R. Galetto (Pavia, Università, Pavia, Italy) and F. Faschi (Istituto di Rilevamenti Terrestri ed Aerei, Milan, Italy). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings.

Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 121-130. In Italian.

The CEE and the Italian Ministry of Agriculture and Forestry agreed to perform a cadastral survey of olive trees over the entire territory of central and meridional Italy, and to determine the number of olive trees in each cadastral parcel. Two ways of correlating the physical surface of the territory with existing cadastral cartography are examined: (1) the production of orthomaps that are superimposable on cadastral maps, and (2) the projection of cadastral parcel limits on aerial pictures by means of advanced analog and digital photogrammetric techniques. Olive trees are discriminated within the general vegetal context by means of

computer processing of multispectral scanner data and through the photointerpretation of the aerial pictures. B.J.

A76-45962 # Aerial thermal surveys for mapping the fresh water springs flowing into the sea. G. M. Lechi and A. M. Tonelli (CNR, Istituto per la Geofisica della Litosfera, Milan, Italy). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 139-141.

A76-45986 # Remote sensing of geothermic activities of the volcanoes Aetna, Stromboli and Vesuv by means of infra-red NOAA-VHRR-satellite data. H. Kaminski (Bochum, Sternwarte, Bochum, West Germany). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 441-455. 9 refs.

A76-46064 # Tethered balloons as geostationary platforms for multispectral radiometry. S. Vetrella, C. Colagiovanni, and A. Afano (Napoli, Università, Naples, Italy). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-152*. 5 p. Consiglio Nazionale delle Ricerche Contracts No. 75,00369,07; No. 75,01394,07.

A research program is being conducted at the University of Naples, in which various remote sensing platforms are being used to integrate and complement space-born platforms in the monitoring and study of earth resources. The experiments described in the present paper were conducted with a small tethered balloon to study the spectral signature of plants and soils, using Hasselblad photographic cameras and a multichannel radiometer. V.P.

A76-46083 # Role of geostationary satellites in data collection and relay during the First GARP Global Experiment. C. A. Spohn and J. H. Puerer (NOAA, National Environmental Satellite Service, Washington, D.C.). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-206*. 8 p.

The new synchronous meteorological satellites (SMS/GOES) now operating in the Western Hemisphere are demonstrating a system for collecting and relaying observations from river gauges, buoys, ships, aircraft, balloons, and other remotely located in-situ environmental platforms. Large in capacity (183 channels per satellite at 100 bits per second per channel), it covers nearly half of the earth's surface. The European Space Agency, Japan, and the USSR expect to have geostationary meteorological satellites operating with a similar data collection capability in time for the First GARP Global Experiment. Common standards and procedures are being developed for this future international system. (Author)

A76-46138 # Radar undersurface sounding as perspective airborne and space method for geological investigation. M. I. Finkel'shtein, V. I. Gornyi, V. A. Kutev, B. V. Shilin, and O. P. Vlasov (Ministry of Geology of USSR, Laboratory of Aeromethod, Leningrad, USSR). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper 76-185*. 8 p. 11 refs.

Basic principles of airborne subsurface radar sounding are analyzed. It is shown that the main problem in interpreting sounding results is the recognition of false signals reflected from different types of surface-relief and subsurface features. Some experimental results are presented which were obtained during airborne subsurface sounding of limestones in Soviet Central Asia and permafrosted rocks in northwestern Siberia. It is concluded that subsurface radar sounding for geologic purposes can be carried out from space platforms. F.G.M.

A76-46320 Method of determination and investigation of the dependence of the resolution of airborne infrared imaging systems on the contrast of the objects. A. M. Shirobokov. (*Optiko-Mekhanicheskaja Promyshlennost'*, vol. 43, Apr. 1976, p. 75-77.) *Soviet Journal of Optical Technology*, vol. 43, Apr. 1976, p. 264, 265. Translation.

A76-46669 # Problematics of using satellite measurements in an astronomical-geodetic net (Problematyka wykorzystania pomiarow satelitarnych w sieci astronomiczno-geodezyjnej). J. Sledzinski, Z. Zabek, K. Czarnecki, and J. B. Rogowski. *Geodezja i Kartografia*, vol. 25, no. 3, 1976, p. 147-155. 21 refs. In Polish.

After reviewing the basic concept of photographic, laser, and Doppler satellite observational techniques, the authors discuss the concept of an astronomical-geodetic net using satellite measurements. Laser range measurements or dynamic methods may be used for scaling the net. Basic problems to be solved for realization of such a net are indicated: reduction of the satellite net to a reference ellipsoid, determination of lengths of geodetic lines and their azimuths, choice of ellipsoid. The advantages of dynamic methods are discussed, and the problem of the effect of the accuracy of determination of the fundamental astronomical and mean terrestrial coordinate systems, and the accuracy of the transformations between the two systems, is touched upon. P.T.H.

A76-47206 Penetration of 0.1 GHz to 1.5 GHz electromagnetic waves into the earth surface for remote sensing applications. P. K. Kadaba (Kentucky, University, Lexington, Ky.). In: Engineering in a changing economy; Proceedings of the Southeast Region 3 Conference, Clemson, S.C., April 5-7, 1976.

New York, Institute of Electrical and Electronics Engineers, Inc., 1976, p. 48-50. 16 refs.

Low-frequency microwaves in the region from 0.4 to 1 GHz have considerable promise for earth-penetration studies and soil moisture estimates using remote-sensing radar techniques. Depths of penetration of the order of tens of centimeters even at high moisture levels seem possible. The attenuation constant or its reciprocal, the skin depth, is a sensitive parameter for moisture determination, and it is rather significant that skin depth is almost constant with frequency beyond 0.1 GHz for low-loss media corresponding to low soil-moisture levels and a variety of natural terrain. In absorption studies below 1 GHz, one needs to consider ion-exchange characteristics of soil materials. As regards scattering models, some progress can be made using computer-fit techniques in particular cases where information about the field of view and geological data over the test site is available. (Author)

A76-47274 # Remote sensing and satellite surveying: Report of ESCAP mission. S. A. Hempenius, F. C. d'Audretsch, and J. Rais. Bangkok, U.N. Economic and Social Commission for Asia and the Pacific, 1976. 43 p. 40 refs.

Some general considerations on how satellite remote sensing can benefit the ESCAP (Economic and Social Commission for Asia and the Pacific) countries - Burma, Nepal, Philippines, Sri Lanka, Malaysia, the Republic of Korea, Iran, Thailand, Bangladesh, Pakistan, Indonesia, India, and Japan - are presented. The status of remote sensing in the ESCAP countries is reviewed, and the Landsat program and its implementation in the ESCAP countries are considered. The development of future operational earth observation satellite systems is discussed. B.J.

A76-47278 # Results of model investigations of balloon triangulation (Rezultati ot modelni izsledvaniia na balonna triangulatsiia). Ts. Gergov (B'lgarska Akademiia na Naukite, Tsentralna Laboratoriia po Vissha Geodeziia, Sofia, Bulgaria). *Vissha Geodeziia*, no. 2, 1976, p. 74-83. 12 refs. In Bulgarian.

The article presents findings of experimental model investiga-

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tions of the effect of some factors (observation equipment, techniques, external conditions, network configuration) on the accuracy of adjusted coordinates of balloon triangulation points. The numerical effect of the balloon position and height, of the number of balloon position observations taken, and of a combination of photographic and distance observations, on the accuracy of stellar triangulations using balloon-borne beacons is expressed using some of the models. An ICL-4/50 computer was employed in the calculations. R.D.V.

A76-47345 # On comparability of terrestrial and satellite triangulation. W. Dobaczewska (Polska Akademia Nauk, Instytut Geofizyki, Warsaw, Poland). *Artificial Satellites*, vol. 11, Sept. 1976, p. 3-11. 10 refs.

