NASA

Earth Resources
A Continuing
Bibliography
with Indexes

NASA SP-7041(42)
July 1984

National Aeronautics and
Space Administration

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ACCESSION NUMBER RANGES

Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series)	N84-16115 - N84-22526
IAA (A-10000 Series)	A84-19349 - A84-30008

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NASA SP-7041(42)

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 42

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between April 1 and June 30, 1984 in

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

NASA Scientific and Technical Information Branch 1984
National Aeronautics and Space Administration
Washington, DC

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INTRODUCTION

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

This literature survey lists 541 reports, articles, and other documents announced between April 1 and June 30, 1984 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 include the original accession numbers from the respective announcement journals.

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 A84-10,000 in ascending accession number order;

STAR entries identified by accession number series N84-10,000 in ascending accession number order.

After the abstract section, there are six indexes:

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

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DOMESTIC: NASA and NASA-sponsored documents and a large number of aerospace publications are available to the public for reference purposes at the library maintained by the American Institute of Aeronautics and Astronautics, Technical Information Service, 555 West 57th Street, 12th Floor, New York, New York 10019.

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TABLE OF CONTENTS

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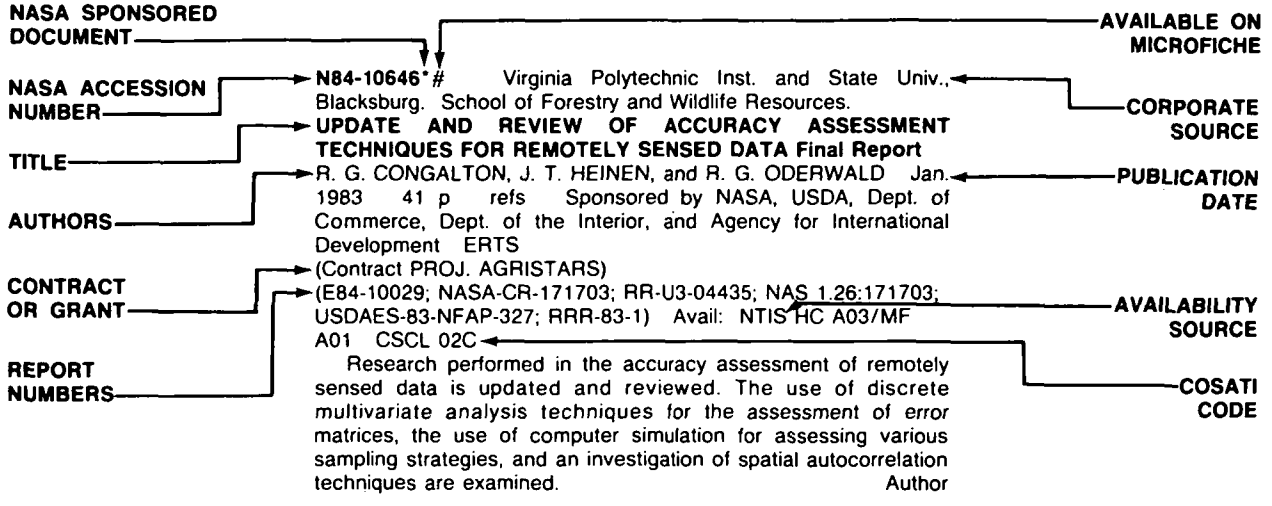

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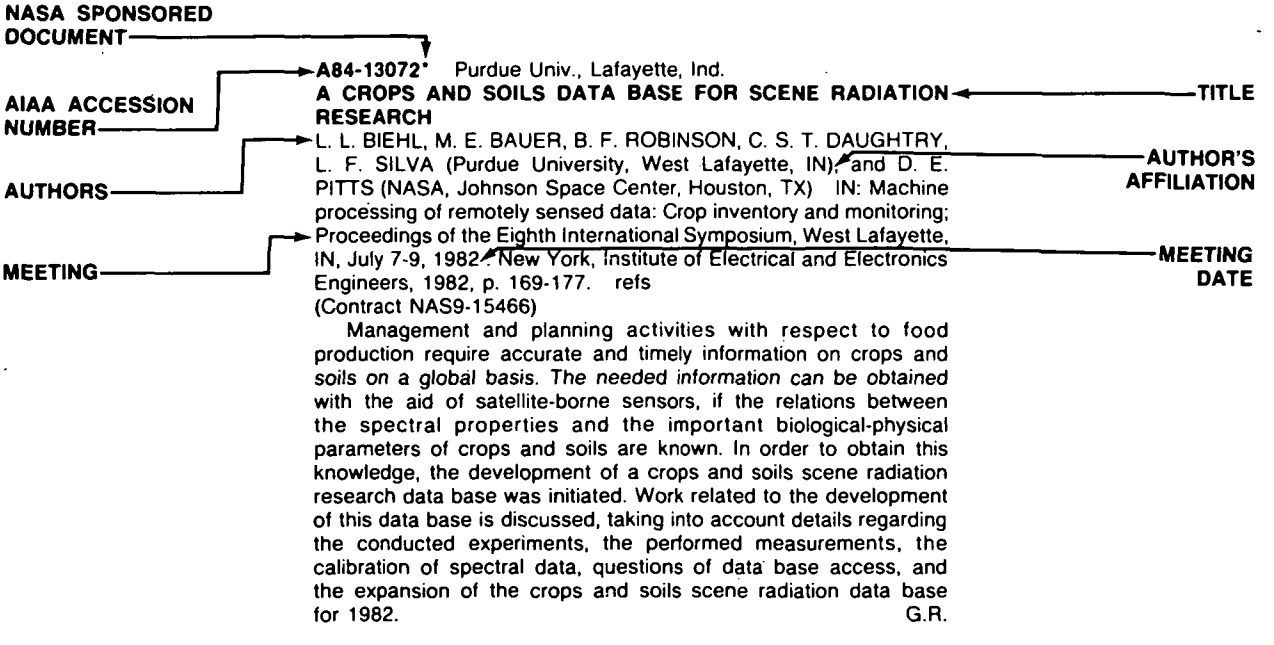

EARTH RESOURCES

A Continuing Bibliography (Issue 42)

JULY 1984

01

AGRICULTURE AND FORESTRY

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

A84-19864
IBEX HABITAT ANALYSIS USING LANDSAT IMAGERY
G. WIERSEMA ITC Journal (ISSN 0303-2434), no. 2, 1983, p. 139-147. Research sponsored by the Prins Bernhard Fonds; Commission of the European Communities. refs
(Contract CEC-ENV-336-D; CEC-ENV-493-D)

A wildlife habitat inventory, focussing on the wild roam-goat species Capra ibex ibex L, is being conducted in adjacent national parks in the French and Italian Alps. Four types of information have been extracted from digitally processed Landsat imagery: (1) a computer-aided class discrimination of vegetation types (generally restricted to formation level); (2) an analysis of snow cover which can be related to ibex distribution as determined by field observations; (3) multi-temporal color coding of a green leaf area index indicating continuity, onset and areal extent of green vegetation cover; (4) the detection of snow free terrain connections which can be interpreted as potential mid-winter migration routes.
Author

A84-19865
APPLICATIONS OF REMOTE SENSING IN EARTH RESOURCES MONITORING IN KENYA
H. EPP, J. AGATSIVA, N. OCHANDA, and D. LANTIERI (Ministry of Tourism and Wildlife, Kenya Rangeland Ecological Monitoring Unit, Nairobi, Kenya) (Remote Sensing Decision Making Seminar, 4th, Nairobi, Kenya, Nov. 1982) ITC Journal (ISSN 0303-2434), no. 2, 1983, p. 148-153. refs

A description is given of methods that combine satellite, aerial, and ground observations in order to provide data on agriculture, forestry, vegetation, and other resources. It is noted that the methods, materials, and equipment are in most cases readily adaptable for use in any large area where reliable data are needed quickly and economically for national or regional planning. The methods are those practiced by the Kenya Rangeland Ecological Monitoring Unit (KREMU). Attention is given to surveying natural wood supplies, to forest cover mapping and monitoring, and to determining wood biomass through large-scale aerial photography. Demonstration projects in agriculture and forestry are described; these indicate that Landsat digital data can be a valuable addition to mapping and monitoring these resources. C.R.

A84-19866
MONITORING CHANGES IN HEATHLAND VEGETATION USING SEQUENTIAL AERIAL PHOTOGRAPHS
W. VAN HEUSDEN ITC Journal (ISSN 0303-2434), no. 2, 1983, p. 160-165. refs

Aerial photographs taken between 1950 and 1981 were used to prepare four maps showing changes in heathland vegetation from heather to grass in a nature reserve in the Netherlands. Changes in vegetation could be accurately assessed at 10, 20 and 30 year intervals, and the direction of grass movement could be plotted. Changes in vegetation could be quantified using the reciprocal vegetation sequence method which indicates the progress from a heather monoculture to a mixed culture to a grass monoculture.
Author

A84-20408* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RED AND NEAR-INFRARED SENSOR RESPONSE TO OFF-NADIR VIEWING
B. HOLBEN and R. S. FRASER (NASA, Goddard Space Flight Center, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Jan.-Feb. 1984, p. 145-160. refs

It has first been intended to employ the Advanced Very High Resolution Radiometer (AVHRR) as a meteorological instrument to aid in detecting clouds and atmospheric temperature stratifications over large areas. However, more recently the satellite data have been used for monitoring large areas of vegetation with emphasis on the visible (VIS) and near-infrared (NIR) bands. The present investigation is concerned with the objective to model ranges in AVHRR VIS and NIR radiances and normalized differences expected under typical AVHRR viewing and illumination conditions. Atmospheric data sets reported by Dave (1978) and Dave and Braslau (1975) were used. It is shown that sensor response to atmospheric path length can be substantial for the AVHRR VIS and NIR channels and normalized difference (ND) values. However, errors can be minimized by high sun and clear atmosphere viewing.
G.R.

A84-21594
ATTEMPT AT A LANDSCAPE-ECOLOGICAL EVALUATION OF THE EFFECT OF FIRES ON THE FORMATION OF FORESTS USING REMOTE-SENSING DATA [OPYT LANDSHAFTNO-EKOLOGICHESKOI OTSENKI VLIIANIIA POZHAROV NA FORMIROVANIE LESOV S ISPOL'ZOVANIEM MATERIALOV AEROKOSMICHESKOI S'EMKI]
V. V. FURIAEV IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 140-149. In Russian. refs

A84-21595
INVESTIGATION OF THE CHARACTERISTICS OF THE SPATIAL DISTRIBUTION OF SOILS USING AERIAL AND SPACEBORNE PHOTOGRAPHS OF THE MIDDLE OB' RIVER REGION [IZUCHENIE ZAKONOMERNOSTEI PROSTRANSTVENNOGO RASPREDELENIIA POCHV S ISPOL'ZOVANIEM AEROKOSMICHESKIKH SNIMKOV SREDNEGO PRIOB'IA]
S. M. OVCHINNIKOV IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 149-155. In Russian. refs

A84-21596
UTILIZATION OF THE INTERRELATIONSHIP BETWEEN VEGETATION AND RELIEF FOR THE INTERPRETATION OF SPACEBORNE PHOTOGRAPHS [ISPOL'ZOVANIE VZAIMOSVIAZEI RASTITEL'NOSTI I REL'EFA PRI DESHIFRIROVANII KOSMICHESKIKH SNIMKOV]
V. N. SEDYKH, S. V. VASILEV, and V. G. MOZALEVSKII IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 155-160. In Russian. refs

Regional interrelationships between vegetation and relief in the middle-taiga Ob' river region are examined. It is shown that the specific features of ecological conditions arising for various degrees of relief division determine both quantitative and qualitative changes of forest cover and hence of the ecological makeup of the forests. The correlations obtained are shown to be useful in the interpretation of spaceborne photographs. B.J.

A84-21597
AERIAL AND SPACEBORNE DATA FOR COMBINED THEMATIC MAPPING OF THE NORTHERN BAIKAL REGION [AEROKOSMICHESKAIA INFORMATSIIA V SOPRIAZHENNOM TEMATICHESKOM KARTOGRAFIROVANII SEVERNOGO PRIBAIKAL'IA]
A. V. BELOV and L. A. PLASTININ IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 160-163. In Russian.

A84-21609
VEGETATION COVER AS AN INTERPRETATIVE FEATURE OF THE HYDROMORPHIC CHARACTER OF A LANDSCAPE [RASTITEL'NYI POKROV KAK DESHIFROVOCHNYI PRIZNAK GIDROMORFNOSTI LANDSHAFTA]
S. M. GOROZHANKINA and V. D. KONSTANTINOV IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 63-74. In Russian. refs

Observations of soil water levels are used to delineate the principal types of forest and swamp ecological systems in the middle-taiga subzone, these systems differing in terms of the seasonal dynamics of water levels. Features according to which remote-sensing images of these systems can be interpreted are indicated. It is shown that aerial and spaceborne photographic data can be employed for the mapping on different scales of the taiga vegetation cover according to hydromorphic characteristics. B.J.

A84-21610
VARIABILITY OF THE SPECTRAL BRIGHTNESS COEFFICIENT OF FOREST VEGETATION [IZMENCHIVOST KOEFFITSIENTA SPEKTRAL'NOI IARKOSTI LESNOI RASTITEL'NOSTI]
V. I. KHARUK, B. A. KHREBTOV, and M. I. TIMCHENKO IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 74-77. In Russian. refs

The seasonal variations of the spectral brightness coefficient of certain forest-vegetation elements (leaves, pine needles, and grass) were investigated in aerial, field, and laboratory studies. Aerial measurements were made in the Minusinsk, Severo-Yeniseysk and Yeniseysk regions of Siberia in the 400-800 nm wavelength region. Significant divergences were found in the results obtained using aerial, field, and laboratory methods. B.J.

A84-21611
PROSPECTS OF USING AERIAL AND SPACEBORNE DATA IN FOREST PROTECTION [PERSPEKTIVY ISPOL'ZOVANIIA AEROKOSMICHESKOI INFORMATSII V LESOZASHCHITE]
V. IA. RIAPOLOV IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 77-80. In Russian.

Methods for the monitoring of forest damage on the basis of aerial and space photograph interpretation are described. Data characterizing the possibility of the forest-damage sounding of taiga landscapes are examined. The main trends in forest-protection studies which facilitate the monitoring of forests subjected periodically to insect damage are indicated. B.J.

A84-21612
THE USE OF GROWTH TABLES FOR FOREST-INVENTORY INTERPRETATION [ISPOL'ZOVANIE TABLITS KHODA ROSTA PRI LESOTAKSATSIONNOM DESHIFRIROVANII]
V. N. SEDYKH IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 80-83. In Russian. refs

The possibility of compiling and utilizing forest-growth tables on the basis of aerial and spaceborne photographic data is examined. It is shown that a genetic classification of forest types can be used to enhance the efficiency of the remote monitoring of temporal changes of forest cover as well as forest-inventory interpretation. B.J.

A84-21619
A SYSTEM FOR THE REMOTE MONITORING AND OPERATIONAL FORECASTING OF FOREST-FIRE PROPAGATION [SISTEMA DISTANTSIONNOGO KONTROLIA I OPERATIVNOGO PROGNOZIROVANIIA RASPROSTRANENIIA LESNYKH POZHAROV]
E. N. VALENDIK, G. A. DORRER, A. I. SUKHININ, V. V. BAZHENOV, and E. K. KISILIAKHOV IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 136-155. In Russian. refs

The paper examines the development of the general structure and software of an automated system for the monitoring and operational forecasting of forest-fire parameters, with particular application to fire monitoring in Siberia and the Far East. Algorithms are presented for solving three classes of problems: (1) calculation of the parameters of lowland forest fires; (2) prediction of the propagation contours of forest fires; and (3) calculations of fire localization. The system is designed to operate in the interactive mode. B.J.