The location of terrestrial triangulation network points in a space coordinate system has been considered. The most important problem is the proper determination of ellipsoidal heights of terrestrial triangulation points. Several geoids have been presented as a reference surface. A formula is presented allowing the comparison of terrestrial and satellite triangulation. It is concluded that due to present day technology only satellite triangulation can contribute to improving terrestrial triangulation, and not vice versa. (Author)

N76-28612*# Battelle Columbus Labs., Ohio.
COASTAL DATA ACCUMULATION POTENTIALS FOR OPERATIONAL SYSTEMS USING AIRPLANES Final Report
M. B. Kuhner 15 Aug. 1975 26 p
(Contract NASw-2800)
(NASA-CR-148473; BCL-OA-TFR-76-1) Avail: NTIS HC \$4.00 CSCL 05B

Potential users of SEASAT for remote sensing of coastal zone phenomena have established a need for resolutions beyond those attainable with SEASAT-A. One method of obtaining higher resolutions would be to fly the instruments aboard airplanes rather than a satellite. The number of aircraft that would be required is estimated along with the rate at which data would be accumulated. Only the East Coast from Maine to Key West is considered. Three different coverage widths are used. The narrowest area is wide enough to cover all bay and estuary regions along the coast; a wider area includes all ocean out to twelve nautical miles from the coast; the maximum size area considered extends out to 200 nautical miles from the coast.

Author

N76-28629*# Geological Survey, Sioux Falls, S. Dak.
LINEAMENTS ON SKYLAB PHOTOGRAPHS: DETECTION, MAPPING, AND HYDROLOGIC SIGNIFICANCE IN CENTRAL TENNESSEE Final Report
Gerald K. Moore Mar. 1976 87 p refs Original contains color illustrations
(NASA Order H-2810B)
(NASA-CR-149947; Rept-76-196) Avail: NTIS HC \$5.00 CSCL 08B

An investigation was carried out to determine the feasibility of mapping lineaments on SKYLAB photographs of central Tennessee and to determine the hydrologic significance of these lineaments, particularly as concerns the occurrence and productivity of ground water. Sixty-nine percent more lineaments were found on SKYLAB photographs by stereo viewing than by projection viewing, but longer lineaments were detected by projection viewing. Most SKYLAB lineaments consisted of topographic depressions and they followed or paralleled the streams. The remainder were found by vegetation alignments and the straight sides of ridges. Test drilling showed that the median yield of wells located on SKYLAB lineaments were about six times the median yield of wells located by random drilling. The best single detection method, in terms of potential savings,

was stereo viewing. Larger savings might be achieved by locating wells on lineaments detected by both stereo viewing and projection. Author

N76-28680*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
ANALYSIS OF SIX BROADBAND OPTICAL FILTERS FOR MEASURING CHLOROPHYLL ALPHA AND SUSPENDED SOLIDS IN THE PATUXENT RIVER
Craig W. Ohlhorst Washington, NASA Jul. 1976 51 p refs (NASA-TM-X-3399; L-10769) Avail: NTIS HC \$4.50 CSCL 13B

Kodak Wratten broadband optical filters numbered 47B (400 to 500 nm), 57 (500 to 600 nm), 58 (500 to 600 nm), 12 (500 to 700 nm), 25 (600 to 700 nm), and 89B (690 to 900 nm) were tested on October 17, 1972, to see whether each spectral band by itself could be used to quantify chlorophyll a and suspended sediment in the Patuxent River. Band 690 to 900 nm showed promise in being able to detect gross changes in chlorophyll a above 28 micrograms/l. None of the broad spectral bands seem capable of measuring chlorophyll a concentrations less than 28 micrograms/l in turbid estuarine water. Except for the 47B spectral band, the bands do show promise for measuring suspended solids. Author

N76-29663*# Ceylon Inst. of Scientific and Industrial Research, Colombo (Sri Lanka).
REMOTE SENSING FROM ARTIFICIAL EARTH SATELLITES
A. T. M. Silva and S. D. F. C. Nanayakkara, Principal Investigators [1975] 12 p Sponsored by NASA ERTS
(E76-10421; NASA-CR-148295) Avail: NTIS HC \$3.50 CSCL 05B

N76-29796# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
A GEOMAGNETIC DATA COLLECTION NETWORK Final Report, 1 Mar. 1972 - 30 Jun. 1975
Robert C. Snare 13 Nov. 1975 38 p refs
(Contract F19628-72-C-0175; AF Proj. 8601)
(AD-A020995; AFCRL-TR-75-0593) Avail: NTIS CSCL 08/14

The development of a data collection system and magnetic field instrumentation is described. GRA.

N76-29815 Advisory Group for Aerospace Research and Development, Paris (France).
OPTICAL PROPAGATION IN THE ATMOSPHERE
May 1976 625 p refs Presented at the Electromagnetic Wave Propagation Panel Symp., Lyngby, Denmark, 27-31 Oct. 1975.
(AGARD-CP-183) Copyright. Avail: NTIS HC \$16.25

Atmospheric effects are reported on the propagation of optical systems emphasizing high power lasers and adaptive optical correction procedures.

N76-29837 Queen Elizabeth Coll., London (England). Dept. of Physics.
MEASUREMENTS OF THE ATMOSPHERIC TRANSFER FUNCTION
J. C. Dainty and R. J. Scaddan (Imperial Coll. of Sci. and Technol.) In AGARD Opt. Propagation in the Atmosphere May 1976 14 p refs

A wavefront folding interferometer has been constructed with which the long time averaged modulation transfer function, MTF, of the atmosphere can be measured. The instrument was used to determine the MTF over 10 nights in June 1974 at Mauna

Kea Observatory, Hawaii, using bright stars as sources. The form of the MTF at separations of a few centimeters in the pupil agreed with that predicted on the basis of a Kolmogorov spectrum of turbulence, but there was a departure at larger separations. The MTFs were highly variable both from hour-to-hour and night-to-night; the wavefront correlation region varying from approximately 4 to 20 cm. Increasing the zenith angle generally decreased the correlation region, but no exact relationship was observed.

Author

N76-30541# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.

AN INFRARED SPECTROMETER UTILIZING A SPIN FLIP RAMAN LASER, IR FREQUENCY SYNTHESIS TECHNIQUES, AND CO₂ LASER FREQUENCY STANDARDS

J. S. Wells, F. R. Peterson, G. E. Streit (NOAA, Boulder, Colo.), P. D. Goldan (NOAA, Boulder, Colo.), and C. M. Sadowski (NOAA, Boulder, Colo.) Jan. 1976 58 p refs (PB-250663/2; NBS-TN-670) Avail: NTIS HC \$4.50 CSCL 13B

N76-31626*# Department of the Environment, Ottawa (Ontario). **RETRANSMISSION OF HYDROMETRIC DATA IN CANADA Quarterly Report, Apr. - Jun. 1976**

R. A. Halliday, Principal Investigator and I. A. Reid Jul. 1976 10 p Sponsored by NASA ERTS (E76-10479; NASA-CR-148786) Avail: NTIS HC \$3.50 CSCL 08H

N76-32623*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.

THE SIGNIFICANCE OF THE S-193 SKYLAB EXPERIMENT USING PRELIMINARY DATA EVALUATION

Kumar Krishen Mar. 1975 76 p refs (Contract NAS9-12200) (NASA-CR-150989; LEC-4250) Avail: NTIS HC \$5.00 CSCL 05B

The Skylab S-193 radiometer/scatterometer/altimeter experiment is described. The spaceborne microwave system acquires simultaneous radiometric brightness temperature and radar backscatter data over land and ocean. Application of the data analysis to the planning of the GEOS-C and SEASAT-A programs, observation of hurricane Ava and evaluation of the sensor inflight performance are discussed in terms of using operationally the spaceborne microwave sensors for sensing earth resources phenomena.

J.M.S.

N76-32630 Research Inst. for Water Resources Development, (VITUKI), Budapest (Hungary).

DETERMINATION OF EXPECTED INFORMATION LOSSES DUE TO SAMPLING OF HYDROLOGICAL RECORDS IN TIME/SPACE USING BAYESIAN DECISION THEORY

A. Szoelloesi-Nagy *In* WMO Hydrol. Network Design and Inform. Transfer 1976 p 27-43 refs

Copyright.

The information requirements of a hydrological data network are outlined. The ways in which decision theory based upon Bayesian statistics can meet these requirements by supplying knowledge about the information losses due to data sampling is discussed.

ESA

N76-32631 Geological Survey, Reston, Va. **REGRESSION ANALYSIS AND PARAMETER IDENTIFICATION**

N. C. Matalas *In* WMO Hydrol. Network Design and Inform. Transfer 1976 p 47-50 refs

Copyright.

The use of regression analysis for hydrological information

transfer is discussed. With the technique, estimates of the values of a statistical parameter, such as the mean, derived from historical records at the gaged sites, are regressed on physiological and meteorological variables associated with the sites. Problems relating to the compounding of model and time errors in the procedure of network design using regression analysis are also considered.

ESA

N76-32633 Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.

INTEGRATED NETWORKS AND THE INFLUENCE OF ERROR IN PRECIPITATION AND EVAPORATION DATA ON STREAMFLOW PREDICTION

P. Johnson *In* WMO Hydrol. Network Design and Inform. Transfer 1976 p 65-75 refs

Copyright.

How interpolation of data in a streamflow network might be improved by the interpolation of additional information as rainfall and evaporation is considered together with a consideration of the design of integrated data networks. The ways in which the design can be varied are summarized and two approaches - mathematical analysis and simulation - to the estimation of the required density of precipitation and/or evaporation gaging are discussed. Various simulation studies carried out elsewhere are reviewed.

ESA

N76-32642# Transportation Research Board, Washington, D.C. **ACQUISITION AND USE OF GEOTECHNICAL INFORMATION Final Report**

Dec. 1975 52 p refs Sponsored in part by Am. Assoc. of State Highway and Transportation Office and FHA (PB-252944/4; TRB/NCHRP/SYN-33; ISBN-0-309-02427-7; LC-76-1350) Avail: NTIS HC \$4.00 CSCL 08G

The report presents the results of a comprehensive review and assessment of the current practices of state highway and transportation agencies in the acquisition and use of geotechnical information in route selection, design, and construction of transportation facilities. Information is presented on such matters as planning, conducting, and presenting information from geotechnical investigations, the equipment, procedures, and selection of sampling locations for geotechnical investigations, and the structuring and positioning within the agency framework of the organization that must acquire and use geotechnical information.

GRA

N76-33595*# Systems Control, Inc., Palo Alto, Calif. **USER DATA DISSEMINATION CONCEPTS FOR EARTH RESOURCES Final Report**

R. Davies, M. Scott, C. Mitchell, and A. Torbett Jun. 1976 254 p refs Prepared in cooperation with Aeronutronic Ford Corp., Palo Alto, Calif.

(Contract NAS2-8964) (NASA-CR-137905; WDL-TR-7187) Avail: NTIS HC \$9.00 CSCL 05B

Domestic data dissemination networks for earth-resources data in the 1985-1995 time frame were evaluated. The following topics were addressed: (1) earth-resources data sources and expected data volumes, (2) future user demand in terms of data volume and timeliness, (3) space-to-space and earth point-to-point transmission link requirements and implementation, (4) preprocessing requirements and implementation, (5) network costs, and (6) technological development to support this implementation. This study was parametric in that the data input (supply) was varied by a factor of about fifteen while the user request (demand) was varied by a factor of about nineteen. Correspondingly, the time from observation to delivery to the user was varied. This parametric evaluation was performed by a computer simulation that was based on network alternatives and resulted in preliminary transmission and preprocessing requirements. The earth-resource data sources considered were: shuttle sorties, synchronous satellites (e.g., SEOS), aircraft, and satellites in polar orbits.

Author

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N76-33596*# Systems Control, Inc., Palo Alto, Calif.
USER DATA DISSEMINATION CONCEPTS FOR EARTH RESOURCES, APPENDIXES Final Report
Jun. 1976 231 p refs Prepared in cooperation with Aeronutronic Ford Corp., Palo Alto, Calif.
(Contract NASw-8964)
(NASA-CR-137910; WDL-TR-7187-App) Avail: NTIS HC \$8.00 CSCL 05B

A number of appendices were presented, dealing with the following topics: (1) a summary of the recommendations for spectral band location from six studies and for six disciplines. (2) demonstration of the LANDSAT scenes required for a satellite of 18-day repeat cycle, and comparison of the data volume associated with scene transmission with the data volume based on length-of-swath estimates. (3) presentation of a sample of the potential user demand projected based on polar orbiter passes over Conus and Alaska. (4) presentation of the nominal and expanded user demands for both Conus and Alaska. (5) derivation of a mathematical relation. (6) tables giving cost calculations for certain data points. (7) presentation of the UOT G/T and link budgets for leased-transponder transmission alternative, and (8) flow charts of the simulation program. Y.J.A.

N76-33610# Development and Resources Transportation Co., Silver Spring, Md.
CORRELATION OF DUAL-CHANNEL AIRBORNE IR DATA WITH SOIL MOISTURE MEASUREMENTS Final Report
Leonard A. LeSchack, Nancy Kerr DelGrande, Sam I. Outcalt, John Lewis, and Carol Tenner May 1975 71 p refs
(Grant NOAA-4-35308)
(PB-251190/5; NOAA-76021302) Avail: NTIS HC \$4.50 CSCL 08H

Cluster analysis was used to divide the raw radiant emittance data into two distinct groups to show that a positive correlation existed among the soil-moisture-radiant emittance data. Regression analysis thereupon showed significant positive correlations. Corrected surface temperature data were compared with calculated values obtained using a Digital Surface-Climate Simulator Model. Additionally, a 'Student Paired-t Test' showed that both observed and simulated temperature data came from the same statistical population. The implication is that the model is a useful tool for estimating the effect of soil moisture on the energy radiated from the surface. GRA

N76-33832# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
AN EVALUATION OF FORMULAS FOR ESTIMATING CLEAR-SKY INSOLATION OVER THE OCEAN
R. K. Reed Dec. 1975 31 p refs
(PB-253055/8; NOAA-TR-ERL-352; PMEL-26; NOAA-76030501) Avail: NTIS HC \$4.00 CSCL 04A

Recent oceanic data and observations from five coastal sites in the National Weather Service solar radiation network are compared with a formula for computing clear sky insolation derived from the Smithsonian meteorological tables, using a transmission coefficient of 0.7. The results are generally in good agreement, and they suggest that this formula is suitable for computing insolation over the ocean for a wide range of latitudes. The formula from the Smithsonian tables can be used to compute insolation over the oceans with a random error of estimate probably not exceeding 5% for periods of a few days or longer. GRA

Includes economic analysis.

A76-38922 # Space law in jurisprudential context (Das Weltraumrecht im Rechtsgefüge). M. A. Dausen. In: Contributions to air and space law: Publication in honor of Alex Meyer.

Cologne, Carl Heymanns Verlag, 1975, p. 283-299. 52 refs. In German.

The effect of recent developments in the use of space, specifically satellite-mediated communications, satellite remote sensing of earth resources, and satellite weather monitoring and natural disaster monitoring, on space law and administration of space is analyzed. Earlier international agreements relevant to space, views of space as a common heritage or patrimonium of humanity, supranational immunity of space vehicles and personnel, demilitarization of space, and international cooperation are discussed and probed along with problems of extent of sovereignty and territorial air space rights in space, space as res nullius or res omnium communes and contrast of geocentric and cosmocentric sovereignty. R.D.V.

A76-38924 # The use of outer space as problem of a future international order (Die Weltraumnutzung als Problem einer künftigen internationalen Ordnung). D. Fleck. In: Contributions to air and space law: Publication in honor of Alex Meyer.

Cologne, Carl Heymanns Verlag, 1975, p. 307-318. 41 refs. In German.

The current possibilities for a use of outer space are reviewed, taking into account communications satellites, the study of earth resources with the aid of remote sensing techniques, and aspects of satellite meteorology. A use of outer space in connection with manufacturing applications, the solution of energy supply problems, and biological studies is also expected. It is pointed out that the organization of the United Nations has been mainly responsible for the conclusion of international treaties related to activities in outer space. The content and the significance of these treaties are discussed. Attention is given to the work of UN committees, the regulation of questions connected with remote sensing studies, and problems related to a treaty with respect to the moon. G.R.

A76-41967. National Association for Remotely Piloted Vehicles, Annual Symposium, 3rd, Dayton, Ohio, May 3-5, 1976, Proceedings. Dayton, Ohio, National Association for Remotely Piloted Vehicles, 1976. 78 p.

The papers cover a variety of industry suggested issues concerning the design and use of remotely piloted vehicles (RPVs) for civil and military applications. Topics include the role of propulsion in the cost effectiveness of RPVs; FAA regulations of RPV flights; civil uses of remotely piloted aircraft; aerial observations for environmental monitoring; and the users' experience with operational RPVs. C.K.D.