A84-21855*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BIOGEOCHEMICAL CYCLING AND REMOTE SENSING
D. L. PETERSON and D. A. MOUAT (NASA, Ames Research Center, Moffett Field, CA) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 22nd, Reno, NV, Jan. 9-12, 1984. 14 p. refs
(AIAA PAPER 84-0191)

The present investigation is concerned with the role of remote sensing in the analysis of biochemical cycling. A general review is provided of the interest of NASA in biochemical cycling, taking into account an assessment of the state and dynamics of the pools and fluxes of four major elements (carbon, nitrogen, phosphorus, sulfur), an understanding of the coupling and interaction of the biosphere and the atmosphere, and an understanding of the biosphere and the oceans. Attention is given to biogeochemical cycling science issues, the potential remote sensing role, the vegetation type, aspects of vegetation structure, the leaf area index, the canopy height, functional relationships, environmental and soil variables, questions of experimental design, sampling sites and ground data, and radiometric data and analysis. G.R.

A84-22385* *National Aeronautics and Space Administration.* Lyndon B. Johnson Space Center, Houston, Tex.
AUTOMATIC CORN-SOYBEAN CLASSIFICATION USING LANDSAT MSS DATA. I - NEAR-HARVEST CROP PROPORTION ESTIMATION. II - EARLY SEASON CROP PROPORTION ESTIMATION
G. D. BADHWAR (NASA, Johnson Space Center, Houston, TX) Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 15-29. refs

The techniques used initially for the identification of cultivated crops from Landsat imagery depended greatly on the iterpretation

of film products by a human analyst. This approach was not very effective and objective. Since 1978, new methods for crop identification are being developed. Badhwar et al. (1982) showed that multitemporal-multispectral data could be reduced to a simple feature space of alpha and beta and that these features would separate corn and soybean very well. However, there are disadvantages related to the use of alpha and beta parameters. The present investigation is concerned with a suitable method for extracting the required features. Attention is given to a profile model for crop discrimination, corn-soybean separation using profile parameters, and an automatic labeling (target recognition) method. The developed technique is extended to obtain a procedure which makes it possible to estimate the crop proportion of corn and soybean from Landsat data early in the growing season. G.R.

A84-22386* Kansas State Univ., Manhattan.
INTERCEPTED PHOTOSYNTHETICALLY ACTIVE RADIATION ESTIMATED BY SPECTRAL REFLECTANCE
J. L. HATFIELD (U.S. Department of Agriculture, Southern Plains Cotton Research Laboratory, Lubbock, TX), G. ASRAR, and E. T. KANEMASU (Kansas State University of Agriculture and Applied Science, Manhattan, KS) Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 65-75. refs
(Contract NAS9-16457)

Interception of photosynthetically active radiation (PAR) was evaluated relative to greenness and normalized difference (MSS (7-5)/(7+5) for five planting dates of wheat for 1978-79 and 1979-80 at Phoenix, Arizona. Intercepted PAR was calculated from leaf area index and stage of growth. Linear relatinships were found with greeness and normalized difference with separate relatinships describing growth and senescence of the crop. Normalized difference was significantly better than greenness for all planting dates. For the leaf area growth portion of the season the relation between PAR interception and normalized difference was the same over years and planting dates. For the leaf senescence phase the relationships showed more variability due to the lack of data on light interception in sparse and senescing canopies. Normalized difference could be used to estimate PAR interception throughout a growing season. Author

A84-22387* State Univ. of New York, Binghamton.
INVERSION OF VEGETATION CANOPY REFLECTANCE MODELS FOR ESTIMATING AGRONOMIC VARIABLES. II - USE OF ANGLE TRANSFORMS AND ERROR ANALYSIS AS ILLUSTRATED BY SUITS' MODEL
N. S. GOEL, R. L. THOMPSON (New York, State University, Binghamton, NY), and D. E. STREBEL Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 77-111. NASA-supported research. refs

The technique for inverting a vegetation canopy reflectance model described earlier (Goel and Strebel, 1983) is investigated further. The novel concept of an 'angle transform' is introduced. This concept allows the formation of functions of reflectances at different view zenith and azimuth angles, which are either sensitive or insensitive to a certain agronomic parameter. A proper combination of these functions can allow determination of all the important agronomic and spectral parameters from measured canopy reflectance data. The technique is demonstrated using Suits' (1972) model for homogeneous canopies. It is shown that leaf area index, leaf reflectance and transmittance, and average leaf angle all can be determined from the canopy reflectance at a set of selected view zenith and azimuth angles. A sensitivity analysis of the calculated values to the errors in the data is also carried out. Guidelines are formulated for the number and types of observations required to obtain the values of a particular canopy variable to within a given degree of accuracy for a given level of error in the measurement of canopy reflectance. Author

A84-22388* Kansas Univ. Center for Research, Inc., Lawrence.
RELATING THE MICROWAVE BACKSCATTERING COEFFICIENT TO LEAF AREA INDEX
F. T. ULABY, C. T. ALLEN, G. EGER, III (University of Kansas Center for Research, Inc., Lawrence, KS), and E. KANEMASU (Kansas State University of Agriculture and Applied Science, Manhattan, KS) Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 113-133. refs
(Contract NAS9-15421)

This paper examines the relationship between the microwave backscattering coefficient of a vegetation canopy, sigma (can, 0) and the canopy's leaf area index (LAI). The relationship is established through the development of one model for corn and sorghum and another for wheat. Both models are extensions of the cloud model of Attema and Ulaby (1978). Analysis of experimental data measured at 8.6, 13.0, 17.0, and 35.6 GHz indicates that most of the temporal variations of sigma (can, 0) can be accounted for through variations in green LAI alone, if the latter is greater than 0.5. Author

A84-22389* Department of Agriculture, Beltsville, Md.
PASSIVE MICROWAVE REMOTE SENSING OF SOIL MOISTURE FROM AN AIRCRAFT PLATFORM
T. J. JACKSON (U.S. Department of Agriculture, Hydrology Laboratory, Beltsville, MD), T. J. SCHMUGGE, and P. ONEILL (NASA, Goddard Space Flight Center, Greenbelt, MD) Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 135-151. refs

A series of experiments were conducted over several years using an aircraft platform to study the relationship between passive microwave data and surface soil moisture. Sensor systems included thermal infrared and multifrequency passive microwave instruments. Aircraft measurements were obtained concurrently with ground observations of soil moisture and land cover. Test sites included areas in both humid and semiarid regions of the United States that were typical of these regions. Data analyses indicated that the basic cause and effect relationships between the sensor measurements and soil moisture can be extrapolated from theory and small scale tests to larger resolution elements observed by the aircraft. Pastures in different climatic regions showed similar responses. Vegetation canopy attenuation was verified. Based on these studies the optimal surface soil moisture sensor using passive techniques was a 21-cm wavelength radiometer. Author

A84-22390
ANALYSIS OF SEASONAL MULTISPECTRAL REFLECTANCES OF SMALL GRAINS
G. P. MILLER, M. FUCHS, M. J. HALL, G. ASRAR, E. T. KANEMASU (Kansas State University of Agriculture and Applied Science, Manhattan, KS), and D. E. JOHNSON Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 153-167. refs

Spectral reflectances of plant canopies combine cryptic information on the optical and geometrical characteristics of vegetation and underlying soil. A procedure was sought to objectively determine the components of multispectral reflectance data most directly related to plant and soil characteristics. The data set was measurements of reflectances in seven spectral bands (0.45-2.35 microns), collected from planting to harvest, over one bare soil, three cultivars of winter wheat, three cultivars of spring wheat, and four cultivars of spring barley at Corvallis, Oregon. A principal component analysis (PCA) executed over the entire data set determined that the distribution of the data is largely two-dimensional. However, it did not yield indices that were related to seasonal crop development. The approach was modified by first applying a PCA to the bare soil data subset only, producing a first principal component accounting for 88 percent of the bare soil temporal variance indicating that soil reflectance is largely one-dimensional. A PCA was then executed on the vegetation data subset under the constraint that its principal components be orthogonal to the bare soil PCA first component. The resulting first component accounted for 92 percent of the remaining variance and paralleled the development profile of vegetation. Author

A84-22391
FUNCTIONAL EQUIVALENCE OF SPECTRAL VEGETATION INDICES
C. R. PERRY, JR. and L. F. LAUTENSCHLAGER (U.S. Department of Agriculture, Statistical Reporting Service, Houston, TX) Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 169-182. refs

Numerous formulae, vegetation indices, have been developed to reduce multispectral scanner (MSS) data to a single number for assessing vegetation characteristics such as species, leaf area, stress, and biomass. Part I of this report gives the history and formulae of some four dozen vegetation indices. Studies investigating the empirical relationships among vegetation indices are summarized. Part II of this report develops the idea of two vegetation indices being functionally equivalent. Two vegetation indices are taken to be equivalent for making a set of decisions, if the decisions made on the basis of one index could have been equally well made on the basis of the other index. The utility of these ideas is explored in the context of alarm models and graphical displays. Several widely used indices are shown to be equivalent. Author

A84-22392* Houston Univ., Clear Lake, Tex.
ESTIMATING OPTIMAL SAMPLING UNIT SIZES FOR SATELLITE SURVEYS
C. R. HALLUM (Houston, University, Clear Lake City, TX) and C. R. PERRY, JR. (U.S. Department of Agriculture, Statistical Reporting Service, Houston, TX) Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 183-196. refs
(Contract NAS9-16815)

This paper reports on an approach for minimizing data loads associated with satellite-acquired data, while improving the efficiency of global crop area estimates using remotely sensed, satellite-based data. Results of a sampling unit size investigation are given that include closed-form models for both nonsampling and sampling error variances. These models provide estimates of the sampling unit sizes that effect minimal costs. Earlier findings from foundational sampling unit size studies conducted by Mahalanobis, Jessen, Cochran, and others are utilized in modeling the sampling error variance as a function of sampling unit size. A conservative nonsampling error variance model is proposed that is realistic in the remote sensing environment where one is faced with numerous unknown nonsampling errors. This approach permits the sampling unit size selection in the global crop inventorying environment to be put on a more quantitative basis while conservatively guarding against expected component error variances. Author

A84-22393* Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
A MIXTURE MODEL APPROACH FOR ESTIMATING CROP AREAS FROM LANDSAT DATA
R. K. LENNINGTON, C. T. SORENSEN (Lockheed Engineering and Management Services Co., Inc., Houston, TX), and R. P. HEYDORN (NASA, Johnson Space Center, Houston, TX) Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 197-206. refs

A84-22394* Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
EFFECT OF MIXED (BOUNDARY) PIXELS ON CROP PROPORTION ESTIMATION
R. S. CHHIKARA (Lockheed Engineering and Management Services Co., Inc., Houston, TX) Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 207-218. refs
(Contract NAS1-5800)

In estimating acreage proportions of crop types in a segment using Landsat data, considerable problem is caused by the presence of mixed pixels. Due to lack of understanding of their spectral characteristics, mixed pixels have been treated in the past as pure while clustering and classifying the segment data. This paper examines this approach of treating mixed pixels as pure pixels and the effect of mixed pixels on the bias and variance of a crop type proportion estimate. First, the spectral response of a boundary pixel is modeled and an analytical expression for the bias and variance of a proportion estimate is obtained. This is followed by a numerical illustration of the effect of mixed pixels on bias and variance. It is shown that as the size of the mixed pixel class increases in a segment, the variance increases, however, such increase does not always affect the bias of the proportion estimate. Author

A84-22395* Environmental Research Inst. of Michigan, Ann Arbor.
COMPARISONS OF THE DIMENSIONALITY AND FEATURES OF SIMULATED LANDSAT-4 MSS AND TM DATA
E. P. CRIST and R. C. CICONE (Michigan, Environmental Research Institute, Ann Arbor, MI) Remote Sensing of Environment (ISSN 0034-4257), vol. 14, Jan. 1984, p. 235-246. refs
(Contract NAS9-16538)

The spectral characteristics of the Landsat-4 MSS and TM are compared using signal counts simulated from field-measured reflectance spectra. The Dave atmospheric model and prelaunch sensor characteristics are also used in the simulation. Comparison is made based on individual bands and Tasseled Cap transformed data. TM bands 2, 3, and 4 are shown to contain virtually all the information contained in the four MSS bands. Tasseled Cap transformed data from the six reflective bands of the TM are shown to contain at least one and possibly two additional dimensions of information beyond the two dimensions in MSS data, while still providing a direct association with the MSS Tasseled Cap features. Author

A84-22422
THE RECOGNITION AND EVALUATION OF THE STATE OF NATURAL FORMATIONS FROM SPACE IMAGERY IN TWO SPECTRAL RANGES [K RASPOZNAVANIIU I OTSENKE SOSTOIANIA PRIRODNYKH OBRAZOVANII PO KOSMICHESKIM IZOBRAZHENIIAM V DVUKH SPEKTRAL'NYKH DIAPAZONAKH]
A. D. KLESHCHENKO (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Sel'skokhoziaistvennoi Meteorologii, Obninsk, USSR) and G. I. BORISOGLEBSKII (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR) Meteorologiia i Gidrologiia (ISSN 0130-2906), Jan. 1984, p. 92-97. In Russian. refs

A method is proposed for recognizing and evaluating natural formations and agricultural crops from medium-resolution satellite imagery of the underlying surface, obtained in two spectral ranges (0.5-0.7 and 0.7-1.1 micron). The method proposed here is based on a determination of the optical density, rather than the spectral brightness coefficient, of the images. The spatial inhomogeneity of the reflection properties of land and vegetation is allowed for by using the approach of Kauth and Thomas (1976). Experimental results are presented. V.L.

A84-22897
USING LANDFORM AND VEGETATIVE FACTORS TO IMPROVE THE INTERPRETATION OF LANDSAT IMAGERY
M. SATTERWHITE (U.S. Army, Engineer Topographic Laboratories, Fort Belvoir, VA), W. RICE, and J. SHIPMAN (IBM Corp., Federal Systems Div., Gaithersburg, MD) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, Jan. 1984, p. 83-91. refs

It is pointed out that classifying land cover and land use by applying pattern classification algorithms to digital multispectral sensor data has become increasingly common since the technique was first proposed by Fu et al. (1969). Satterwhite et al. (1982) have found that relations between cover, soil, and plant reflectance in the four Landsat bands are related to the percent cover of the soil-vegetation targets. The present study has mainly the objective to apply the findings of these previous investigations, and to develop a methodology for improving the classification of Landsat data. Attention is given to the study area, materials and methods, the classification results of the Meyer region, basin area results, alluvial fans, mountainous areas, and seasonal results. G.R.

A84-23346*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL MICROWAVE EMISSION FROM VEGETATED FIELDS - A COMPARISON BETWEEN THEORY AND EXPERIMENT
J. R. WANG, J. C. SHIUE, M. DOMBROWSKI (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, MD), S. L. CHUANG, and R. T. SHIN (MIT, Cambridge, MA) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-22, March 1984, p. 143-150. refs

The radiometric measurements over bare field and fields covered with grass, soybean, corn, and alfalfa were made with 1.4- and 5-GHz microwave radiometers during August-October 1978. The measured results are compared with radiative transfer theory treating the vegetated fields as a two-layer random medium. It is found that the presence of a vegetation cover generally gives a higher brightness temperature T sub B than that expected from a bare soil. The amount of this T sub B excess increases with increase in the vegetation biomass and in the frequency of the observed radiation. The results of radiative transfer calculations, which include a parameter characterizing ground surface roughness, generally match well with the experimental data.
Author

A84-26831
APPLICATION OF REMOTE SENSING TECHNIQUES FOR LAND EVALUATION AND CLASSIFICATION FOR AGRICULTURE
L. VENKATARATNAM (National Remote Sensing Agency, Soils Div., Hyderabad, India), R. K. SAXENA (National Bureau of Soil Survey and Land Use Planning, Nagpur, India), and R. S. MURTHY Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Sept. 1983, p. 177-188. refs

A study is reported in which Landsat imagery was used in the delineation and mapping of soil salinity. It is shown that two degrees of soil salinity can be differentiated by using a computer-aided multispectral data analysis system. Small-scale color-coded soil maps have been prepared using Landsat data at 1:250,000 scale. The maps, which show various soil hazards, such as soil salinity/alkalinity, water-logging, and desertification, are useful in planning reclamation and other corrective measures aimed at improving land productivity. V.L.