A76-42117 # European space applications. R. Gibson (ESA, Paris, France). *British Interplanetary Society, Journal*, vol. 29, Sept. 1976, p. 539-548.

Objectives concerning space applications in the field of communications are related to point-to-point communication services, mobile communications to assist in the evaluation of satellite techniques, and direct broadcasting. The missions and facilities for implementing the considered objectives are discussed and a description is presented of specialized communications satellite services. Attention is given to offshore communications, data transmission,

computer communications, remote printing, teleconferencing, video-phone service, and electronic mail service. Applications related to a study of earth resources, meteorology, and Spacelab investigations are also considered. G.R.

A76-42201 Colloquium on the Law of Outer Space, 18th, Lisbon, Portugal, September 21-27, 1975, Proceedings. Colloquium sponsored by the International Astronautical Federation. Edited by M. D. Schwartz (California, University, Davis, Calif.). Davis, Calif., University of California; South Hackensack, N.J., Fred B. Rothman and Co., 1976. 206 p. In English and French. \$25.

Topics considered at the colloquium included the legal aspects of the utilization of extraterrestrial energy sources (e.g., solar energy), the legal status of the geostationary orbit, and the legal aspects of international cooperation in space. Papers are presented on the human rights aspects of direct broadcasting satellites, some considerations on European cooperation regarding the Space Shuttle project, the region between airspace and outer space (mesospace), the Earth Resources Survey Program, and the relation of earth law to extraterrestrial intelligence. Also considered are international quarantine regulations for the back contamination of the earth biosphere by Mars surface samples, space-law aspects of Spacelab, and future European operational satellite systems. B.J.

A76-42256 # The first Spacelab payload (La première charge utile Spacelab). M. J. Collet (ESA, Neuilly-sur-Seine, Hauts-de-Seine, France). In: Technology of scientific space experiments; International Conference, Paris, France, May 26-30, 1975, Reports. Toulouse, Centre National d'Etudes Spatiales, 1975, p. 331-344. In French.

The development of mission objectives in addition to system verification for the first Spacelab flight is discussed. The scientific and industrial community was invited to submit proposals for experiments to be included in the first Spacelab payload, in concordance with constraints agreed upon jointly by NASA and ESA. Candidate experiments, selected for their utilization of those capabilities peculiar to Spacelab and potential usefulness in future Spacelab missions, encompassed all disciplines. Experiments with direct commercial objectives were not considered, nor were experiments involving extravehicular activity. Seven payload options were developed and subsequently narrowed down to two. Both final options place heavy emphasis on observations of the atmosphere and earth resources; one is slightly more applications oriented and includes a telecommunications experiment and materials science experiments. C.K.D.

A76-42376 # The coming of age of astronautics. G. W. Morgenthaler (Martin Marietta Aerospace, Denver, Colo.). *American Astronautical Society and Deutsche Gesellschaft für Luft- und Raumfahrt, International Meeting on Utilization of Space Shuttle and Spacelab, Bonn, West Germany, June 2-4, 1976, Paper*. 10 p. 5 refs.

Elaboration of the best payload design, European participation and future payload concepts for Shuttle missions are discussed. The basic question of why astronautics should continue to be supported in times of increasing economic stress is considered, analyzing: (1) pursuit of basic knowledge; (2) man's need for adventure and exploration; (3) space missions which are the most efficient or only possible ways to achieve 'ground' objectives, such as television, communication and meteorological satellites; (4) space technology application to consumer products; (5) assistance in solving world problems. In discussing this last point, possible ways in which astronautics could help solve major world problems, including food and energy shortages, pollution, distribution of social services and achieving and maintaining peace, are considered in some detail. S.N.

09. GENERAL

A76-42801 International Telemetering Conference, Washington, D.C., October 14-16, 1975, Proceedings. Conference sponsored by the International Foundation for Telemetering and Instrument Society of America. Pittsburgh, Pa., Instrument Society of America (ITC Proceedings. Volume 11), 1975. 663 p. \$30.

The present collection of papers is concerned with advances in modulation systems theory, telemetry in earth resources and applications to mobile systems, coding and telemetry channels, and optical detection and communication. Particular attention is devoted to telemetry in remote monitoring, innovations in data recording techniques, satellite communications and techniques, and high-G telemetry systems. Other topics include advances in computer architectures, source coding, device applications in telemetry, and applications of remotely piloted vehicles. Telemetry for the benefit of mankind's health and education is also discussed.

S.D.

A76-45951 International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings (Convegno Internazionale Tecnico Scientifico sullo Spazio, 16th, Rome, Italy, March 18-20, 1976, Atti). Conference sponsored by the Ministero degli Affari Esteri, European Space Agency, and Associazione Industrie Aerospaziali. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976. 604 p. In Italian, English, German and French.

Papers are presented on the use of Landsat-1 data products for the multispectral radiometric analysis of sedimentation in a reservoir, the Landsat ground station at Fucino, Italy, and the use of Landsat-1 and 2 imagery for the delineation of active faulting in the eastern Alps. Attention is also paid to thermostructural design of the antennas of Meteosat, OTS and Sirio, the realization of the first development unit of the Spacelab module, and Sirio's solar array and voltage limiter. The design characteristics of the active thermal control system of Spacelab, a program for utilizing Meteosat in Italy and a comparison of silicon solar cell efficiency for space and earth use are also examined.

B.J.

A76-45989 # Mission model for a national Spacelab utilization programme - Earth observation and atmosphere. D. Meissner (Messerschmitt-Bölkow-Blohm GmbH, Munich, West Germany). In: International Scientific-Technological Conference on Space, 16th, Rome, Italy, March 18-20, 1976, Proceedings. Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1976, p. 481-490. 9 refs.

It is seen that planning of Shuttle/Spacelab missions should be carried out within a frame that would take the specific features of the Shuttle/Spacelab system into consideration and would provide for correlating national or multinational missions with NASA and ESA, with a view toward the world-wide spectrum of potential users and the financial and other constraints. Based on an analysis and evaluation of mission proposals, payloads and missions are defined which feature a step by step buildup of sensor and data management capabilities compatible with budgetary constraints.

V.P.

A76-46001 Legal implications of remote sensing from outer space; Proceedings of the Symposium, McGill University, Montreal, Canada, October 16, 17, 1975. Symposium supported by McGill University, American Society of International Law, and International Law Association. Edited by N. M. Matte (McGill University, Montreal, Canada) and H. DeSaussure (Akron, University, Akron, Ohio). Leiden, A. W. Sijthoff, 1976. 210 p. \$18.

Papers are presented on the technical applications of satellite remote sensing, the impact of remote sensing on the economic development of Western Europe and Latin America, and the worldwide utilization and dissemination of satellite remote sensing data. Also considered are a possible integrated North American

Landsat program, and the role of the United Nations in the field of satellite remote sensing.

B.J.

A76-46004 Remote sensing by satellites and legality. G. C. M. Reijnen (Utrecht, Rijksuniversiteit, Utrecht, Netherlands). In: Legal implications of remote sensing from outer space; Proceedings of the Symposium, Montreal, Canada, October 16, 17, 1975. Leiden, A. W. Sijthoff, 1976, p. 19-32. 11 refs.

Definitions of satellite remote sensing, given by United Nations committees are presented. The purposes of remote sensing and the relationship to developing countries are examined. In a summation of the legal aspects of remote sensing satellites, it is stated that remote sensing falls under the Outer Space Treaty of 1967, and that the question whether remote sensing is a lawful activity under existing international law has not been answered. Some considerations are put forth toward an international treaty on satellite remote sensing with the most important items considered as follows: international cooperation, sovereignty, responsibility for activities of remote sensing, access to data, authorization to use data, consultation, the role of the U.N.

B.J.

A76-46005 Remote sensing of earth resources - Technique and law. A. W. Stoebner. In: Legal implications of remote sensing from outer space; Proceedings of the Symposium, Montreal, Canada, October 16, 17, 1975. Leiden, A. W. Sijthoff, 1976, p. 33-40.

Satellite remote sensing is discussed in the context of a conflict between technology which claims liberty of exploitation and investigation and law which seeks to impose restrictions on technology for reasons of national security and international equity. It is suggested that satellite remote sensing be confined in a framework of internationally institutionalized cooperation.

B.J.

A76-46006 Europe and remote sensing. M. Bourély. In: Legal implications of remote sensing from outer space; Proceedings of the Symposium, Montreal, Canada, October 16, 17, 1975. Leiden, A. W. Sijthoff, 1976, p. 43-61. 11 refs.