A84-26832
ASSESSMENT OF VEGETATION COVER IN INDIA - LANDSAT IMAGES ON BAND 5 BLACK AND WHITE OF 1980-82
A. B. CHAUDHURI, R. P. SHARMA, and M. K. SHARMA (Forest Survey of India, Dehradun, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Sept. 1983, p. 189-195.

A84-26833
SOIL MAPPING USING REMOTE SENSING TECHNIQUES
R. L. KARALE, Y. P. BALI, and K. V. S. RAO (All India Soil and Land Use Survey, Hyderabad, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Sept. 1983, p. 197-208. refs

Advancements in space technology opened application possibilities for remote sensing in soil mapping. The achievements in this field are reviewed, various techniques of remote sensing applications are outlined, and their merits and limitations discussed in the context of soil mapping in the Mahaboobnagar area. The products of different techniques including visual interpretation of imageries, I2S, and computer analysis of Landsat digital data are compared with aerial photo interpretation and soil map drawn by the conventional method. The study reveals that both airborne and spaceborne data afford greater accuracy, economy and efficiency than the conventional method at reconnaissance level of mapping. The efficiency in terms of time spent on soil mapping by computer techniques, aerial photointerpretation, and the conventional method was of 1:5:10. A case study of erosion mapping by remote sensing techniques is also presented.
Author

A84-26834
FOREST SURVEY AND MANAGEMENT USING REMOTE SENSING
N. V. MADHAVAN UNNI (National Remote Sensing Agency, Forestry and Ecology Div., Hyderabad, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Sept. 1983, p. 209-232. refs

Recent developments in the application of remote sensing to forest resource survey and management are reviewed. Topics discussed include airborne remote sensing and the use of aerial photography for the classification of forest lands and forest volume inventory; multispectral photographs and multispectral digital data; satellite remote sensing; visual interpretation of Landsat imagery; and digital analysis of multispectral Landsat data. Attention is given to the multistage approach generally used to extract quantitative information, such as timber stand volumes, using stratification of imagery obtained from space and aerial platforms and estimating the total volume from the information obtained from ground samples. The use of remote sensing for damage assessment and fire control is also discussed. V.L.

A84-27203* State Univ. of New York, Syracuse.
EFFECT OF SUB-PIXEL SIZED CLOUD ON VEGETATION ASSESSMENT FROM SATELLITE DATA
M. J. DUGGIN, L. SCHOCH (New York, State University, Syracuse, NY), and T. I. GRAY (NOAA, National Environmental Satellite Service, Houston, TX) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 97-101. refs
(Contract NAS9-16514)

The visible and reflected infrared channels of the NOAA-7 Advanced Very High Resolution Radiometer (AVHRR) are used for environmental monitoring, including agricultural crop assessment. An index consisting of a combination of digital data from these channels is used to screen the AVHRR data for cloud. The effects on spectral signature of sub-pixel sized cloud, which does not fill the entire IFOV of the instrument, are considered. It is shown that, for two different targets, for clear and turbid atmospheric conditions and for various scan angles, cloud which would not be detected during the screening process will cause substantial effects (up to a five-fold decrease) in the data.
Author

A84-27276* Purdue Univ., Lafayette, Ind.
OVERVIEW OF REMOTE SENSING FIELD RESEARCH - REQUIREMENTS AND STATUS
B. F. ROBINSON and L. L. BIEHL (Purdue University, West Lafayette, IN) IN: Field measurement and calibration using electro-optical equipment: Issues and requirements; Proceedings of the Conference, San Diego, CA, August 24, 25, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 118-125. refs
(Contract NAS9-15466)

The history of the development of remote sensing is briefly discussed, taking into account the study of the optical spectral properties of plants in the early 1950s, the concept of 'spectral signature', the multispectral scanner, and the Thematic Mapper scanner. The present state of development of remote sensing is examined. It is found that the requirements for field measurements for remote sensing field research are the same as the requirements envisioned in the 1960s. However, improved models for predicting scene reflectance and considerable field experience have clarified the aims and procedures. Information related to the status of optical measurements for crops and soils research is presented. G.R.

A84-27280* Purdue Univ., Lafayette, Ind.
DATA ACQUISITION AND PREPROCESSING TECHNIQUES FOR REMOTE SENSING FIELD RESEARCH
L. L. BIEHL and B. F. ROBINSON (Purdue University, West Lafayette, IN) IN: Field measurement and calibration using electro-optical equipment: Issues and requirements; Proceedings of the Conference, San Diego, CA, August 24, 25, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 143-149. refs
(Contract NAS9-15466)

A crops and soils data base has been developed at Purdue University's Laboratory for Applications of Remote Sensing using spectral and agronomic measurements made by several government and university researchers. The data are being used to (1) quantitatively determine the relationships of spectral and agronomic characteristics of crops and soils, (2) define future sensor systems, and (3) develop advanced data analysis techniques. Researchers follow defined data acquisition and preprocessing techniques to provide fully annotated and calibrated sets of spectral, agronomic, and meteorological data. These procedures enable the researcher to combine his data with that acquired by other researchers for remote sensing research. The key elements or requirements for developing a field research data base of spectral data that can be transported across sites and years are appropriate experiment design, accurate spectral data calibration, defined field procedures, and through experiment documentation. Author

A84-27377* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIRECTIONAL REFLECTANCE FACTOR DISTRIBUTIONS OF A COTTON ROW CROP
D. S. KIMES, W. W. NEWCOMB, J. B. SCHUTT (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, MD), P. J. PINTER, JR., and R. D. JACKSON (U.S. Department of Agriculture, Water Conservation Laboratory, Phoenix, AZ) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 263-277. refs

The directional reflectance factor distribution spanning the entire exitance hemisphere was measured for a cotton row crop (Gossypium barbadense L.) with 39 percent ground cover. Spectral directional radiances were taken in NOAA satellite 7 AVHRR bands 1 and 2 using a three-band radiometer with restricted 12 deg full angle field of view at half peak power points. Polar co-ordinate system plots of directional reflectance factor distributions and three-dimensional computer graphic plots of scattered flux were used to study the dynamics of the directional reflectance factor distribution as a function of spectral band, geometric structure of the scene, solar zenith and azimuth angles, and optical properties of the leaves and soil. The factor distribution of the incomplete row crops was highly polymodal relative to that for complete vegetation canopies. Besides the enhanced reflectance for the antisolar point, a reflectance minimum was observed towards the forwardscatter direction in the principle plane of the sun. Knowledge of the mechanics of the observed dynamics of the data may be used to provide rigorous validation for two- or three-dimensional radiative transfer models, and is important in interpreting aircraft and satellite data where the solar angle varies widely. J.N.

A84-27378
APPRAISAL OF MULTISPECTRAL SCANNER SYSTEMS FROM ANALYSIS OF HIGH-RESOLUTION PLANT SPECTRA
A. R. MACK (Department of Agriculture, Land Resource Research Institute, Ottawa, Canada), E. J. BRACH (Department of Agriculture, Engineering and Statistics Research Institute, Ottawa, Canada), and C. R. RAO (Indian Space Research Organization, Bangalore, India) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 279-288. refs

The specificity of a multiband sensing system to structural features of the radiance spectrum is evaluated by superimposing the spectral structure on the designated bandwidth channels for Skylab S-192, Landsat-1, Landsat-2, Landsat-4, four airborne multispectral systems, and one optical photographic system. Radiance spectra (350-1850 nm) from cereal crops and corn at specific stages of physiological development were acquired with a ground-based spectroradiometer. It was found that, because the radiance spectra contain effects of the solar radiation source and of the biochemical and physiological characteristics of the reflectance plant, the bandwidths should be selected to clearly avoid inclusion of extraneous structural features. Only a few channels in each multispectral system had bandwidths corresponding to structural features associated with specific plant characteristics and chemical compounds. To facilitate referencing of the various bands, a numerical system for identifying bands of uniform radiance is presented. J.N.

A84-27387
SEMIQUANTITATIVE CLASSIFICATION OF RAINFOREST TERRAIN IN COLOMBIAN AMAZONIA USING RADAR IMAGERY
M. J. EDEN, D. F. M. MCGREGOR (Bedford College, London, England), and J. A. MORELO (Instituto Geografico, Bogota, Colombia) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 423-431. Research supported by the Rockefeller Foundation, University of London, 20th International Geographical Congress Fund, and Dudley Stamp Memorial Trust. refs

A semiquantitative method has been developed for the classification of lowland forest terrain in Colombian Amazonia. The method, which makes use of SLAR imagery at a scale of 1:200,000, is hierarchic in character and provides for the recognition of up to seven terrain classes. The morphological evolution of the landscape is discussed in the light of preliminary terrain mapping. Author

A84-27786*# Washington Univ., Seattle.
USE OF LABORATORY SPECTRA FOR DETERMINING VEGETATION ASSEMBLAGES IN LANDSAT IMAGES
J. D. ADAMS, M. SMITH, and J. B. ADAMS (Washington, University, Seattle, WA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 757-761.
(Contract NAGW-85; NSG-7173; JPL-955520)

A spectral library is a diverse collection of reflectance spectra which are used, not as an image-matching data base, but rather as an interpretive link to the physical/chemical processes that cause absorption of light in plants, minerals, rocks, and soils. Techniques for using this library to interpret Landsat MSS data are described, including the process of normalization which largely eliminates brightness effects of both laboratory and image data. Three image-to-library programs are explained. These have been used successfully to descriminate very small (less than 10 percent) changes in plant species components, to detect the presence of vegetation in units where percent cover is only 5 percent, and to recognize unusual vegetation patterns that relate to substrate changes where the substrate is not directly resolvable. Author

A84-28568* State Univ. of New York, Syracuse.
REMOTE SENSING AND VEGETATION STRESS DETECTION - PROBLEMS AND PROGRESS
M. J. DUGGIN (New York, State University, Syracuse, NY) and V. WHITEHEAD (U.S. Department of Agriculture, Houston, TX) IN: Advanced remote sensing; Proceedings of the Meeting, San Diego, CA, August 26, 27, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 2-10. refs
(Contract NAS9-16514)

Although considerable progress has been made in applying remote sensing technology to vegetation monitoring, considerable problems still exist in the improvement of techniques for crop type discrimination, stress detection on a large scale, and stress quantification. In this paper, some of the problems remaining in the operational use of remote sensing technology for vegetation stress detection are discussed, and directions in which some of these problems might be solved are proposed. Author

A84-28689
A METHOD OF SOIL INTERPRETATION FOR TILLED FIELDS ACCORDING TO SPECTRAL BRIGHTNESS MEASURED ON SPACE IMAGES [METODIKA DESHIFRIROVANIIA POCHVENNOGO POKROVA RASPAKHANNYKH POLEI PO SPEKTRAL'NYM IARKOSTIAM, IZMERENNYM PO KOSMICHESKIM SNIMKAM]
L. N. VASILEV and A. G. POLUARSHINOVA (Akademiia Nauk SSSR, Institut Geografii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 51-57. In Russian.

A soil-interpretation technique is described which relies on satellite (Meteor-Fragment), aerial, field, and laboratory observations. Cluster analysis of the measured brightness of tilled fields was performed by a specially developed procedure, and the cluster elements were transferred to a landscape map. This approach was used for the soil interpretation of a territory of 20,000 sq km for soils differing in humus content by 2-3.5 percent. B.J.

A84-28690
SPACE OBSERVATION OF LATITUDINAL VARIATIONS OF THE STATE OF VEGETATION COVER [NABLIUDENIE SHIROTNYKH IZMENENII SOSTOIANIIA RASTITEL'NOGO POKROVA IZ KOSMOSA]
V. A. KOTTSOV (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovannii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 58-61. In Russian. refs

The character of latitudinal variations of spectral contrasts during autumn was studied on the basis of Soyuz-22 multispectral photography. The relationship between these variations and variations of the phenological state of vegetation cover is established. It is concluded that the data make it possible to assess the required accuracy of photometric determinations, as well as the sampling volume and the accuracy of coordinate referencing for the planning of space observations during autumn. B.J.

A84-28691
PRINCIPLES OF ENVIRONMENTAL-AGRICULTURAL MAPPING FOR RATIONAL LAND USE (ON THE EXAMPLE OF THE KALMYK ASSR) [PRINTSIPY SOSTAVLENIIA PRIRODNO-SEL'SKOKHOZIAISTVENNYKKH KART DLIA TSELEI RATSIONAL'NOGO ISPOL'ZOVANIIA ZEMEL' /NA PRIMERE KALMYTSKOI ASSR/]
L. N. KULESHOV (Gosudarstvennyi Nauchno-Issledovatel'skii Institut Zemel'nykh Resursov, Mytishchi, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 62-67. In Russian. refs

A84-29724* Environmental Research Inst. of Michigan, Ann Arbor.
APPLICATION OF THE TASSELED CAP CONCEPT TO SIMULATED THEMATIC MAPPER DATA
E. P. CRIST and R. C. CICONE (Michigan, Environmental Research Institute, Ann Arbor, MI) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, March 1984, p. 343-352. refs
(Contract NAS9-16538)

Thematic Mapper signal counts in the six reflective bands (i.e., excluding the thermal band) are simulated using field and laboratory spectrometer measurements of a variety of crops, crop conditions, and soil types. The Dave atmospheric model and prelaunch sensor characteristics comprise the other components of the simulation. The simulated data are found to occupy essentially three dimensions, two of which are equivalent to the MSS Tasseled Cap Greennes and Brightness features, and a third which is substantially influenced by the mid-infrared bands of the TM. This new dimension is primarily related to soil characteristics, including soil moisture. The nature and characteristics of each dimension are discussed, as are some of the expected information gains (over MSS data) resulting from the additional dimensionality of the data.

N84-16404*# Zurich Univ. (Switzerland). Dept. of Geology.
CROP IDENTIFICATION OF SAR DATA USING DIGITAL TEXTURAL ANALYSIS
D. R. NUESCH *In* JPL Spaceborne Imaging Radar Symp. p 79-82 1 Jul. 1983 refs
(Contract AGRISTARS PROJ. IT-E2-04233)
Avail: NTIS HC A08/MF A01 CSCL 02F

After preprocessing SEASAT SAR data which included slant to ground range transformation, registration to LANDSAT MSS data and appropriate filtering of the raw SAR data to minimize coherent speckle, textural features were developed based upon the spatial gray level dependence method (SGLDM) to compute entropy and inertia as textural measures. It is indicated that the consideration of texture features are very important in SAR data analysis. The SEASAT SAR data are useful for the improvement of field boundary definitions and for an earlier season estimate of corn and soybean area location than is supported by LANDSAT alone. E.A.K.

N84-16620*# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
AN INITIAL ANALYSIS OF LANDSAT 4 THEMATIC MAPPER DATA FOR THE CLASSIFICATION OF AGRICULTURAL, FORESTED WETLAND, AND URBAN LAND COVERS
D. A. QUATTROCHI, J. E. ANDERSON, D. P. BRANNON, and C. L. HILL Nov. 1982 50 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E84-10073; NASA-TM-85499; NSTL/ERL-215; NAS 1.15:85499)
Avail: NTIS HC A03/MF A01 CSCL 08B

An initial analysis of LANDSAT 4 thematic mapper (TM) data for the delineation and classification of agricultural, forested wetland, and urban land covers was conducted. A study area in Poinsett County, Arkansas was used to evaluate a classification of agricultural lands derived from multitemporal LANDSAT multispectral scanner (MSS) data in comparison with a classification of TM data for the same area. Data over Reelfoot Lake in northwestern Tennessee were utilized to evaluate the TM for delineating forested wetland species. A classification of the study area was assessed for accuracy in discriminating five forested wetland categories. Finally, the TM data were used to identify urban features within a small city. A computer generated classification of Union City, Tennessee was analyzed for accuracy in delineating urban land covers. An evaluation of digitally enhanced TM data using principal components analysis to facilitate photointerpretation of urban features was also performed. M.G.