The paper discusses the activities of Western European countries in the field of satellite remote sensing of the earth surface. Projects referred to are the NASA Landsat program, passive microwave radiometry of the earth surface and atmosphere, and the AGRESTE agricultural project of Northern Italy and Southern France. The elements of a European remote sensing program are considered with discussions of regional monitoring, the monitoring of global features, development aid and the manner in which the program would be implemented.

B.J.

A76-46007 Remote sensing of natural resources by means of space technology - A Latin American point of view. A. A. Cocca (United Nations, Committee on the Peaceful Uses of Outer Space, New York, N.Y.). In: Legal implications of remote sensing from outer space; Proceedings of the Symposium, Montreal, Canada, October 16, 17, 1975. Leiden, A. W. Sijthoff, 1976, p. 63-68.

The paper discusses the Latin American view of satellite remote sensing with reference to the joint proposal 'Treaty on Remote Sensing of Natural Resources by means of Space Technology - Draft Basic Articles' submitted to the UN General Assembly on October 15, 1974 by Brazil and Argentina and also sponsored by Chile, Mexico and Venezuela. The key proposals in this draft refer to international cooperation, benefit for the whole of mankind and, the possibility of attaining a global ecological equilibrium.

B.J.

A76-46014 **The case for a possible integrated North-American Landsat program.** C. Q. Christol (Southern California, Los Angeles, Calif.). In: Legal implications of remote sensing from outer space; Proceedings of the Symposium, Montreal, Canada, October 16, 17, 1975. Leiden, A. W. Sijthoff, 1976, p. 131-140. 7 refs.

Cooperation between the United States and Canada in the Landsat program is discussed from the political-security, economic and legal points of view all of them considered in a practical light. The benefits to be drawn from such cooperation are: greater legal validity, a sense of greater authenticity associated with a joint disclosure of data, greater economy and efficiency, greater ecological benefit and pollution control. B.J.

A76-46016 **The U.N. - Framework for a consensus on remote sensing.** A. P. Jankowitsch (United Nations, New York, N.Y.). In: Legal implications of remote sensing from outer space; Proceedings of the Symposium, Montreal, Canada, October 16, 17, 1975. Leiden, A. W. Sijthoff, 1976, p. 159-166.

A brief review is given of the development of satellite remote sensing with emphasis on the Landsat program. The work of the U.N. committee on the Peaceful Uses of Outer Space is discussed, as is the U.N. international conference on the Peaceful Uses of Outer Space convened in 1968. It is hoped that a way could be found to engage all the countries of the world in the remote sensing of the earth from space within the framework of the United Nations. B.J.

A76-46018 **The United Nations contribution towards an international agreement on remote sensing.** M. Menter (Haffer and Alterman, Washington, D.C.). In: Legal implications of remote sensing from outer space; Proceedings of the Symposium, Montreal, Canada, October 16, 17, 1975. Leiden, A. W. Sijthoff, 1976, p. 173-185. 24 refs.

The recommendations of the Legal Subcommittee of the United Nations committee for the Peaceful Uses of Space concerning satellite remote sensing are considered. Detailed studies of the Scientific and Technical Subcommittee of this committee are discussed with emphasis on three draft proposals submitted to it on remote sensing by (1) France and the USSR, (2) Latin American countries, and (3) the United States. B.J.

A76-46122 # Is there a general international law of original ownership - The possible relevance of general doctrines governing the possession of deep ocean-bed resources. L. F. E. Goldie. *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper ISL-76-31.* 6 p. 7 refs.

A76-46125 # **Remote sensing by satellites and aerospace law.** N. M. Matte (McGill University, Montreal, Canada). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper ISL-76-44.* 13 p. 115 refs.

The paper examines the legal problems related to a future agreement on sovereignty over air space and freedom of outer space, remote sensing programs associated with applications and benefits to be derived, best international organizations for peaceful and efficient use of results obtained from remote sensing, and choice of an adequate international legal instrument in this respect. Existing opinions and drafts are compared. Particular attention is given to

prior consent, conditions for the use of data, communication of sensed information, areas outside national jurisdiction, and need for an agreement. It is clear that a compromise must be found between the principle of freedom of exploration and use of outer space and the principle of national sovereignty over natural resources. The solution should perhaps be sought in the adoption of a free dissemination of data rule, with certain priorities for the sensed State. S.D.

A76-46158 # **Scientific and legal objectives in remote sensing.** S. K. Sarkar. *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper ISL-76-49.* 5 p.

Technical aspects of satellite remote sensing are discussed. Certain guiding principles given by the U.N. Declaration on the Human Environment concerning the international responsibility of states for the preservation of the environment are reproduced and discussed in relation to remote sensing. Institutional objectives relating to remote sensing are presented. B.J.

A76-46169 # **Study of the Seasat project for a proposal of a French participation.** J.-J. Chevalier and M. Piau (ONERA, Groupe de Recherches de Géodésie Spatiale, Toulouse, France). *International Astronautical Federation, International Astronautical Congress, 27th, Anaheim, Calif., Oct. 10-16, 1976, Paper ST-76-02.* 6 p.

The three-axis stabilized U.S. oceanographic and meteorological satellite Seasat A is scheduled for launch at the end of 1978. The paper analyzes the scientific objectives of the Seasat mission, the main scientific instrumentation onboard the satellite, and atmospheric influence on remote sensing. Information is given on the French participation in the Seasat mission. The satellite will carry out investigations in oceanography (surface winds, generation of waves, sea state, tsunamis, storm surges, upwellings, global model of tides, and cartography of currents), in meteorology and climatology (climatic fronts, wind speeds, clouds, heat exchange, polar studies), in glaciology (iceberg detection and movement, ice cartography), and in geodesy (undulations of the geoid and gravity anomalies). Technical characteristics of the onboard sensors, including visible-infrared and microwave scanning radiometers, side looking radar with synthetic aperture, K-band altimeter, and radiometer, and their application in the Seasat mission are discussed. S.N.

N76-28605*# South Dakota State Univ., Brookings. Remote Sensing Inst.

INVESTIGATION OF REMOTE SENSING TECHNIQUES AS INPUTS TO OPERATIONAL RESOURCE MANAGEMENT MODELS Interim Report, 11 Mar. - 10 Jun. 1976

Fred A. Schmer, Principal Investigator and Robert E. Isakson Jul. 1976 41 p refs ERTS
(Contract NAS5-20982)
(E76-10429; NASA-CR-148305; SDSU-RSI-76-05; Rept-5)
Avail: NTIS HC \$4.00 CSCL 08F

N76-28614*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 1: SUMMARY AND CONCLUSIONS Final Report, Feb. 1974 - Aug. 1975

31 Aug. 1975 34 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148494; Rept-75-125-1B-Vol-1) Avail: NTIS HC \$4.00 CSCL 05C

A summary is presented of the economic benefits that can be derived from using the SEASAT Satellite System. A statement of the major findings of case studies of the practical applications of the SEASAT program to the following areas is given: (1)

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offshore oil and natural gas industry, (2) ocean mining, (3) coastal zones, (4) oil exploration in Arctic regions, (5) ocean fishing, and (6) ports and harbors. Also given is a description of the SEASAT System and its performance. A computer program, used to optimize SEASAT System's costs and operational requirements, is also considered. Author

N76-28615*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 2: THE SEASAT SYSTEM DESCRIPTION AND PERFORMANCE Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 99 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148495; Rept-75-125-2A-Vol-2) Avail: NTIS HC \$5.00 CSCL 05C

Results are presented of preliminary trade-off studies of operational SEASAT systems. The trade-off studies were used as the basis for the estimation of costs and net benefits of the operational SEASAT system. Also presented are the preliminary results of simulation studies that were designed to lead to a measure of the impact of SEASAT data through the use of numerical weather forecast models. Author

N76-28616*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 3: OFFSHORE OIL AND NATURAL GAS INDUSTRY CASE STUDY AND GENERALIZATION Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 147 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148496; Rept-75-125-3B-Vol-3) Avail: NTIS HC \$6.00 CSCL 05C