N84-16631*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
CASE STUDIES USING GOES INFRARED DATA AND A PLANETARY BOUNDARY LAYER MODEL TO INFER REGIONAL SCALE VARIATIONS IN SOIL MOISTURE M.S. Thesis
F. G. ROSE Dec. 1983 91 p refs
(Contract NAG1-84)
(NASA-CR-173250; NAS 1.26:173250) Avail: NTIS HC A05/MF A01 CSCL 08M

Modeled temperature data from a one-dimensional, time-dependent, initial value, planetary boundary layer model for 16 separate model runs with varying initial values of moisture availability are applied, by the use of a regression equation, to longwave infrared GOES satellite data to infer moisture availability over a regional area in the central U.S. This was done for several days during the summers of 1978 and 1980 where a large gradient in the antecedent precipitation index (API) represented the boundary between a drought area and a region of near normal precipitation. Correlations between satellite derived moisture availability and API were found to exist. Errors from the presence of clouds, water vapor and other spatial inhomogeneities made the use of the measurement for anything except the relative degree of moisture availability dubious. Author

N84-16637# European Association of Remote Sensing Labs., Paris (France). Working Group 7.
GROUP AGROMET MONITORING PROJECT (GAMP), PHASE 1 Summary Report
C. E. ENGLAND (Laboratory for Planeraty Atmospheres, London), R. GOMBEER (Laboratorium voor Bodemgenese en Bodemgeografia, Leuven, Belgium), E. HECHINGER (Groupe de Teledetection, Strasbourg), R. W. HERSCHY (Dept. of the Environment, London), A. ROSEMA (environmental Analysis and remote Sensing Ltd., Delft), and L. STROOSNIJDER (Agricultural Univ. of Wageningen, Netherlands) Paris ESA 1983 37 p refs
(Contract ESA-4660/81/D-IM(SC))
(ESA-CR(P)-1769) Avail: NTIS HC A03/MF A01

Meteosat surface climatological data coverage over large areas was investigated. Time and space variations in agrometeorological conditions were mapped in a 280 x 340 km area in the Sahel at the beginning of the growing season. Post rain Meteosat IR imagery shows distinct surface temperature patterns which represent the effect of precipitation on soil moisture and evaporation distribution. Rainfall and evaporation mapping results are consistent. Evaporation maps are well correlated to previous rainfall events and show actual soil moisture state. Thermal inertia mapping results agree with the physiographic characteristics of the area. Soil thermal inertia and evaporation resistance are strongly related and give the same information on soil moisture state. Analysis of germination events, based on rainfall and evaporation, is demonstrated, but requires further study. The accuracy of algorithms and results needs to be improved, particularly calculation of atmospheric corrections, and subsequent determination of net radiation and surface temperature. Author (ESA)

N84-17641*# Agricultural Research Service, Beltsville, Md. Hydrology Lab.
COMPARISON OF THE INFORMATION CONTENT OF DATA FROM THE LANDSAT 4 THEMATIC MAPPER AND THE MULTISPECTRAL SCANNER Final Report
J. C. PRICE 1984 56 p *Original contains imagery. Original* photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NASA ORDER S-10772-C)
(E84-10081; NASA-CR-173231; NAS 1.26:173231) Avail: NTIS HC A04/MF A01 CSCL 08B

Evaluation of information contained in data from the visible and near-IR channels of LANDSAT 4 TM and MSS for five agricultural scenes shows that the TM provides a significant advance in information gathering capability as expressed in terms *of bits per pixel or bits per unit area. The six reflective channels* of the TM acquire 18 bits of information per pixel out of a possible 48 bits, while the four MSS channels acquire 10 bits of information per pixel out of a possible 28 bits. Thus the TM and MSS are equally efficient in gathering information (18/48 to approximately 10/28), contrary to the expected tendency toward lower efficiency as spatial resolution is improved and spectral channels are added to an observing system. The TM thermal IR data appear to be of interest mainly for mapping water bodies, which do not change temperature during the day, for assessing surface moisture, and for monitoring thermal features associated with human activity.
A.R.H.

N84-17658# European Space Agency, Paris (France).
LAND USE INVENTORY AND STATISTICAL SAMPLING IN AGRICULTURE
J. MEYER-ROUX (Service Central des Enquetes et Etudes Statistiques, St. Mande, France) *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 59-66 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

The need to adapt satellite land use data and traditional data acquisition techniques to each other is discussed. Agricultural statistics sampling techniques based on large administrative areas, farms, and frame sampling are described. It is argued that spaceborne techniques combined with regression analysis can provide optimal area frames. Author (ESA)

N84-17659# Freiburg Univ. (West Germany). Abt. Luftbildmessung und Fernerkundung.
REMOTE SENSING FROM SPACE FOR FORESTRY PURPOSES
G. HILDEBRANDT *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 67-74 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

Spaceborne detection of forest fires, and forest cover mapping are discussed. Using LANDSAT data it is possible to classify either by visual intepretation or by computer assisted digital methods closed forest as one among other main land use classes with 90% to 95% accuracy. Within closed forests, clear cuttings and areas of planned or destructive deforestation can be detected. Forest types are distinguished with 80% accuracy. Author (ESA)

N84-17666# Centre National d'Etudes Spatiales, Toulouse (France).
REMOTE SENSING FOR AGRICULTURE AND LAND USE
A. PODAIRE *In* ESA Remote Sensing: New Satellite Systems and potential Appl. p 137-139 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

Simulated bands of SPOT and LANDSAT 4 data, based on vegetation and soil signatures, were analyzed. Visual interpretation of color composites (color infrared type) shows important correlations between visible channels. By computing these correlations on a 7 km sq region, correlation coefficients close to 0.95 between SPOT and LANDSAT data are obtained. The vegetation index was used to eliminate simultaneous changes of solar illumination (direct flux) in IR and visible spectral bands, due to structural heterogeneities in the landscape (slopes), and, with the same (direct) solar illumination, simultaneous variations of the reflectance factor. The index gives information on the growth cycle of winter and spring crops. Author (ESA)

N84-17680# Marine Biological Lab., Woods Hole, Mass. Ecosystems Center.
TEST OF THE USE OF LANDSAT IMAGERY TO DETECT CHANGES IN THE AREA OF FOREST IN THE TROPICS
G. M. WOODWELL, J. E. HOBBIE, R. A. HOUGHTON, J. M. MELILLO, and T. A. STONE Sep. 1983 39 p refs
(Contract DE-AC02-80EV-10468)
(DE84-004444; DOE/EV-10468/T1) Avail: NTIS HC A03/MF A01

Rates of change in the area of tropical moist forest in the Brazilian state of Rondonia in the southwestern Amazon Basin were measured over several years using LANDSAT data. The purpose was to test in the tropics a technique of change detection developed in temperate forests. The entire procedure was tested from the availability of imagery on computer tapes through the details of the analysis. Three LANDSAT scenes were used to detect and measure change: June 1976, August 1978 and May 1981. Results showed within the area of one LANDSAT scene (34,000 km(2)) rates of deforestation of 26,900 ha/y from 1976 to 1978 and 55,200 ha/y from 1978 to 1981. The LANDSAT data were used with 1981 data from NOAA7 satellite to show in a preliminary estimate that 12,650 km(2) of forest was cleared in Rondonia prior to 1981. A survey of LANDSAT data available from tropical regions around the world showed that there is ample data for a LANDSAT-based evaluation of deforestation for the period 1972 to 1982 for Amazonia, Central Africa and mainland Southeast Asia. The evaluation of deforestation in insular Southeast Asia would be more difficult by LANDSAT currently due to high cloud cover in the region. DOE

N84-19953*# Southern Methodist Univ., Dallas, Tex. Center for Applied Mathematical and Statistical Research.
CENTER OF EXCELLENCE FOR APPLIED MATHEMATICAL AND STATISTICAL RESEARCH IN SUPPORT OF DEVELOPMENT OF MULTICROP PRODUCTION MONITORING CAPABILITY Final Report, 1 Feb. - 31 Aug. 1983
W. A. WOODWARD and H. L. GRAY Aug. 1983 101 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development
(Contract NAS9-16438; PROJ. AGRISTARS)
(E84-10062; NASA-CR-171729; SR-63-04444; NAS 1.26:171729) Avail: NTIS HC A06/MF A01 CSCL 02C

Efforts in support of the development of multicrop production monitoring capability are reported. In particular, segment level proportion estimation techniques based upon a mixture model were investigated. Efforts have dealt primarily with evaluation of current techniques and development of alternative ones. A comparison of techniques is provided on both simulated and LANDSAT data along with an analysis of the quality of profile variables obtained from LANDSAT data. M.G.

N84-19955*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
L BAND PUSH BROOM MICROWAVE RADIOMETER: SOIL MOISTURE VERIFICATION AND TIME SERIES EXPERIMENT DELMARVA PENINSULA
T. J. JACKSON (Agricultural Research Center, Beltsville, Md.), J. SHIUE, P. ONEILL, J. WANG, J. FUCHS, and M. OWE Feb. 1984 76 p refs ERTS
(E84-10084; NASA-TM-86068; NAS 1.15:86068) Avail: NTIS HC A05/MF A01 CSCL 08M

The verification of a multi-sensor aircraft system developed to study soil moisture applications is discussed. This system consisted of a three beam push broom L band microwave radiometer, a thermal infrared scanner, a multispectral scanner, video and photographic cameras and an onboard navigational instrument. Ten flights were made of agricultural sites in Maryland and Delaware with little or no vegetation cover. Comparisons of aircraft and ground measurements showed that the system was reliable and consistent. Time series analysis of microwave and evaporation data showed a strong similarity that indicates a potential direction for future research. M.G.

N84-19956*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADAR RESPONSE FROM VEGETATION WITH NODAL STRUCTURE
B. J. BLANCHARD and P. E. ONEILL Feb. 1984 21 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E84-10085; NASA-TM-86066; NAS 1.15:86066) Avail: NTIS HC A02/MF A01 CSCL 02C

Radar images from the SEASAT synthetic aperture radar (SAR) produced unusually high returns from corn and sorghum fields, which seem to indicate a correlation between nodal separation in the stalk and the wavelength of the radar. These images also show no difference in return from standing or harvested corn. Further investigation using images from the Shuttle Imaging Radar (SIR-A) substantiated these observations and showed a degradation of the high return with time after harvest. From portions of corn and sweet sorghum stalks that were sampled to measure stalk water content, it was determined that near and after maturity the water becomes more concentrated in the stalk nodes. The stalk then becomes a linear sequence of alternating dielectrics as opposed to a long slender cylinder with uniform dielectric properties. M.G.

N84-19958*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
CROP AREA ESTIMATION BASED ON REMOTELY-SENSED DATA WITH AN ACCURATE BUT COSTLY SUBSAMPLE Final Report, 1 Jan. - 30 Oct. 1983
R. F. GUNST 30 Oct. 1983 97 p refs ERTS
(Contract NCC9-9)
(E84-10087; NASA-CR-171731; NAS 1.26:171731) Avail: NTIS HC A05/MF A01 CSCL 02C

Alternatives to sampling-theory stratified and regression estimators of crop production and timber biomass were examined. An alternative estimator which is viewed as especially promising is the errors-in-variable regression estimator. Investigations established the need for caution with this estimator when the ratio of two error variances is not precisely known. A.R.H.

N84-19959*# Agricultural Research Service, Weslaco, Tex. Soil and Water Conservation Research.
INCREASE OF COLD TOLERANCE IN COTTON PLANT (GOSSYPIUM HIRSUTUM L.) BY MEPIQUAT CHLORIDE
H. W. GAUSMAN, D. E. ESCOBAR, R. R. RODRIGUEZ, Principal Investigators, S. Y. HUANG (Texas A and M Univ., Weslaco), and F. R. RITTIG (BASF Experiment Station, Limburgerhof, West Germany) Feb. 1982 10 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract PROJ. AGRISTARS)
(E84-10088; NASA-CR-175383; EW-U2-04243; JSC-17817; NAS 1.26:175383) Avail: NTIS HC A02/MF A01 CSCL 02C

Three mepiquat chloride (MC) concentrations - 40, 70, and 100 g a.i./ha - were used to spray cotton (Gossypium hirsutum L., cultival McNair 220) plants to determine whether or not MC would increase their cold tolerance. Seven to ten days after the spray, the plants were exposed to three different cold treatments. No important difference in cold damage was noticed between the control and the MC-treated plants when they were exposed repeatedly to 4.5 C. No plants died when exposed to 0.5 C for 12 h; however, 90% of the 1st and 2nd leaves of the control plants were damaged. This was three times more damage than those leaves of plants treated with 70 and 100 g a.i./ha MC concentrations; 60% f the control and 10-20% of the MC-treated plants died when the plants were subjected to a cold hardening process with 15.5 C day (12 h) and 1.7 C night (12 h) for 10 days, and then, held at -2.2 C for 24 hours. The electrolyte leakage and reflectance measurement data showed that the cell membranes of the MC-treated plants sustained much less damage than those of the control. Freezing injury was easily assessed by reflectance measurements at the 1.65 micrometer wavelength.
Author

N84-19960*# Agricultural Research Service, Weslaco, Tex. Remote Sensing Research Unit.
REFLECTANCE MEASUREMENTS OF COTTON LEAF SENESCENCE ALTERED BY MEPIQUAT CHLORIDE
H. W. GAUSMAN, D. E. ESCOBAR, and R. R. RODRIGUEZ, Principal Investigators Feb. 1982 15 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract PROJ. AGRISTARS)
(E84-10089; NASA-CR-175384; EW-U2-04244; JSC-17818; NAS 1.26:175384) Avail: NTIS HC A02/MF A01 CSCL 02C

Spectrophotometric reflectance measurements were made on plant-attached leaves to evaluate growth chamber-grown cotton leaf (Gossypium hirsutum L.) senescence (chlorophyll degradation as criterion) that was delayed by mepiquat chloride (1,1-dimethylpiperidinium chloride) rates of 0, 10, 40, 70, and 100 g a.i./ha. Mepiquat chloride (MC increased both chlorophyll and leaf water contents as compared with that of untreated leaves. Reflectance was inversely and linearly correlated ($r = -0.873^{**}$) with eater content at the 1.65 micrometer wavelength and was inversely correlated ($r = -0.812^{**}$) with chlorophyll concentration at the 0.55 micrometer wavelength but best fit a quadratic equation. Either wavelength measurement might be useful to remotely detect

cotton leaf senescence or fields of MC-treated cotton plants.
Author

N84-19961*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ACCOMPLISHMENTS OF THE NASA JOHNSON SPACE CENTER PORTION OF THE SOIL MOISTURE PROJECT IN FISCAL YEAR 1981 Annual Report, 1981
J. F. PARIS, L. M. ARYA, S. A. DAVIDSON, W. W. HILDRETH, J. C. RICHTER, and W. A. ROSENKRANZ Jan. 1982 95 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Prepared in cooperation with Lockheed Engineering and Management Services Co., Inc., Houston, Tex. ERTS
(Contract NAS9-15800; PROJ. AGRISTARS)
(E84-10090; NASA-TM-85562; SM-L1-04209; JSC-17798; NAS 1.15:85562; LEMSCO-17305) Avail: NTIS HC A05/MF A01 CSCL 02C

The NASA/JSC ground scatterometer system was used in a row structure and row direction effects experiment to understand these effects on radar remote sensing of soil moisture. Also, a modification of the scatterometer system was begun and is continuing, to allow cross-polarization experiments to be conducted in fiscal years 1982 and 1983. Preprocessing of the 1978 agricultural soil moisture experiment (ASME) data was completed. Preparations for analysis of the ASME data is fiscal year 1982 were completed. A radar image simulation procedure developed by the University of Kansas is being improved. Profile soil moisture model outputs were compared quantitatively for the same soil and climate conditions. A new model was developed and tested to predict the soil moisture characteristic (water tension versus volumetric soil moisture content) from particle-size distribution and bulk density data. Relationships between surface-zone soil moisture, surface flux, and subsurface moisture conditions are being studied as well as the ways in which measured soil moisture (as obtained from remote sensing) can be used for agricultural applications. A.R.H.

N84-19962*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AGRISTARS: AGRICULTURE AND RESOURCES INVENTORY SURVEYS THROUGH AEROSPACE REMOTE SENSING Annual Report, 1981
Jan. 1982 89 p ERTS
(E84-10091; NASA-TM-85558; AP-J2-04225; NAS 1.15:85558) Avail: NTIS HC A05/MF A01 CSCL 02C

The rationale, objectives, participants, and approach of the AgRISTARS program are described. Progress is reported in activities related to early warning and crop condition assessment; inventory technology development (formerly foreign commodity production forecasting); yield model development; supporting research; soil moisture; renewable resources inventory; domestic crops and land cover; and conservation and pollution. Emphasis is on technological highlights. A.R.H.

N84-19963*# Dartmouth Coll., Hanover, N.H.
INVESTIGATION OF FORESTRY RESOURCES AND OTHER REMOTE SENSING DATA. 1: LANDSAT. 2: REMOTE SENSING OF VOLCANIC EMISSIONS Final Technical Report, 1 Feb. 1980 - 31 Oct. 1983
R. W. BIRNIE and R. E. STOIBER, Principal Investigators 31 Oct. 1983 81 p refs ERTS
(Contract NCC5-22)
(E84-10092; NASA-CR-175385; NAS 1.26:175385) Avail: NTIS HC A05/MF A01 CSCL 08K

Computer classification of LANDSAT data was used for forest type mapping in New England. The ability to classify areas of hardwood, softwood, and mixed tree types was assessed along with determining clearcut regions and gypsy moth defoliation. Applications of the information to forest management and locating potential deer yards were investigated. The principal activities concerned with remote sensing of volcanic emissions centered around the development of remote sensors for SO2 and HCl gas, and their use at appropriate volcanic sites. Two major areas were investigated (Masaya, Nicaragua, and St. Helens, Washington) along with several minor ones. M.G.

N84-19989*# Agricultural Research Service, Beltsville, Md. Hydrology Lab.
COMPARISON OF THE INFORMATION CONTENT OF DATA FROM THE LANDSAT-4 THEMATIC MAPPER AND THE MULTISPECTRAL SCANNER Final Report
J. C. PRICE 1984 55 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198
(Contract NASA ORDER S-10772-C)
(E84-10056; NASA-CR-173302; NAS 1.26:173302) Avail: NTIS HC A04/MF A01 CSCL 05B

The information contained in data from the visible and near-IR channels of the LANDSAT 4 thematic mapper (TM) and multispectral scanner (MSS) is evaluated for five agricultural scenes, leading to the conclusion that the TM provides a significant advance in information gathering capability as expressed in terms of bits per pixel or bits per unit area. The six reflective channels of the TM acquire 18 bits of information per pixel out of a possible 6 x (8 bits) = 48 bits, while the four MSS channels acquire 10 bits of information per pixel out of a possible 4x (7 bits) = 28 bits. Thus the TM and MSS are equally efficient in gathering information (18/48 = 10/28), contrary to the expected tendency toward lower efficiency as spatial resolution is improved and spectral channels are added to an observing system. The result is attributed to: (1) superior selection of spectral channels in the TM; (2) higher precision of the TM data, i.e., lower system noise; and (3) the advantage of higher spatial resolution, even in agricultural areas where fields are larger than the MSS pixel size. Because the MSS lacks a thermal IR channel, the 10-12 micrometer data of the TM at 120 m resolution are analyzed theoretically using an energy balance approach. It apppears that the TM thermal IR data are of interest mainly for mapping water bodies, which do not change temperature during the day, for assessing surface moistness, and for monitoring thermal features associated with human activity. M.G.

N84-20005# Bureau of Land Management, Denver, Colo.
THE USE OF REMOTE SENSING FOR SOILS INVESTIGATIONS ON BLM LANDS
W. D. DIPAOLO and L. R. HALL May 1983 72 p refs
(PB84-132075; BLM-DCS-PT-83-003-4420; TN-361) Avail: NTIS HC A04/MF A01 CSCL 08M

This report primarily concerns use of LANDSAT digital data as an aid in the soil survey mapping efforts taking place on Federal, particularly BLM, lands in the western U.S. Its purpose is to help BLM personnel become more familiar with the use and potential of LANDSAT data for soil survey work. To better understand how LANDSAT data can be used in resource investigations, a brief description is given of the LANDSAT system and electromagnetic spectrum. The body of the report describes a project in southwestern Idaho where LANDSAT digital data was used as an aid in an Order 3 soil survey. GRA

N84-21917*# Michigan State Univ., East Lansing. Center for Remote Sensing.
INTERPRETING MICHIGAN FOREST COVER TYPES FROM COLOR INFRARED AERIAL PHOTOGRAPHS
W. D. HUDSON Jan. 1984 28 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NGL-23-004-083)
(E84-10097; NASA-CR-173346; NAS 1.26:173346) Avail: NTIS HC A03/MF A01 CSCL 02F

The characteristics of 17 cover types (13 forest types or tree species and 4 nonforest cover types) in Michigan are discussed as well as their interpretation from medium scale color infrared photography. The occurrence of each type is described by region and site requirements. Those attributes of a tree or stand which are helpful when attempting to interpret the type from a vertical

perspective are discussed as well as common crown types. The identification of the forest type or tree species by using image characteristics (size, shape, shadow, color, texture, pattern, or association) is discussed. Ground photographs and sketches of individual trees are included. Stereograms of typical stands are available. A.R.H.

N84-21919*# National Oceanic and Atmospheric Administration, Columbia, Mo.
ARGENTINA WHEAT YIELD MODEL
S. L. CALLIS and C. SAKAMOTO 16 Jan. 1984 38 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract PROJ. AGRISTARS)
(E84-10101; NASA-CR-173370; YM-N4-04457; JSC-18909; NAS 1.26:173370) Avail: NTIS HC A03/MF A01 CSCL 02C

Five models based on multiple regression were developed to estimate wheat yields for the five wheat growing provinces of Argentina. Meteorological data sets were obtained for each province by averaging data for stations within each province. Predictor variables for the models were derived from monthly total precipitation, average monthly mean temperature, and average monthly maximum temperature. Buenos Aires was the only province for which a trend variable was included because of increasing trend in yield due to technology from 1950 to 1963. M.G.

N84-21920*# National Oceanic and Atmospheric Administration, Columbia, Mo.
ARGENTINA SOYBEAN YIELD MODEL
S. L. CALLIS and C. SAKAMOTO 16 Jan. 1984 15 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract PROJ. AGRISTARS)
(E84-10102; NASA-CR-173371; YM-N4-04453; JSC-18905; NAS 1.26:173371) Avail: NTIS HC A02/MF A01 CSCL 02C

A model based on multiple regression was developed to estimate soybean yields for the country of Argentina. A meteorological data set was obtained for the country by averaging data for stations within the soybean growing area. Predictor variables for the model were derived from monthly total precipitation and monthly average temperature. A trend variable was included for the years 1969 to 1978 since an increasing trend in yields due to technology was observed between these years. M.G.

N84-21921*# National Oceanic and Atmospheric Administration, Columbia, Mo.
BRAZIL WHEAT YIELD COVARIANCE MODEL
S. L. CALLIS and C. SAKAMOTO 16 Jan. 1984 22 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract PROJ. AGRISTARS)
(E84-10103; NASA-CR-173372; YM-N4-04454; JSC-18906; NAS 1.26:173372) Avail: NTIS HC A02/MF A01 CSCL 02C

A model based on multiple regression was developed to estimate wheat yields for the wheat growing states of Rio Grande do Sul, Parana, and Santa Catarina in Brazil. The meteorological data of these three states were pooled and the years 1972 to 1979 were used to develop the model since there was no technological trend in the yields during these years. Predictor variables were derived from monthly total precipitation, average monthly mean temperature, and average monthly maximum temperature. M.G.

N84-21922*# National Oceanic and Atmospheric Administration, Columbia, Mo.
BRAZIL SOYBEAN YIELD COVARIANCE MODEL
S. L. CALLIS and C. SAKAMOTO 16 Jan. 1984 25 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract PROJ. AGRISTARS)
(E84-10104; NASA-CR-173373; YM-N4-04455; JSC-18907; NAS 1.26:173373) Avail: NTIS HC A02/MF A01 CSCL 02C

A model based on multiple regression was developed to estimate soybean yields for the seven soybean-growing states of Brazil. The meteorological data of these seven states were pooled and the years 1975 to 1980 were used to model since there was no technological trend in the yields during these years. Predictor variables were derived from monthly total precipitation and monthly average temperature. M.G.

N84-21923*# National Oceanic and Atmospheric Administration, Columbia, Mo.
ARGENTINA CORN YIELD MODEL
S. L. CALLIS and C. SAKAMOTO 16 Jan. 1984 15 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract PROJ. AGRISTARS)
(E84-10105; NASA-CR-173374; YM-N4-04456; JSC-18908; NAS 1.26:173374) Avail: NTIS HC A02/MF A01 CSCL 02C

A model based on multiple regression was developed to estimate corn yields for the country of Argentina. A meteorological data set was obtained for the country by averaging data for stations within the corn-growing area. Predictor variables for the model were derived from monthly total precipitation, average monthly mean temperature, and average monthly maximum temperature. A trend variable was included for the years 1965 to 1980 since an increasing trend in yields due to technology was observed between these years. M.G.

N84-21924*# California Univ., Berkeley. Space Sciences Lab.
ANALYSIS OF THE QUALITY OF IMAGE DATA ACQUIRED BY THE LANDSAT-4 THEMATIC MAPPER AND MULTISPECTRAL SCANNERS Quarterly Status Technical Progress Report, 1 Oct. - 31 Dec. 1983
R. N. COLWELL, Principal Investigator 15 Jan. 1984 25 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS5-17377)
(E84-10106; NASA-CR-173375; NAS 1.26:173375; QSTPR-4)
Avail: NTIS HC A02/MF A01 CSCL 05B

A seven step procedure developed for evaluating the geometric properties of MSS and TM film produces is being implemented. Some 476 control points were selected of which 238 are being tested and edited for digitization and scaling errors. Tables show statistics established for assessing the spectral characteristics and variability, as well as the spatial resolution and radiometric sensitivity of TM data for a forest environment in an effort to determine the extent to which major forest cover type can be detected and identified on TM digital and image products. Results thus far show that the high quality obtained are more than sufficient for meeting most of the inventory objectives of the renewable resource specialist. The TM data should be extremely valuable for: (1) estimating forest cover types; (2) updating land use survey maps; and (3) determining the size and shape and location of individual forest clearings and water resources. A.R.H.

N84-21925*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

REMOTE SENSING OF AGRICULTURAL CROPS AND SOILS Final Report

M. E. BAUER, Principal Investigator Feb. 1983 173 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NAS9-16528; PROJ. AGRISTARS)

(E84-10107; NASA-CR-171768; SR-P3-04399; NAS 1.26:171768; LARS-022183) Avail: NTIS HC A08/MF A01 CSCL 02C

Research in the correlative and noncorrelative approaches to image registration and the spectral estimation of corn canopy phytomass and water content is reported. Scene radiation research results discussed include: corn and soybean LANDSAT MSS classification performance as a function of scene characteristics; estimating crop development stages from MSS data; the interception of photosynthetically active radiation in corn and soybean canopies; costs of measuring leaf area index of corn; LANDSAT spectral inputs to crop models including the use of the greenness index to assess crop stress and the evaluation of MSS data for estimating corn and soybean development stages; field research experiment design data acquisition and preprocessing; and Sun-view angles studies of corn and soybean canopies in support of vegetation canopy reflection modeling. A.R.H.

N84-21926*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

EVALUATION OF A NATIVE VEGETATION MASKING TECHNIQUE

M. C. KINSLER Feb. 1984 30 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15800; PROJ. AGRISTARS)

(E84-10108; NASA-CR-171767; EW-L4-04452; JSC-18903; NAS 1.26:171767; LEMSCO-20206) Avail: NTIS HC A03/MF A01 CSCL 02C

A crop masking technique based on Ashburn's vegetative index (AVI) was used to evaluate native vegetation as an indicator of crop moisture condition. A mask of the range areas (native vegetation) was generated for each of thirteen Great Plains LANDSAT MSS sample segments. These masks were compared to the digitized ground truth and accuracies were computed. An analysis of the types of errors indicates a consistency in errors among the segments. The mask represents a simple quick-look technique for evaluating vegetative cover. A.R.H.

N84-21927*# Kansas State Univ., Manhattan. Dept. of Agronomy.

INTERCEPTED PHOTOSYNTHETICALLY ACTIVE RADIATION ESTIMATED BY SPECTRAL REFLECTANCE

J. L. HATFIELD, G. ASRAR, and E. T. KANEMASU Sep. 1982 28 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-16457; PROJ. AGRISTARS)

(E84-10109; NASA-CR-171758; SR-M2-04342; NAS 1.26:171758; CONTRIB-82-559-J) Avail: NTIS HC A03/MF A01 CSCL 02C

The interception of photosynthetically active radiation (PAR) was evaluated relative to greenness and normalized difference (MSS 7-5/7+5) for five planting dates of wheat for 1978-79 and 1979-80 in Phoenix. Intercepted PAR was calculated from a model driven by leaf area index and stage of growth. Linear relationships were found between greenness and normalized difference with a separate model representing growth and senescence of the crop. Normalized difference was a significantly better model and would be easier to apply than the empirically derived greenness parameter. For the leaf area growth portion of the season the model between PAR interception and normalized difference was the same over years, however, for the leaf senescence the models showed more variability due to the lack of data on measured interception in sparse canopies. Normalized difference could be used to estimate PAR interception directly for crop growth models. Author

N84-21929*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FUNDAMENTAL REMOTE SENSING SCIENCE RESEARCH PROGRAM. PART 1: SCENE RADIATION AND ATMOSPHERIC EFFECTS CHARACTERIZATION PROJECT Status Report

R. E. MURPHY and D. W. DEERING Mar. 1984 259 p refs (NASA-TM-86078; NAS 1.15:86078) Avail: NTIS HC A12/MF A01 CSCL 05B

Brief articles summarizing the status of research in the scene radiation and atmospheric effect characterization (SRAEC) project are presented. Research conducted within the SRAEC program is focused on the development of empirical characterizations and mathematical process models which relate the electromagnetic energy reflected or emitted from a scene to the biophysical parameters of interest.

N84-21930*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NASA FUNDAMENTAL REMOTE SENSING SCIENCE RESEARCH PROGRAM

In its Fundamental Remote Sensing Sci. Res. Program, Part 1 p 2-29 Mar. 1984

Avail: NTIS HC A12/MF A01 CSCL 05B

The NASA Fundamental Remote Sensing Research Program is described. The program provides a dynamic scientific base which is continually broadened and from which future applied research and development can draw support. In particular, the overall objectives and current studies of the scene radiation and atmospheric effect characterization (SRAEC) project are reviewed. The SRAEC research can be generically structured into four types of activities including observation of phenomena, empirical characterization, analytical modeling, and scene radiation analysis and synthesis. The first three activities are the means by which the goal of scene radiation analysis and synthesis is achieved, and thus are considered priority activities during the early phases of the current project. Scene radiation analysis refers to the extraction of information describing the biogeophysical attributes of the scene from the spectral, spatial, and temporal radiance characteristics of the scene including the atmosphere. Scene radiation synthesis is the generation of realistic spectral, spatial, and temporal radiance values for a scene with a given set of biogeophysical attributes and atmospheric conditions. M.G.

N84-21931*# Colorado State Univ., Fort Collins. School of Forestry and Natural Resources.

REFLECTANCE MODELING Abstract Only

J. A. SMITH, K. COOPER, and M. RANDOLPH *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 30 Mar. 1984

Avail: NTIS HC A12/MF A01 CSCL 20F

A classical description of the one dimensional radiative transfer treatment of vegetation canopies was completed and the results were tested against measured prairie (blue grama) and agricultural canopies (soybean). Phase functions are calculated in terms of directly measurable biophysical characteristics of the canopy medium. While the phase functions tend to exhibit backscattering anisotropy, their exact behavior is somewhat more complex and wavelength dependent. A Monte Carlo model was developed that treats soil surfaces with large periodic variations in three dimensions. A photon-ray tracing technology is used. Currently, the rough soil surface is described by analytic functions and appropriate geometric calculations performed. A bidirectional reflectance distribution function is calculated and, hence, available for other atmospheric or canopy reflectance models as a lower boundary condition. This technique is used together with an adding model to calculate several cases where Lambertian leaves possessing anisotropic leaf angle distributions yield non-Lambertian reflectance; similar behavior is exhibited for simulated soil surfaces. M.G.