The economic benefits of improved ocean condition, weather and ice forecasts by SEASAT satellites to the exploration, development and production of oil and natural gas in the offshore regions are considered. The results of case studies which investigate the effects of forecast accuracy on offshore operations in the North Sea, the Celtic Sea, and the Gulf of Mexico are reported. A methodology for generalizing the results to other geographic regions of offshore oil and natural gas exploration and development is described. Author

N76-28617*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 4: OCEAN MINING CASE STUDY AND GENERALIZATION Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 43 p refs
(Contract NASw-2558)
(NASA-CR-148497; Rept-75-125-4B-Vol-4) Avail: NTIS HC \$4.00 CSCL 05C

The results of a study of the weather sensitive features of near shore and deep water ocean mining industries are described. Problems with the evaluation of economic benefits for the deep water ocean mining industry are attributed to the relative immaturity and highly proprietary nature of the industry. Case studies on the gold industry, diamond industry, tin industry and sand and gravel industry are cited. Author

N76-28618*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 5: COASTAL ZONES CASE STUDY AND GENERALIZATION Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 91 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148498; Rept-75-125-5B-Vol-5) Avail: NTIS HC \$5.00 CSCL 05C

The economic losses sustained in the U.S. coastal zones were studied for the purpose of quantitatively establishing economic benefits as a consequence of improving the predictive quality of destructive phenomena in U.S. coastal zones. Improved prediction of hurricane landfall and improved experimental knowledge of hurricane seeding are discussed. Author

N76-28619*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 6: ARCTIC OPERATIONS CASE STUDY AND GENERALIZATION Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 77 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148499; Rept-75-125-6B-Vol-6) Avail: NTIS HC \$5.00 CSCL 05C

The hypothetical development and transportation of Arctic oil and other resources by ice breaking super tanker fleets to the continental East Coast are discussed. The utilization of SEASAT ice mapping data is shown to contribute to a more effective transportation operation through the Arctic ice by reducing transportation costs as a consequence of reduced transit time per voyage.

N76-28620*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 7: MARINE TRANSPORTATION CASE STUDY Final Report, Feb. 1974 - Aug. 1975
Oct. 1975 289 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148500; Rept-75-125-7A-Vol-7) Avail: NTIS HC \$9.25 CSCL 05C

The studies conducted of the potential use of SEASAT ocean condition data and resulting forecasts by dry cargo ships and tankers reached the following conclusions. The SEASAT ocean condition data and resulting forecasts could be usefully employed to route ships around storms, thereby resulting in reduced adverse weather damage, time loss and the related operating costs, and occasional catastrophic losses. These benefits are incremental benefits beyond those which present and future conventional ship routing procedures can supply. The values of the benefits are listed. Author

N76-28621*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 8: OCEAN FISHING CASE STUDY Final Report, Feb. 1974 - Aug. 1975
Oct. 1975 131 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148501; Rept-75-125-8A-Vol-8) Avail: NTIS HC \$6.00 CSCL 05C

The potential application of SEASAT data with regard to ocean fisheries is discussed. Tracking fish populations, indirect assistance in forecasting expected populations and assistance to fishing fleets in avoiding costs incurred due to adverse weather through improved ocean conditions forecasts were investigated. Case studies on fisheries in the United States and Canada are cited. Author

N76-28622*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 9: PORTS AND HARBORS CASE STUDY AND GENERALIZATION Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 201 p refs 10 Vol.
(Contract NASw-2558)
(NASA-CR-148502; Rept-75-125-9B-Vol-9) Avail: NTIS HC \$7.75 CSCL 05C

This case study and generalization quantify benefits made possible through improved weather forecasting resulting from the integration of SEASAT data into local weather forecasts. The major source of avoidable economic losses to shipping from inadequate weather forecasting data is shown to be dependent on local precipitation forecasting. The ports of Philadelphia and Boston were selected for study. Author

N76-28623*# ECON, Inc., Princeton, N.J.
SEASAT ECONOMIC ASSESSMENT. VOLUME 10: THE SATIL 2 PROGRAM (A PROGRAM FOR THE EVALUATION OF THE COSTS OF AN OPERATIONAL SEASAT SYSTEM AS A FUNCTION OF OPERATIONAL REQUIREMENTS AND RELIABILITY) Final Report, Feb. 1974 - Aug. 1975
31 Aug. 1975 206 p refs 10 Vol.

(Contract NASw-2558)

(NASA-CR-148503; Rept-75-125-10B-Vol-10) Avail: NTIS HC \$7.75 CSCL 05C

The SATIL 2 computer program was developed to assist with the programmatic evaluation of alternative approaches to establishing and maintaining a specified mix of operational sensors on spacecraft in an operational SEASAT system. The program computes the probability distributions of events (i.e., number of launch attempts, number of spacecraft purchased, etc.), annual recurring cost, and present value of recurring cost. This is accomplished for the specific task of placing a desired mix of sensors in orbit in an optimal fashion in order to satisfy a specified sensor demand function. Flow charts are shown, and printouts of the programs are given. Author

N76-29055# Committee on Science and Technology (U. S. House).

NASA AUTHORIZATION, 1977, VOLUME 1, PART 2

Washington GPO 1976 1278 p refs Hearings on H.R. 11573 (superseded by H.R. 12453) before Subcomm. on Space Sci. and Applications of Comm. on Sci. and Technol., 94th Congr., 2d Sess., No. 65, 28-29 Jan.; 3-5, 13-14, 16-17, and 19 Feb. 1976

(GPO-70-079) Avail: Subcomm. on Space Sci. and Applications

An overview of NASA space programs is presented. Project planning and management of current and proposed research and test facilities for the various programs is discussed. An assessment of the economic, scientific, and technological benefits to the nation from each of the programs is treated. The various programs that are discussed are: (1) Technology Utilization, (2) the Space Shuttle, (3) Large Space Telescope, (4) Spacelab, (5) Lunar and Planetary Exploration (Viking, Pioneer, and Mariner spacecraft), (6) Space Solar Power, and (7) the Earth Resources program. Federal budgets and a general cost review for the programs are given. Photographs of spacecraft and test facilities are shown. J.R.T.

N76-29682# Committee on Aeronautical and Space Sciences (U. S. Senate).

AN ANALYSIS OF THE FUTURE LANDSAT EFFORT

Washington GPO 1976 45 p Staff rept. for Comm. on Aeron. and Space Sci., 94th Congr., 2d Sess., 10 Aug. 1976 (GPO-75-422) Avail: SOD HC \$0.70

The Senate report concerning the operational configuration of a LANDSAT system is presented. Background material including descriptions of uses are given along with characteristics of a LANDSAT operational system. Programmatic and institutional issues are discussed, and recommendations are included. F.O.S.

N76-29683*# General Electric Co., Philadelphia, Pa. Space Div.

LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION Quarterly Report, 23 Oct. 1975 - 23 Jan. 1976

29 Feb. 1976 188 p refs

(Contract NAS5-21808)

(NASA-CR-144772; DOC-76SDS4207) Avail: NTIS HC \$7.50 CSCL 05B

Flight performances of LANDSAT 1 and LANDSAT 2 are evaluated. The in-flight systems discussed are: (1) power supplies, (2) attitude control, (3) command/clock, (4) telemetry, (5) orbit adjust, (6) electrical interface, (7) thermal, (8) tape recorders, (9) multispectral scanner, (10) data collection and (11) magnetic moment compensating assembly. Tables are presented for easy reference. L.S.

N76-29684*# General Electric Co., Philadelphia, Pa. Space Division.

LANDSAT-1 AND LANDSAT-2 FLIGHT EVALUATION REPORT, 23 JULY 1975 TO 23 OCTOBER 1975

1 Dec. 1975 195 p

(Contract NAS5-21808)

(NASA-CR-144771; DOC-76SDS4266) Avail: NTIS HC \$7.50 CSCL 05B

The orbital operations and payload subsystems performance of LANDSAT 1 and LANDSAT 2 are described. Various operational problems and their solutions are discussed. D.M.L.

N76-29686*# General Electric Co., Philadelphia, Pa. Space Div.

TERSE. DEFINITION OF THE TOTAL EARTH RESOURCES SYSTEM FOR THE SHUTTLE ERA. VOLUME 9: EARTH RESOURCES SHUTTLE APPLICATIONS

U. Alverado Aug. 1975 170 p refs

(Contract NAS9-13401)

(NASA-CR-147840) Avail: NTIS HC \$6.75 CSCL 08B

The use of the space shuttle for the Earth Resources Program is discussed. Several problems with respect to payload selection, integration, and mission planning were studied. Each of four shuttle roles in the sortie mode were examined and projected into an integrated shuttle program. Several representative Earth Resources missions were designed which would use the shuttle sortie as a platform and collectively include the four shuttle roles. An integrated flight program based on these missions was then developed for the first two years of shuttle flights. A set of broad implications concerning the uses of the shuttle for Earth Resources studies resulted. D.M.L.

N76-29687*# General Electric Co., Philadelphia, Pa. Valley Forge Space Center.

TERSE. DEFINITION OF THE TOTAL EARTH RESOURCES SYSTEM FOR THE SHUTTLE ERA. VOLUME 10: (TOSS) TERSE OPERATIONAL SYSTEM STUDY

W. Kent Stow, Charles Cheeseman, William Dallam, David Dietrich, Gerald Dorfman, Robert Fleming, Ronald Fries, Wayne Guard, Fredrick Jackson, Herman Jankowski et al. Dec. 1975 626 p refs Prepared in cooperation with ECON, Inc., Princeton, N. J. 10 Vol.

(Contract NAS9-13401)

(NASA-CR-147841) Avail: NTIS HC \$16.25 CSCL 14E

Economic benefits studies regarding the application of remote sensing to resource management and the Total Earth Resources for the Shuttle Era (TERSE) study to outline the structure and development of future systems are used, along with experience from LANDSAT and LACIE, to define the system performance and economics of an operational Earth Resources system. The system is to be based on current (LANDSAT follow-on) technology and its application to high priority resource management missions, such as global crop inventory. The TERSE Operational System Study (TOSS) investigated system-level design alternatives using economic performance as the evaluation criterion. As such, the TOSS effort represented a significant step forward in the systems engineering and economic analysis of Earth Resources programs. By parametrically relating engineering design parameters, such as sensor performance details, to the economic benefit mechanisms a new level of confidence in the conclusions concerning the implementation of such systems can be reached. Author

N76-29692# Minnesota Water Resources Council, St. Paul. Water and Related Land Resources Information Systems Subcommittee.

WATER INFORMATION SYSTEMS CATALOG

Mar. 1975 149 p

(PB-251688/8; MWRC-1; W76-06256;

OWRT-A-031-MINN(1)) Avail: NTIS HC \$6.00 CSCL 13B

The catalog is a compilation of inventories of water and related land resources information systems used by state agencies, selected colleges, and the University of Minnesota. This catalog is divided into four sections. The first offers an introduction, study outline and rationale for the catalog. The second describes the many information systems inventoried. A third section of this catalog is a cross tabulation of information types and organizations. This shows which organizations manage which information types. Thus, organization, information types, methodol-

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ogy of collection, use, and analysis are presented in cross-tabulation. The final section of the catalog is a detailed index of information types which indicates the pages from the catalog on which this information is discussed. GRA

N76-30252# Telespazio, S.p.A., Rome (Italy).
THE LANDSAT EARTH RESOURCES GROUND RECEIVING AND PROCESSING STATION AT FUCINO, ITALY
G. Bressanin Nov. 1975 16 p Presented at the Remote Sensing Soc. Meeting, London, 20 Nov. 1975
Avail: NTIS HC \$3.50

The Italian ground facility which began operations in April 1975 in Fucino, near Rome, Italy, includes an antenna 10 m in diameter equipped with the relevant control and receiving subsystems, and a data recording and processing subsystem. The main features of the latter two subsystems are described. Technical solutions adopted for these systems differ significantly from those utilized in other existing systems (NASA, CCRS, INPE) in that a totally digital approach is used. The throughput achievable is basically limited by the speed of the input/output devices on which image data is stored for distribution to the users' community. Radiometric and geometric corrections are off-loaded to a high-speed programmable processor, which operates in conjunction with a general purpose minicomputer. This setup is also used for further processing of the data. The products available from the facility include 70 mm black and white transparencies, 240 mm black and white paper prints, and computer compatible tapes. Images and tapes are framed and referenced consistently with the Worldwide Reference System for LANDSAT data retrieval. Author (ESA)

N76-30635*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
MATRIX OF EDUCATIONAL AND TRAINING MATERIALS IN REMOTE SENSING
John C. Lindenlaub and Bruce M. Lube 1976 46 p
(Contract NAS9-14016)
(NASA-CR-147838; LARS-IN-052576) Avail: NTIS HC \$4.00 CSCL 05B

Remote sensing educational and training materials developed by LARS have been organized in a matrix format. Each row in the matrix represents a subject area in remote sensing and the columns represent different types of instructional materials. This format has proved to be useful for displaying in a concise manner the subject matter content, prerequisite requirements and technical depth of each instructional module in the matrix. A general description of the matrix is followed by three examples designed to illustrate how the matrix can be used to synthesize training programs tailored to meet the needs of individual students. A detailed description of each of the modules in the matrix is contained in a catalog section. Author

N76-30639# Institute for Water Resources, Fort Belvoir, Va.
ECONOMIC CONCEPTS AND TECHNIQUES PERTAINING TO WATER SUPPLY, WATER ALLOCATION AND WATER QUALITY Final Report
Eric D. Bovet Dec. 1975 293 p
(Contract DACW-76-M-0435)
(AD-A018242; IWR-Paper-75-P5) Avail: NTIS CSCL 13/2

The report presents in a systematic manner economic concepts and techniques helpful in analyzing alternative solutions to problems commonly found in planning for water supply and water quality. Seven economic studies published by the US Army Engineer Institute for Water Resources between 1971 and 1974, and related reports, were selected as source material for the reference manual. These do not cover in detail all facets of water supply, water allocation and water quality. The contents of the IWR sponsored studies fall under three main headings: Water Supply, Water Allocation and Water Quality. Waste Water Renovation for Reuse, which provides an alternative source of supply, was treated under water quality because of the problems raised by varying user tolerance to water of varying degrees of purity. GRA

N76-31087# Committee on Science and Technology (U. S. House).

AUTHORIZING APPROPRIATIONS TO THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington GPO 1974 185 p Rept. to accompany H.R. 4700 for Comm. on Sci. and Technol., 94th Congr., 1st Sess., 14 Mar. 1974

(H-Rept-94-63) Avail: US Capitol, House Document Room

A bill to authorize appropriations to the National Aeronautics and Space Administration for FY 1976 is presented. Programs discussed include research and development, construction of facilities, and research program management. J.M.S.

N76-31611*# Yacimientos Petroliferos Fiscales Bolivianos, La Paz.

GENERAL STUDY OF THE REGION OF LAKE TITICACA, BOLIVIA, USING A SATELLITE MULTISPECTRAL SCANNING SYSTEM. PETROLOGIC STUDY OF METAMORPHIC ROCKS IN THE ZONGO VALLEY IN BOLIVIA. INSTALLATION PROJECT OF A BACTERIA IN THE LOS MONOS PLAINS. GEOLOGICAL STUDY OF THE ULLA ULLA CHARAZANI REGION [ESTUDIO GENERAL DE LA REGION DEL LAGO TITICACA, EVALUANDO EN FORMA PRELIMINAR UN SISTEMADE ANALISIS INTERACTIVO DE IMAGENES MULTIESPECTRALES. ESTUDIO PETROLOGICO DE LAS ROCAS METAMORFICAS DE UN SECTOR DEL VALLE DE ZONGO. PROYECTO INSTALACION DE UNA BATERIA EN EL CAMPO LOS MONOS. ESTUDIO GEOLOGICO DE LA REGION ULLA ULLA-CHARAZANI]

Carlos E. Brockmann, Principal Investigator Apr. 1976 104 p refs In SPANISH; ENGLISH summary Sponsored by NASA. Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(E76-10453; NASA-CR-148562) Avail: NTIS HC \$5.50 CSCL 08B

N76-31625*# Ohio Dept. of Economic and Community Development, Columbus.

DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO Quarterly Progress Report

Paul E. Baldrige, Principal Investigator 10 Jun. 1976 5 p ERTS

(Contract NAS5-22399)

(E76-10478; NASA-CR-148785; QPR-4) Avail: NTIS HC \$3.50 CSCL 05B

N76-31664# Bureau of Mines, Washington, D.C. Div. of Economic Analysis.