N84-21932*# Nebraska Univ., Lincoln. Dept. of Agronomy.
BIDIRECTIONAL REFLECTANCE MODELING OF NON-HOMOGENEOUS PLANT CANOPIES Abstract Only
J. M. NORMAN *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 31 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20F

Efforts to develop a three dimensional model to predict canopy, bidirectional reflectance for heterogenous plant stands using incident radiation and canopy structural descriptions as inputs are described. Utility programs were developed to cope with the complex output from the 3 dimensional model. In addition an attempt was made to define leaf and soil properties, which are appropriate to the mode, by measuring leaf and soil bidirectional reflectance distribution functions; since almost no data exist on these distributions. In the process it was realized that most models probably are using the wrong leaf spectral properties, and that off-nadir reflectance measurements are difficult to make because of non-Lambertian properties of reference surfaces. Also, in the visible wavebands, rough soil may not be distinguishable from canopies when viewed from above. M.G.

N84-21933*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPREHENSIVE UNDERSTANDING FOR VEGETATED SCENE RADIANCE RELATIONSHIPS Abstract Only
D. S. KIMES and D. W. DEERING *In its* Fundamental Remote Sensing Sci. Res. Program, Part 1 p 32 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20F

Directional reflectance distributions spanning the entire existent hemisphere were measured in two field studies; one using a Mark III 3-band radiometer and one using the rapid scanning bidirectional field instrument called PARABOLA. Surfaces measured included corn, soybeans, bare soils, grass lawn, orchard grass, alfalfa, cotton row crops, plowed field, annual grassland, stipa grass, hard wheat, salt plain shrubland, and irrigated wheat. Analysis of field data showed unique reflectance distributions ranging from bare soil to complete vegetation canopies. Physical mechanisms causing these trends were proposed. A 3-D model was developed and is unique in that it predicts: (1) the directional spectral reflectance factors as a function of the sensor's azimuth and zenith angles and the sensor's position above the canopy; (2) the spectral absorption as a function of location within the scene; and (3) the directional spectral radiance as a function of the sensor's location within the scene. Initial verification of the model as applied to a soybean row crop showed that the simulated directional data corresponded relatively well in gross trends to the measured data. The model was expanded to include the anisotropic scattering properties of leaves as a function of the leaf orientation distribution in both the zenith and azimuth angle modes. M.G.

N84-21934*# Purdue Univ., Lafayette, Ind.
MEASUREMENT AND MODELING OF THE OPTICAL SCATTERING PROPERTIES OF CROP CANOPIES Abstract Only
V. C. VANDERBILT and L. GRANT *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 33 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20F

Efforts in measuring, analyzing, and mathematically modeling the specular, polarized, and diffuse light scattering properties of several plant canopies and their component parts (leaves, stems, fruit, soil) as a function of view angle and illumination angle are reported. Specific objectives were: (1) to demonstrate a technique for determining the specular and diffuse components of the reflectance factor of plant canopies; (2) to acquire the measurements and begin assembling a data set for developing and testing canopy reflectance models; (3) to design and build a new optical instrument to measure the light scattering properties of individual leaves; and (4) to use this instrument to survey and investigate the information in the light scattering properties of individual leaves of crops, forests, weeds, and horticulture. M.G.

N84-21935*# Hunter Coll., New York. Dept. of Geography.
REFLECTANCE MODELING Abstract Only
A. H. STRAHLER *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 34 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20F

The main thrust of the work conducted is in the modeling of spectral responses of discontinuous conifer forest canopies, considered as collections of conical forms that are illuminated at an angle and cast shadows on contracting background. The three first-year objectives are: (1) modification of the variance-driven model to incorporate overlapping of shadows and crowns; (2) collection and analysis of photographic data to calibrate tree-spacing functions; and (3) collection of field data to determine height, spacing, and shape of conifers in open and closed stands in the Goosenest (California) test area. Modification of the invertible model uses a linear approximation to correct for the reduction in shadow and canopy area that occurs when shadows fall on crowns or tree crowns intersect. Comparison of the results of the approximation with a series of Monte Carlo simulations shows that the mean area covered by crowns or shadows is approximated quite accurately, but the variance calculated departs significantly from simulated values. The analysis of tree spacing patterns using air photos showed that spacing tended to be somewhat regular at a scale approximately equal to the average distance between trees, but at larger distance scales counts of trees in cells could be approximated acceptably by a Poisson (random) function. M.G.

N84-21936*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A STUDY OF THE RELATION BETWEEN CROP GROWTH AND SPECTRA REFLECTANCE PARAMETERS Abstract Only
G. BADHWAR *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 35 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20F

A differential equation describing the temporal behavior of greenness, G(t), with time was developed. The basic equation, $dG(t)/dt = k(t)(1-G/G_m)$ where G sub m is the saturation value of greenness at time, t sub p. It demonstrated that k(t) is linearly proportional to the rate of change of leaf area index. It was also demonstrated that G sub m, t sub p and profile width, are the key to vegetation identification and that the inflection points of the profile are related to the ontogenic state of the plant. These profile features were shown to hold not only throughout the United States corn/soybean growing area, but for the first time in Argentina. A mathematical technique that maximizes the sensitivity of spectral transformation to Leaf Area Index and simultaneously minimizes the sensitivity to all other variables was formulated. Initial results on corn and wheat were obtained. M.F.

N84-21937*# Kansas Univ., Lawrence. Center for Research.
SCATTERING MODELS IN THE MICROWAVE REGIME
A. K. FUNG *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 37 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20N

Scattering from an inhomogeneous layer with irregular boundaries was calculated to model natural terrain such as a layer of vegetation or sea ice. The inhomogeneities were modeled by spherical or disc-shaped discrete scatterers which were small compared with the incident wavelength and were in the far field of one another. It was found that the cross-polarized scattering was dominated by multiple scattering effects and was sensitive to the orientations and distributions of the scatterers. This model has been applied to interpret measurements from vegetation, snow and sea ice. The scattering model was extended to handle disc-shaped scatterers which are comparable to the incident wavelength. The model was used to investigate the relative merits between active versus passive sensing of soil moisture over vegetated terrain. Results indicate that scattering mesurements are more sensitive to soil moisture changes than emission measurements. This is because while both types of measurements

lose sensitivity to soil moisture because of the vegetation layer, the loss is greater for passive than active measurements. M.G.

N84-21938*# Massachusetts Inst. of Tech., Cambridge. Research Lab. for Electronics.
REMOTE SENSING OF EARTH TERRAIN
J. A. KONG *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 38 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 08B

Theoretical models that are useful and practical in relating remote sensing data to the important physical parameters characterizing Earth terrain are developed. The development of models that are useful in data analysis and interpretation, scene simulation, and developing new remote sensing approaches and techniques is discussed. Numerous theoretical models that are applicable to the active and passive remote sensing of plowed fields, atmospheric precipitation, vegetation, and snow fields were developed. The radiative transfer theory is used to interpret the active and passive data as a function of rain rate. Both the random medium model and the discrete scatterer model is used to study the remote sensing of vegetation fields. Due to the non-spherical geometry of the scatterers there is strong azimuthal dependence in the observed data. Thus, the anisotropic random medium model and the discrete scatterer model with nonspherical particles was developed. In order to relate the remote sensing data to the actual physical parameters, the scattering of electromagnetic waves from randomly distributed dielectric scatterers was studied. Both the rigorous random discrete scatterer theory and the strong fluctuation theory are used to derive the backscattering cross section in terms of the actual physical parameters and the results agree well with the data obtained from the snow fields. M.A.C.

N84-21939*# George Washington Univ., Washington, D.C. Dept. of Electrical Engineering and Computer Science.
DISCRETE RANDOM MEDIA TECHNIQUES FOR MICROWAVE MODELING OF VEGETATED TERRAIN Abstract Only
R. H. LANG *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 39 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20N

Microwave remote sensing of agricultural crops and forested regions is studied. Long term goals of the research involve modeling vegetation so that radar signatures can be used to infer the parameters which characterize the vegetation and underlying ground. Vegetation is modeled by discrete scatterers viz, leaves, stems, branches and trunks. These are replaced by glossy dielectric discs and cylinders. Rough surfaces are represented by their mean and spectral characteristics. Average scattered power is then calculated by employing discrete random media methodology such as the distorted Born approximation or transport theory. Both coherent and incoherent multiple scattering techniques are explored. Once direct methods are developed, inversion techniques can be investigated. M.A.C.

N84-21941*# Kansas Univ., Lawrence. Center for Research.
DETERMINATION OF THE SOURCES OF RADAR SCATTERING Abstract Only
R. K. MOORE and R. ZOUGHI *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 41 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 17I

Fine-resolution radar backscattering measurements were proposed to determine the backscattering sources in various vegetation canopies and surface targets. The results were then used to improve the existing theoretical models of terrain scattering, and also to enhance understanding of the radar signal observed by an imaging radar over a vegetated area. Various experiments were performed on targets such as corn, milo, soybeans, grass, asphalt pavements, soil and concrete walkways. Due to the lack of available references on measurements of this type, the obtained results will be used primarily as a foundation or future experiments. The constituent backscattering characteristics of the vegetation canopies was also examined. M.A.C.

N84-21942*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EFFECTS OF VEGETATION CANOPY STRUCTURE ON MICROWAVE SCATTERING Abstract Only
J. F. PARIS *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 42 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20N

The role of canopy structure on microwave backscattering is studied. Structure refers to the size, orientation, and vertical placement of scatterers in the canopy. Models to predict the backscattering coefficient, SIGMAO, of vegetation with explicit biophysical and explicit polarization-dependent parameters were developed. Preparation for field measurements with radar scatterometers was completed. Technical progress included: (1) the modification of the Attema and Ulaby (1977) model and its multilayer variation by Hoekman et al. (1983) to include polarization explicitly (i.e., to allow for separate backscattering cross sections, SIGMA, and extinction cross sections, Q, for each polarization), (2) the investigation of the modified model to isolate canopy element orientation parameters by the rationing of SIGMAO measurements for different polarization combinations, (3) the development of expressions for bistatic scattering and canopy-substrate scattering to supplement the models, (4) the performance of sensitivity analyses on these models, (5) the modification of the Attema and Ulaby model to alloy for changes, (6) the use of the modified model with a seasonal corn data set from Kansas (Eger et al., 1983), and (7) the initiation of preparations for empirical measurements with radar spectrometer and the Mobile Radar Scatterometer in irrigated cropland to test the models. M.A.C.

N84-21943*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATMOSPHERIC EFFECTS ON REMOTE SENSING OF THE EARTH'S SURFACE Abstract Only
R. E. FRASER and Y. KAUFMAN *In its* Fundamental Remote Sensing Sci. Res. Program, Part 1 p 44 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 04A

The main causes and magnitude of the atmospheric effects on remote sensing of the Earth's surface are determined. Theoretical study as well as measurements are included. The knowledge gained from this study will be used to develop atmospheric correction algorithms and to test them with satellite data. In a theoretical investigation of the relative effects of the aerosol optical thickness, absorption, and size distribution on remote sensing, it was found that aerosol absorption has a significant effect on satellite measurements of surface reflectivity. The absorption effect is stronger for high than for low surface reflectances. The aerosol optical thickness is dominant for small surface reflectances. The accuracy of clustering algorithms depends on both parameters. The vegetation index, however, is affected by the optical thickness but only weakly affected by the absorption. A laboratory simulation of the atmospheric effect on the radiance of sunlight scattered from the Earth's surface-atmosphere system was performed. This experiment verified the existence of the adjacency effect (the effect of a bright field on the radiance detected above a dark field) and was used to test 3-D radiative transfer models. In a theoretical study it was found that atmospheric scattering resulting from the adjacency effect reduces the separability between surface classes. M.A.C.

N84-21945*# Los Alamos Scientific Lab., N. Mex. Theoretical Div.
MULTIDIMENSIONAL MODELING OF ATMOSPHERIC EFFECTS AND SURFACE HETEROGENEITIES ON REMOTE SENSING Abstract Only
S. A. GERSTL *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 46 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 04A

A modeling capability that allows a quantitative determination of atmospheric effects on remote sensing including the effects of surface heterogeneities is established. The objectives include: (1)

the adaptation of existing radiative transfer codes to remote sensing applications, (2) the implementation of a realistic atmospheric data base, (3) the definition and verification against field measurements of a coupled atmosphere/canopy model, and (4) the quantitative characterization of the effects of some biophysical canopy parameters and soil surface boundary conditions on satellite-sensed Multispectral Scanner System (MSS) data. Substantial progress was also made in quantifying the effects of varying atmospheric turbidity and different non-Lambertian and specular ground reflectances on MSS data and its transforms like greenness and brightness. M.A.C.

N84-21946*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
BIDIRECTIONAL SPECTRAL REFLECTANCE OF EARTH RESOURCES: INFLUENCE OF SCENE COMPLEXITY AND ATMOSPHERIC EFFECTS ON REMOTE SENSING Abstract Only
D. J. DINER *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 47 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 04A

Practical methods for remote sensing when scene complexity and atmospheric effects modify intrinsic reflective properties are developed. The radiation history from ground to space of light reflected from individual leaves is initially multiply scattered within the crop canopy, whose geometry provides a controlling influence, then scattered and attenuated as a result of transmission through the Earth's atmosphere. The experimental and theoretical tools for studying these effects quantitatively are under development. A new radiative transfer code which uses Fourier transforms to solve the 3-D equation of transfer was developed. The initial version permits inhomogeneous non-Lambertian surfaces but assumes horizontal uniformity for the atmosphere. The computational results are in excellent agreement with Monte Carlo calculations. Laboratory apparatus to study the variation of spectral reflectance of individual leaves as a function of illumination incidence angle and reflection angle was used. These data can then be used in models to determine canopy scattering effects. Stress tests by observing leaf reflectance at 0.9 microns as a function of time following clipping from the stem was performed. A reflectance increase due to loss of water has been observed. M.A.C.

N84-21947*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPREHENSIVE UNDERSTANDING FOR VEGETATED SCENE RADIANCE RELATIONSHIPS
D. S. KIMES and D. W. DEERING *In its* Fundamental Remote Sensing Sci. Res. Program, Part 1 p 75-86 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20F

The improvement of our fundamental understanding of the dynamics of directional scattering properties of vegetation canopies through analysis of field data and model simulation data is discussed. Directional reflectance distributions spanning the entire existance hemisphere were measured in two field studies; one using a Mark III 3-band radiometer and one using rapid scanning bidirectional field instrument called PARABOLA. Surfaces measured included corn, soybeans, bare soils, grass lawn, orchard grass, alfalfa, cotton row crops, plowed field, annual grassland, stipa grass, hard wheat, salt plain shrubland, and irrigated wheat. Some structural and optical measurements were taken. Field data show unique reflectance distributions ranging from bare soil to complete vegetation canopies. Physical mechanisms causing these trends are proposed based on scattering properties of soil and vegetation. Soil exhibited a strong backscattering peak toward the Sun. Complete vegetation exhibited a bowl distribution with the minimum reflectance near nadir. Incomplete vegetation canopies show shifting of the minimum reflectance off of nadir in the forward scattering direction because both the scattering properties or the vegetation and soil are observed. E.A.K.

N84-21948*# Purdue Univ., Lafayette, Ind.
MEASUREMENT AND MODELING OF THE OPTICAL SCATTERING PROPERTIES OF CROP CANOPIES
V. C. VANDERBILT and L. GRANT *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 87-91 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20F

Progress and results in the measurement and scattering properties of crop canopies was examined. The following accomplishments are reported: (1) analysis of inhouse polarization, Sun/view angle data set of wheat was completed; (2) polarization photometer instrument system was completed; (3) light polarization properties (measured with polarization photometer) of individual plant leaves initiated, and twenty two species/varieties were measured before frost; (4) light polarizing properties of both moisture-stressed corn leaves and diseased wheat leaves were measured; (5) Sun/view angle data and ancillary data were acquired on two wheat canopies on two dates and on one sorghum canopy on two adjacent days. E.A.K.

N84-21949*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A STUDY OF THE RELATION BETWEEN CROP GROWTH AND SPECTRA REFLECTANCE PARAMETERS
G. BADHWAR *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 96-105 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20F

The relationship between crop growth and spectra reflectance parameters was studied. The dynamic behavior of canopy reflectance versus time and the relationship of trajectories to canopy dynamics, ontogeny and morphology was investigated. The determination of which transformations of spectral data best suited for observing key canopy characteristics, such as leaf area index and vegetation identification are understood. A physical basis to understand how various spectral transform trajectories depend on vegetation type and models that describe the time delayed interaction of reflectance in the chlorophyll and water absorption bands to monitor stress were formulated. The general process of physical understanding of canopy reflectance is evaluated and existing canopy models are improved. E.A.K.

N84-21950*# Kansas Univ., Lawrence. Center for Research.
SCATTERING MODELS IN THE MICROWAVE REGIME
A. K. FUNG *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 106-121 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20N

Vegetation growth observations by microwave scattering was investigated. The purpose of the study was: (1) to develop scattering models for an inhomogeneous medium; (2) to develop scattering models for an irregular surface; (3) to combine volume and surface scattering to obtain useful scattering and emission models for terrains; and (4) to apply the developed model to the interpretation of measured data and the design of future experiments. E.A.K.

N84-21951*# Massachusetts Inst. of Tech., Cambridge. Research Lab. for Electronics.
REMOTE SENSING OF EARTH TERRAIN
J. A. KONG *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 122-147 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 08B

Work performed on remote sensing of each terrain is outlined. The purpose of the investigation was: (1) development of theoretical models for remote sensing of Earth terrain; (2) data analysis and interpretation using the models developed; (3) scene simulation; and (4) development of new remote sensing approaches and techniques. E.A.K.

N84-21952*# George Washington Univ., Washington, D.C. Dept. of Electrical Engineering and Computer Science.
DISCRETE RANDOM MEDIA TECHNIQUES FOR MICROWAVE MODELING OF VEGETATED TERRAIN
R. H. LANG *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 148-157 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20N

Microwave modeling of vegetated terrain was investigated. The purpose was to: (1) use discrete scatter theory to model vegetation (crops and forested regions) in microwave region; (2) develop models for scatterers and ground; (3) multiple scattering analysis relate model parameters to average scattered power; and (4) develop inversion techniques to remotely determine model parameters. E.A.K.

N84-21953*# Kansas Univ., Lawrence. Remote Sensing Lab.
MEASURING AND MODELING OF THE DIELECTRIC PROPERTIES AND ATTENUATION OF VEGETATION
F. T. ULABY *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 158-160 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 20N

The dielectric properties and attenuation of vegetation was measured and modeled. The purpose was to: (1) measure the microwave dielectric properties of vegetation material as a function of moisture content and microwave frequency; (2) develop dielectric mixing models for the vegetation-water mixture; (3) develop a model for the loss factor of a vegetation canopy; (4) relate the results of (1) and (2) to (3); and (5) test the model in (3) against direct canopy transmission measurements. E.A.K.

N84-21954*# Kansas Univ., Lawrence. Center for Research.
DETERMINATION OF THE SOURCES OF RADAR SCATTERING
R. K. MOORE, R. ZONGHI, L. K. WU, A. AFIFI, and F. T. ULABY *In* NASA Goddard Space Flight Center Fundamental Remote Sensing Sci. Res. Program, Part 1 p 161-175 Mar. 1984
Avail: NTIS HC A12/MF A01 CSCL 17I

The sources of radar backscattering sources in vegetation canopies and surface targets were determined. The fundamental questions were, how much of backscattering is due to direct volume backscatter by the canopy, the soil, and indirect backscatter by soil/vegetation, and what are the relative roles in terms of scattering. The results for crops, milo plant, wheat plant, soybean plant, and surface targets are reported. E.A.K.

N84-21976# Bristol Univ. (England). nj943970
AGRISTARS STAGE 3: THE BRISTOL INTERACTIVE SCHEME (BIAS) FOR SATELLITE-IMPROVED RAINFALL MONITORING: FURTHER DEVELOPMENTS, TESTING AND METHOD DESCRIPTION Final Report
E. C. BARRETT 31 Aug. 1983 104 p refs
(Contract NA82SA-C-00083)
(PB84-150630; NOAA-84012601) Avail: NTIS HC A06/MF A01 CSCL 04B

Since about 1970 interest in the possibility of using weather satellite data as an aid in rainfall monitoring has steadily grown. The initiation of the AgRISTARS (Agriculture & Resource Inventory Surveys through Aerospace Remote Sensing) Program in 1979 afforded a new focus for such work, linked particularly to the aims of developing an early warning system for conditions affecting crop production. The 'Bristol Method' is a cloud-indexing technique of satellite-improved rainfall monitoring designed originally to combine conventional and polar-orbiting satellite data into single assessments of 12-hourly rainfall totals. As such it has been identified by NOAA as a potentially useful complement to geostationary (life-history) techniques for the rainfall segments of AgRISTARS. GRA

02

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

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

A84-19861* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
REMOTE SENSING FOR RURAL DEVELOPMENT PLANNING IN AFRICA
C. DUNFORD (Arizona Remote Sensing Center, Tucson, AZ), D. A. MOUAT (NASA, Ames Research Center, Moffett Field, CA), M. NORTON-GRIFFITHS (Ecosystems, Ltd., Nairobi, Kenya), and D. M. SLAYMAKER (Exploration Photography, Tucson, AZ) ITC Journal (ISSN 0303-2434), no. 2, 1983, p. 99-108. Sponsorship: U.S. Agency for International Development. refs
(Contract AID-AFR-C-1556)

Multilevel remote-sensing techniques were combined to provide land resource and land-use information for rural development planning in Arusha Region, Tanzania. Enhanced Landsat imagery, supplemented by low-level aerial survey data, slope angle data from topographic sheets, and existing reports on vegetation and soil conditions, was used jointly by image analysts and district-level land-management officials to divide the region's six districts into land-planning units. District-planning officials selected a number of these land-planning units for priority planning and development activities. For the priority areas, natural color aerial photographs provided detailed information for land-use planning discussions between district officials and villagers. Consideration of the efficiency of this remote sensing approach leads to general recommendations for similar applications. The technology and timing of data collection and interpretation activities should allow maximum participation by intended users of the information. Author

A84-21601
SPACEBORNE METHODS FOR INVESTIGATING THE NATURAL ENVIRONMENT OF SIBERIA AND THE FAR EAST [KOSMICHESKIE METODY IZUCHENIIA PRIRODNOI SREDY SIBIRI I DAL'NEGO VOSTOKA]
A. L. IANSHIN, ED. and A. S. ALEKSEEV, ED. Novosibirsk, Izdatel'stvo Nauka, 1983, 193 p. In Russian.

Topics discussed include complex methods for the processing of aerial and spaceborne photographs to reveal crustal features in Siberia and the Far East; multiple-aspect utilization of the Meteor-satellite system for geological purposes; investigations of the variability of the spectral brightness coefficient of forest vegetation; and the prospects of using aerial and spaceborne data in forest protection. Consideration is also given to a transformation method for revealing semihidden objects on space images; the identification of geological formations in the interactive mode; a system for the remote monitoring and operational forecasting of forest-fire propagation; and a statistical-simulation algorithm for calculating the frequency-contrast characteristics of the atmosphere. B.J.

A84-22896
THE CHANNEL CORRELATION METHOD FOR ESTIMATING AEROSOL LEVELS FROM MULTISPECTRAL SCANNER DATA
J. F. POTTER (Lockheed Engineering and Management Services Co., Inc., Las Vegas, NV) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, Jan. 1984, p. 43-52. Research supported by the Lockheed Engineering and Management Services Co., Inc.; U.S. Environmental Protection Agency. refs
(Contract EPA-68-03-3049)

The present investigation is concerned with the estimation of atmospheric aerosol levels from airborne multispectral scanners.

It is assumed that the aerosols are uniform in composition and size distribution. A study is conducted regarding the possibility of using correlations between channels to estimate the aerosol level for each pixel or for small groups of pixels which are called 'cells'. The considered channel correlation method is based on the findings that (1) the data from certain MSS channels are highly correlated with the data from certain other channels and (2) aerosols have a different effect on different MSS channels. G.R.

A84-24648* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ISLSCP - INTERNATIONAL SATELLITE LAND-SURFACE CLIMATOLOGY PROJECT
S. I. RASOOL (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) and H. J. BOLLE (Innsbruck, Universitaet, Innsbruck, Austria) American Meteorological Society, Bulletin (ISSN 0003-0007), vol. 65, Feb. 1984, p. 143-148. NASA-supported research.

Three workshops have been conducted in order to define a research program which would in the course of five years lead to a concensus on methodologies for the conversion of satellite-measured irradiances into quantitative data concerning the earth's surface. Standardized data analysis algorithms would be the major product of this concensus. The three workshops have recommended the evaluation of retrospective satellite data, starting from the July, 1972 initial operation of Landsat-1, in order to demonstrate whether they can be used to detect climate-related or man-induced changes on the earth's surface quantitatively. Also suggested is the validation of current satellite data with ground truth campaigns in several different regions, and the preparation of an operational phase involving the testing of the selected data extraction algorithms for conversion of satellite-measured radiances into albedo, moisture, and vegetation data. O.C.

A84-26682
COOLING TOWER PLUME RISE ANALYSES BY AIRBORNE LIDAR
E. E. UTHE (SRI International, Atmospheric Science Center, Menlo Park, CA) Atmospheric Environment (ISSN 0004-6981), vol. 18, no. 1, 1984, p. 107-119. Research sponsored by the U.S. Department of Energy and California Energy Commission. refs

As part of the Atmospheric Studies in Complex Terrain (ASCOT) program, five cooling-tower plume experiments were conducted at The Geysers geothermal area in California during August 1981. The experiments were designed to investigate plume behavior during conditions of valley nocturnal drainage flow and daytime vertical mixing on a mountain ridge. The Airborne Lidar Plume and Haze Analyzer (ALPHA-1) system was used during the experiments to observe plume geometry and aerosol structure of the boundary layer. Subvisible plume rise derived from the backscatter signatures is related to visible plume-rise results recently published. This analysis indicates that the lidar-observed plumes are about 10 times higher than visually observed plumes. The lidar-observed plume rise seemed to correspond with heights of elevated aerosol layers that typically indicate the presence of temperature inversions. Pictorial displays are presented which provide information on atmospheric behavior over mountainous terrain. Author

A84-27379
LAND CLASSIFICATION OF PART OF CENTRAL MACEDONIA (GREECE) BY THE USE OF REMOTE-SENSING TECHNIQUES
T. ASTARAS and N. SILLEOS (Salonika, University, Salonika, Greece) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 289-302. refs

The objective of this study was the classification of a Mediterranean humid mesothermal area (Csa) of central Macedonia into land systems, using LANDSAT images (1:250,000 in scale). The information obtained was combined with field surey work in order to study the wide range of natural environmental conditions of the area. In general the survey area includes mountainous ridges up 2054 m, hills up to 300 m, plains either near flat or gently undulating and tectonic fill valleys about 150m in elevation. During the survey the area was subdivided into 31 land systems according to distinctive combination of physiography, soils and vegetation. The land-system map produced by this method is of considerable interest because it provides the framework for more detailed geological, geomorphological, soil and land-use studies. Author

A84-28693
ECONOMIC EVALUATION OF THE UTILIZATION OF SPACE REMOTE-SENSING DATA IN LAND-RECLAMATION PROSPECTING [OB EKONOMICHESKOI OTSENKE ISPOL'ZOVANIIA MATERIALOV KOSMICHESKOI S'EMKI ZEMLI V MELIORATIVNYKH IZYSKANIIAKH]
V. I. GORBUNOV (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Gidrotekhniki i Melioratsii, Tomsk, USSR) and N. A. ROMANOVA (Nauchno-Issledovatel'skii Institut Prikladnoi Geodezii, Novosibirsk, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 73-78. In Russian. refs

A84-29000
DOMESTIC SATELLITE SERVICES FOR RURAL AREAS
R. D. BRISKMAN (COMSAT General Corp., Washington, DC) IEEE Communications Magazine (ISSN 0163-6804), vol. 22, March 1984, p. 35-38.

It is pointed out that rural areas can be served by a domestic satellite communications system in an efficient and economical manner. To accomplish such efficiency and economy, the engineering parameters of the satellite communications system must be analyzed and selected with a view toward achieving the desired performance at minimum total cost. The equipment for an entire rural satellite communication system serving 1200 communities can be acquired for approximately $200 million (1983 dollars). An identical system, however, could also be implemented at much lower capital costs by leasing space segment capacity from existing satellite systems (Briskman and Savage, 1983). C.R.

A84-29065* National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
A PROGRAM IN GLOBAL BIOLOGY
D. W. MOONEYHAN (NASA, National Space Technology Laboratories, Earth Resources Laboratory, Bay Saint Louis, MS) AIAA, SAE, ASME, AIChE, and ASMA, Intersociety Conference on Environmental Systems, 13th, San Francisco, CA, July 11-13, 1983. 11 p.
(SAE PAPER 831136)

NASA's Global Biology Research Program and its goals for greater understanding of planetary biological processes are discussed. Consideration is given to assessing major pathways and rates of exchange of elements such as carbon and nitrogen, extrapolating local rates of anaerobic activities, determining exchange rates of ocean nutrients, and developing models for the global cycles of carbon, nitrogen, sulfur, and phosphorus. Satellites and sensors operating today are covered: the Nimbus, NOAA, and Landsat series. Block diagrams of the software and hardware for a typical ground data processing and analysis system are provided. Samples of the surface cover data achieved with the Advanced Very High Resolution Radiometer, the Multispectral Scanner, and the Thematic Mapper are presented, as well as a productive capacity model for coastal wetlands. Finally, attention is given to future goals, their engineering requirements, and the necessary data analysis system. C.M.

A84-29689#
APPLICATION OF LARGE-SCALE CIR AERIAL PHOTOGRAPHS TO ENVIRONMENTAL PROTECTION AND PLANNING [ANWENDUNG GROSSMASSSTAEBIGER CIR-LUFTAUFNAHMEN FUER UMWELTSCHUTZ UND PLANUNG]
K.-U. KOMP (Hansa Luftbild GmbH, Muenster, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Munich, West Germany, Oct. 17-19, 1983. 8 p. In German.
(DGLR PAPER 83-158)

The use of large-scale aerial photographs of the central European region to provide an exact, detailed, short-term, and comprehensive regional analysis for practical environmental planning is discussed. The use of aerial photography for thematic picture evaluation, documentation of catastrophes, of changes in ground water, and of epidemics, and for regional and landscape planning is discussed. C.D.