THE STATE OF THE UNITED STATES COAL INDUSTRY--A FINANCIAL ANALYSIS OF SELECTED COAL PRODUCING COMPANIES WITH OBSERVATIONS ON INDUSTRY STRUCTURE Information Circular 1976

T. T. Tomimatsu and Robert E. Johnson Mar. 1976 40 p refs

(PB-252496/5; BM-IC-8707) Avail: NTIS HC \$4.00 CSCL 08I

This report discusses the corporate structure dynamics, methods of financing, and financial assessment approaches that should be utilized to evaluate the economic health of the coal industry. It suggests rates of return and other measures of corporate economies necessary to attract capital required to finance emerging coal demand, plus impact of coal sales to total revenues. The study illuminates the activities of 30 selected coal-producing companies, including their subsidiaries or affiliates, that were responsible for approximately 60 percent of the total U.S. production in 1974. GRA

N76-32610*# Atomic Energy Commission, Dacca (Bangladesh).
INVESTIGATIONS USING DATA FROM LANDSAT-2
Quarterly Report, Apr. - Jun. 1976
 Anwar Hossain, Principal Investigator Aug. 1976 34 p refs
 Sponsored by NASA ERTS
 (E76-10496; NASA-CR-148802) Avail: NTIS HC \$4.00 CSCL
 05B

The author has identified the following significant results. Preliminary land use maps of Sunamgonj, Baniachong, and Srimongal areas in the Sylhet districts were prepared. Indication of new land in southern Patuakhali district and Hatiya island were found, and erosion in the northern part of Hatiya island is also shown.

N76-32618*# National Aeronautics and Space Administration,
 Goddard Space Flight Center, Greenbelt, Md.
LANDSAT US STANDARD CATALOG, 1-30 APRIL 1976
 30 Apr. 1976 142 p
 (NASA-TM-X-74151; NTISUB/B/138-76/004;
 GSFC/LU-76/004) Avail: NTIS HC \$6.00 CSCL 05B

Information regarding the availability of LANDSAT imagery processed and input to the data files by the NASA Data Processing Facility is published on a monthly basis. The U.S. Standard Catalog includes imagery covering the continental United States, Alaska and Hawaii. The Non-U.S. Standard Catalog identifies all the remaining coverage. Sections 1 and 2 describe the contents and format for the catalogs and the associated microfilm. Section 3 provides a cross-reference defining the beginning and ending dates for LANDSAT cycles. Sections 4 and 5 cover LANDSAT-1 and LANDSAT-2 coverage, respectively. Author

N76-32629 Geological Survey, Reston, Va.
DECISION THEORY AND ITS APPLICATION TO NETWORK DESIGN
 Marshall E. Moss *In* WMO *Hydrol. Network Design and Inform. Transfer* 1976 p 23-25 refs

Copyright.

A brief discussion is presented on decision theory and Bayesian statistics. The role the latter can play in the optimum design of networks for hydrological data is considered. ESA

N76-32635 Geological Survey, Reston, Va.
STATISTICS OF DATA TRANSFER
 N. C. Matalas, E. Todini (IBM, Pisa, Italy), and J. R. Wallis (IBM, Pisa, Italy) *In* WMO *Hydrol. Network Design and Inform. Transfer* 1976 p 103-109 refs

Copyright.

The possibility of regression analysis as a technique for information transfer in water resources (streamflow) investigations is outlined and the use of the technique as a hydrological design tool is illustrated. Discussion is limited to estimating the mean faster than the variance. ESA

N76-32641*# National Aeronautics and Space Administration,
 Goddard Space Flight Center, Greenbelt, Md.
LANDSAT NON-US STANDARD CATALOG, 1-30 APRIL 1976
 30 Apr. 1976 138 p
 (NASA-TM-X-74150; NTISUB/B/139-76/004;
 GSFC/LN-76/004) Avail: NTIS HC \$6.00 CSCL 05B
 For abstract see N76-32618.

N76-33594*# Systems Control, Inc., Palo Alto, Calif.
USER DATA DISSEMINATION CONCEPTS FOR EARTH RESOURCES: EXECUTIVE SUMMARY
 R. Davies, M. Scott, C. Mitchell, and A. Torbett Jun. 1976 56 p refs. Prepared in cooperation with Aeronutronic Ford Corp., Palo Alto, Calif.

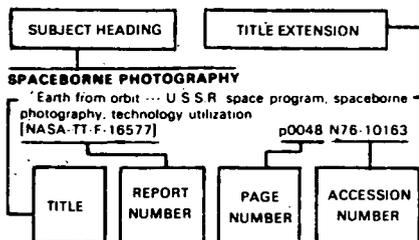
(Contract NAS2-8964)
 (NASA-CR-137904; WDL-TR-7187A) Avail: NTIS HC \$4.50 CSCL 05B

The impact of the future capabilities of earth-resources data sensors (both satellite and airborne) and their requirements on the data dissemination network were investigated and optimum ways of configuring this network were determined. The scope of this study was limited to the continental U.S.A. (including Alaska) and to the 1985-1995 time period. Some of the conclusions and recommendations reached were: (1) Data from satellites in sun-synchronous polar orbits (700-920 km) will generate most of the earth-resources data in the specified time period. (2) Data from aircraft and shuttle sorties cannot be readily integrated in a data-dissemination network unless already preprocessed in a digitized form to a standard geometric coordinate system. (3) Data transmission between readout stations and central preprocessing facilities, and between processing facilities and user facilities are most economically performed by domestic communication satellites. (4) The effect of the following factors should be studied: cloud cover, expanded coverage, pricing strategies, multidiscipline missions. Author

N76-33608# Colorado State Univ., Fort Collins. Environmental Resources Center.
MANUAL FOR TRAINING IN THE APPLICATION OF THE PRINCIPLES AND STANDARDS OF THE WATER RESOURCES COUNCIL
 Dec. 1974 528 p refs
 (Contracts DI-14-31-0001-4260; DI-14-31-0001-4242; Proj. X-143; Proj. C-5345)
 (PB-250959/4; W76-05348; OWRT-C-5345(4242)) Avail: NTIS HC \$13.00 CSCL 05I

Materials for the conduct of training courses are set forth. Principles and Standards relate directly to Federal water resources planning but state and local agencies and private firms need to understand their application to Federal and Federally assisted projects. Levels of planning are identified: Framework studies and assessment which deal with major policy decisions; regional or river basin plans; and implementation studies. The Principles apply at all levels but the components of objectives will be specified differently though in a manner providing insights about tradeoffs among alternatives. The planning process is visualized in 5 steps. GRA

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section (of this supplement). If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

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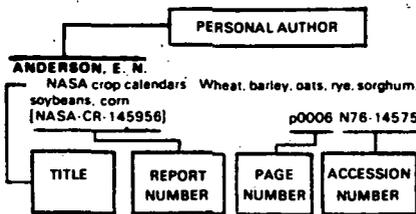
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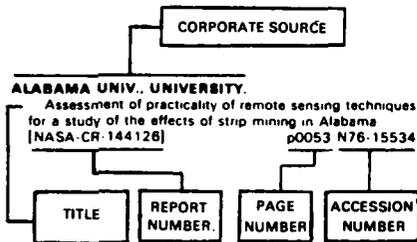
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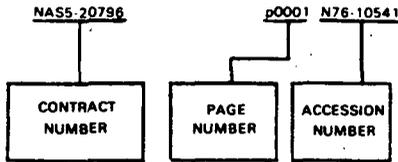
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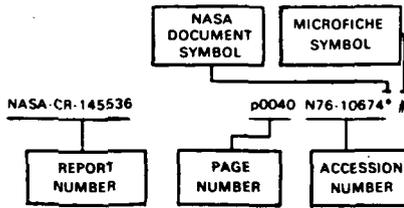
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1. Report No. NASA SP-7041 (12)		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle EARTH RESOURCES A Continuing Bibliography (Issue 12)				5. Report Date January 1977	
				6. Performing Organization Code	
7. Author(s)				8. Performing Organization Report No.	
				10. Work Unit No.	
9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, D. C. 20546				11. Contract or Grant No.	
				13. Type of Report and Period Covered	
12. Sponsoring Agency Name and Address				14. Sponsoring Agency Code	
15. Supplementary Notes					
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17. Key Words (Suggested by Author(s)) Bibliographies Earth Resources Program Remote Sensors			18. Distribution Statement Unclassified - Unlimited		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 138	22. Price* \$9.00 HC

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