A84-29723
L- AND X-BAND LIKE- AND CROSS-POLARIZED SYNTHETIC APERTURE RADAR FOR INVESTIGATING URBAN ENVIRONMENTS
B. N. HAACK Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, March 1984, p. 331-340. refs

Four synthetic aperture airborne radar data sets, L- and X-band like- and cross-polarizations, were spatially registered to a common map base for a portion of the Los Angeles basin. Texture calculations fo the four SAR data sets were also obtained. Training sites for eight urban land-cover types were located, and statistics were determined for the eight data files. The training site statistics were examined for intraclass variability, the number of channels necessary for classification, and the best channels for classification using transformed divergence calculations. The X-band like-polarized data were the most useful, the L-band cross-polarized data were the least useful among the original data sets, and the texture calculations used in this study did not contribute toward urban cover type delineations. Author

N84-16616*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
URBAN LAND USE OF THE SAO PAULO METROPOLITAN AREA BY AUTOMATIC ANALYSIS OF LANDSAT DATA [USO DO SOLO URBANO DA AREA METROPOLITANA DE SAO PAULO ATRAVES DA ANALISE AUTOMATICA DE DADOS LANDSAT]
N. D. J. PARADA, Principal Investigator, M. NIERO, and C. FORESTI Jun. 1983 58 p refs In PORTUGUESE; ENGLISH summary Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E84-10069; NASA-CR-173219; NAS 1.26:173219; INPE-2788-RPE/437) Avail: NTIS HC A04/MF A01 CSCL 08B

The separability of urban land use classes in the metropolitan area of Sao Paulo was studied by means of automatic analysis of MSS/LANDSAT digital data. The data were analyzed using the media K and MAXVER classification algorithms. The land use classes obtained were: CBD/vertical growth area, residential area, mixed area, industrial area, embankment area type 1, embankment area type 2, dense vegetation area and sparse vegetation area. The spectral analysis of representative samples of urban land use classes was done using the 'Single Cell' analysis option. The classes CBD/vertical growth area, residential area and embankment area type 2 showed better spectral separability when compared to the other classes. Author

N84-16619*# Kansas Univ., Lawrence. Space Technology Center.
AN INVENTORY OF STATE NATURAL RESOURCES INFORMATION SYSTEMS Final Report
E. A. MARTINKO, Principal Investigator, L. M. CARON, and D. S. STEWART Jan. 1984 400 p refs ERTS
(Contract NAG2-201)
(E84-10072; NASA-CR-173222; NAS 1.26:173222) Avail: NTIS HC A17/MF A01 CSCL 05B

Data bases and information systems developed and maintained by state agencies to support planning and management of environmental and nutural resources were inventoried for all 50 states, Puerto Rico, and U.S. Virgin Islands. The information obtained is assembled into a computerized data base catalog which is throughly cross-referecence. Retrieval is possible by code, state, data base name, data base acronym, agency, computer, GIS capability, language, specialized software, data category name, geograhic reference, data sources, and level of reliability. The 324 automated data bases identified are described. A.R.H.

N84-17651*# National Aeronautics and Space Administration, Washington, D. C. Office of Space Science and Applications.
CURRENT TRENDS AND RESEARCH CHALLENGES IN LAND REMOTE SENSING
M. SETTLE *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 3-10 Sep. 1983
Avail: NTIS HC A09/MF A01

The use of space technology to conduct repetitive global surveys of terrestrial surface conditions is reviewed. The state-of-the-art is determined by the measurement capabilities of orbital sensor systems, the maneuvering and data transmission capabilities of orbital platforms, and the sophistication of the user community. Introduction of the Landsat Thematic Mapper and SPOT sensor systems and operational use of the Space Shuttle are discussed. Research challenges of the 1980's are related to the removal of atmospheric and topographic effects in remotely sensed imagery, the extraction of information from high dimensionality data sets, and the ability to conduct meaningful ground truth surveys to support the analysis and interpretation of remotely sensed data. Author (ESA)

N84-17670# Maryland Univ., College Park. Computer Vision Lab.
APPLICATION OF HIERARCHICAL DATA STRUCTURES TO GEOGRAPHICAL INFORMATION SYSTEMS Contract Report, 29 Jul. 1982 - 29 Jun. 1983
H. SAMET and A. ROSENFELD Fort Belvoir, Va. Army Engineer Topographic Labs. 30 Sep. 1983 84 p
(Contract DAAK70-81-C-0059)
(AD-A134999; TR-1327; ETL-0337) Avail: NTIS HC A05/MF A01 CSCL 08B

The purposes of this investigation were twofold: (1) to construct a geographic information system based on the quadtree hierarchical data structure, and (2) to gather statistics to allow the evaluation of the usefulness of this approach to geographic information system organization. To accomplish the above objectives, in Phase I of the project a database was built that contained three maps supplied under the terms of the contract. These maps described the flood plain, elevation contours, and language classes of a region in California. The map regions were represented in quadtree form, and algorithms were developed for basic operations on quadtree-represented regions (set-theoretic operations, point-in-region determination, region property computation, and submap generation). The efficiency of these algorithms was studied theoretically and experimentally. On Phase II of the project, the following additional tasks were performed: (a) Query Language Design; (b) Database updating; (c) Point and linear feature data construction. GRA

N84-17676# Autometric Corp., Inc., Falls Church, Va.
APPS-4 (ANALYTICAL PHOTOGRAMMETRIC PROCESSING SYSTEM-4) REMOTE SENSING APPLICATIONS GUIDE
J. D. PEROUTKY Fort Belvoir, Va. Army Engineer Topographic Labs. Jun. 1983 86 p
(Contract DAAK70-81-C-0261)
(AD-A134977; REPT-901-0081; ETL-0333) Avail: NTIS HC A05/MF A01 CSCL 14B

This report describes the Computer-Assisted Photo Interpretation Research (CAPIR) facility at the U.S. Army Engineer Topographic Laboratories (USAETL) and discusses its use, primarily with the APPS-IV analytical stereoplotter, for various remote sensings applications. The components of the APPS-IV and the geographic information system (AUTOGIS) are described, followed by discussions of the capabilities and advantages of a CAPIR-type system. A general workflow is also included as a guide to the undertaking of this type project. GRA

N84-17678# Oak Ridge National Lab., Tenn. Computer Sciences Div.
ESTIMATION OF SMALL AREA POPULATONS USING REMOTE SENSING AND OTHER APPROACHES
R. B. HONEA, B. L. SHUMPERT, R. G. EDWARDS, S. M. MARGLE, P. R. COLEMAN, J. L. SMYRE, R. M. RUSH, and R. C. DURFEE 1983 31 p refs Presented at the Energy Resource Management, San Francisco, 22-26 Aug. 1983
(Contract W-7405-ENG-26)
(DE84-003404; CONF-830847-6) Avail: NTIS HC A03/MF A01

This paper documents the results of an assessment of a variety of techniques for estimating residential population for a five-mile radial grid around a nuclear power plant located near Philadelphia, PA. Techniques evaluated ranged from the use of air photos to infer population from housing distributions to the use of LANDSAT data to characterize probable residential population around the plant site. Although the techniques involving the use of LANDSAT data provided good results, a simple proportional area allocation method and the current procedure used by Oak Ridge National Laboratory for the Nuclear Regulatory Commission were among the best techniques. Further research using other sites and better resolution satellite data is recommended to investigate the possible refinement of population estimates using remote sensing media. DOE

N84-17757# Science Applications, Inc., San Diego, Calif. Electronic Vision Systems Div.
SATELLITE MEASUREMENTS OF ATMOSPHERIC AEROSOLS Annual Report, 1 Dec. 1982 - 18 Nov. 1983
M. GRIGGS 23 Nov. 1983 34 p
(Contract N00014-77-C-0489)
(AD-A135241; SAI-83/1239) Avail: NTIS HC A03/MF A01 CSCL 04B

Analysis of the Midway data set shows that the aerosol content determined with the two-channel technique is less accurate than with the one-channel method. An error analysis indicates that the main error sources affecting the use of the two-channel technique are the unknown atmospheric ozone and water vapor contents and the AVHRR sensor noise; if it is assumed that the ozone and water vapor contents would be known in operational use of the technique, then only the AVHRR sensor noise is of concern. Author (GRA)

N84-18100# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOGRAPHY INFORMATION SYSTEMS PROJECT [PROJETO DE UM SISTEMA GEOGRAFICO DE INFORMACAO]
G. C. NETO, F. R. D. VELASCO, and J. L. DEOLIVEIRA Jun. 1983 20 p refs In PORTUGUESE; ENGLISH summary Presented at the 10th Integrated Software and Hardware Seminar, Campinas, Brazil, 25-29 Jul. 1983
(INPE-2782-PRE/348) Avail: NTIS HC A02/MF A01

A geographic information system (GIS) project that enables combining of satellite imagery and other data such as maps and reports is described. The main technical difficulties in a GIS project are discussed, as well as the solution found in the literature and the options chosen for the GIS. Author

N84-19985# Geological Survey, Reston, Va. National Mapping Div.
RESEARCH, INVESTIGATIONS AND TECHNICAL DEVELOPMENTS: NATIONAL MAPPING PROGRAM, 1982
1983 90 p refs
(USGS-OPEN-FILE-83-568) Avail: NTIS HC A05/MF A01

Cartographic systems and techniques, digital cartographic systems, photogrammetry and surveying, image mapping, remote sensing data analysis, land use and land cover studies, and resource information studies are addressed. N.W.

N84-19987# Geological Survey, Reston, Va.
LAND USE AND LAND COVER DIGITAL DATA
R. G. FEGEAS, R. W. CLAIRE, S. C. GUPTILL, K. E. ANDERSON, and C. A. HALLAM 1983 29 p refs
(GS-CIRC-895-E) Avail: NTIS HC A03/MF A01

Some of the pertinent issues relative to digital cartographic data standards, are described, the digital cartographic data standards currently in use within the USGS are documented and the efforts of the USGS related to the definition of national digital cartographic data standards are detailed. The Geographic Information Retrieval and Analysis System that is used in conjunction with the USGS land use and land cover classification system to encode, edit, manipulate, and analyze land use and land cover digital data is described. Author

N84-19988*# *Environmental Systems Research Inst., Redlands, Calif.*
REVIEW AND SYNTHESIS OF PROBLEMS AND DIRECTIONS FOR LARGE SCALE GEOGRAPHIC INFORMATION SYSTEM DEVELOPMENT Final Report
A. R. BOYLE, J. DANGERMOND, D. MARBLE, D. S. SIMONETT, and R. F. TOMLINSON Apr. 1983 82 p
(Contract NAS2-11346)
(NASA-CR-166563; NAS 1.26:166563) Avail: NTIS HC A05/MF A01 CSCL 08B

Problems and directions for large scale geographic information system development were reviewed and the general problems associated with automated geographic information systems and spatial data handling were addressed. Author

N84-21418*# Pennsylvania State Univ., University Park. Office for Remote Sensing of Earth Resources.
DEVELOPMENT OF A DATA MANAGEMENT FRONT-END FOR USE WITH A LANDSAT-BASED INFORMATION SYSTEM Final Report, Feb. - Dec. 1982
B. J. TURNER Dec. 1982 42 p
(Contract NAS5-26468)
(NASA-CR-175151; NAS 1.26:175151) Avail: NTIS HC A03/MF A01 CSCL 05B

The development and implementation of a data management front-end system for use with a LANDSAT based information system that facilitates the processsing of both LANDSAT and ancillary data was examined. The final tasks, reported on here, involved; (1) the implementation of the VICAR image processing software system at Penn State and the development of a user-friendly front-end for this system; (2) the implementation of JPL-developed software based on VICAR, for mosaicking LANDSAT scenes; (3) the creation and storage of a mosiac of 1981 summer LANDSAT data for the entire state of Pennsylvania; (4) demonstrations of the defoliation assessment procedure for Perry and Centre Counties, and presentation of the results at the 1982 National Gypsy Moth Review Meeting, and (5) the training of Pennsylvania Bureau of Forestry personnel in the use of the defoliation analysis system. M.A.C.

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A84-20750
EVALUATION OF GEOMETRICAL ERROR COMPONENTS IN MULTISPECTRAL CLASSIFICATION [ABSCHAETZUNG EINIGER GEOMETRISCHER FEHLERKOMPONENTEN BEI DER MULTISPEKTRALEN KLASSIFIZIERUNG]
H.-P. BAEHR (Karlsruhe, Universitaet, Karlsruhe, West Germany) Bildmessung und Luftbildwesen (ISSN 0006-2421), vol. 52, Jan. 1984, p. 23-29. In German. refs

The sources of error in the classification of multispectral remote-sensing data (such as Landsat images) are investigated, applying analysis techniques developed in geodesy and photogrammetry. The common statistical basis of remote sensing and geodesy is demonstrated: both the probability-density approach of geodesy and its application in the maximum-likelihood method in classification assume a normal distribution and seek to reduce input data to that form. The error associated with mixed signatures at the edges of an object is exmined quantitatively as it affects digital area determination and object classification. The relatively high values associated with the small-area, widely varying land use typical of Central Europe place a theoretical limit on the accuracy obtainable using a sensor of given resolution. The results of numerical calculations are presented graphically, and some other potential sources of error are indicated T.K.

A84-21421
HIGHER HARMONIC EFFECTS OF THE EARTH'S GRAVITATIONAL FIELD FROM POST-GLACIAL REBOUND AS OBSERVED BY LAGEOS
J. C. ALEXANDER (Maryland, University, College Park, MD) Geophysical Research Letters (ISSN 0094-8276), vol. 10, Nov. 1983, p. 1085-1087. NSF-supported research. refs

Recently, long-term orbital data from the artificial satellite Lageos have been analyzed to determine the rate of post-glacial rebound. Rubincam (1983) has compared the observed values against values derived from two realistic earth models (Wu-Peltier L1,L2), working with the second harmonic mode of excitation. The data support model L1, with a uniform mantle viscosity of 10 to the 22nd poise, over L2, with a lower mantle viscosity of 10 to the 23rd poise. The higher degree harmonic contributions are found to be significant, and considerably strengthen the support for model L1. Such calculations are performed using the same parameter values for glaciation as Rubincam, and also values due to Peltier and coworkers (1982). It is also shown that a similar analysis of a data from the satellite Starlette is less likely to be as definitive as analysis of Lageos data, since there are significant contributions from very high harmonics, indicating that the behavior of the earth must be known in much greater detail. Author

A84-23678*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSTGLACIAL REBOUND OBSERVED BY LAGEOS AND THE EFFECTIVE VISCOSITY OF THE LOWER MANTLE
D. P. RUBINCAM (NASA, Goddard Space Flight Center, Geodynamics Branch, Greenbelt, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, Feb. 10, 1984, p. 1077-1087. refs

Sixty-four observations of the orbital node made by the Lageos satellite over a five year time interval reveal an acceleration of (-8.1 + or - 1.8) x 10 to the -8 power arcseconds day/2 due to a source which is not presently modeled in the GEODYN orbit determination computer program. This acceleration cannot be explained by the ocean tide with 18.6 year period, assuming it to be an equilibrium tide. Instead it seems to be due to postglacial rebound, which changes the J(2) coefficient in the spherical harmonic expansion of the earth's gravitational field at the rate of (-8.2 + or - 18) x 10 to the -19th power/s; this in turn accelerates the node. This rate does not agree with the -32 x 10 to the -19th power/s predicted by Wu and Peltier's (1982) L2 model, which has upper and lower mantle effective viscosities of 10 to the 21st and 22nd powers Pa's, respectively. It does agree well with their L1 model, which gives about 10 x 10 to the 19th power/s. Since the effective viscosity is 10 to the 21st power Pa s throughout the entire mantle in the L1 model, the results support the contentions that the efective viscosity is near 10 to the 21st power Pa s everyhere in the mantle, and this relatively low value for the effective viscosity may have permitted several degrees of polar wander due to glaciation during the Quaternary Ice Age. Previously announced in STAR as N84-13705 A.R.H.

A84-23679#
A DETAILED VIEW OF THE SOUTH PACIFIC GEOID FROM SATELLITE ALTIMETRY
D. T. SANDWELL (NOAA, National Oceanic Service, Rockville, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, Feb. 10, 1984, p. 1089-1104. refs

Images of sea surface undulations in the South Pacific have been constructed from GEOS 3 and SEASAT altimeter data. A survey is made of the various forms of isostatic compensation of seafloor topography, in particular the thermal compensation mechanism associated with oceanic fracture zones and hot spot swells. The altimetric technique for constructing subsatellite geoid profiles from both altimeter and tracking data is briefly discussed. Ephemeris error and the topographically produced geoid undulations are used to arrive at a simple map construction technique which is discussed. Sampling problems, interpolation schemes, and image processing techniques are addressed. Grey-tone images of the geoid constructed from the two components of the deflection from the vertical are presented, and the images are compared with recent bathymetric charts of the South Pacific in order to locate a number of previously undetected large seamounts. C.D.

A84-25411
INSTRUMENT DEVELOPMENT FOR APPLICATIONS IN REMOTE SENSING, PHOTOGRAMMETRY, GEOPHYSICS, AND GEODESY [INSTRUMENTENENTWICKLUNGEN FUER ANWENDUNGSAUFGABEN DER FERNERKUNDUNG, PHOTOGRAMMETRIE, GEOPHYSIK UND GEODAESIE]
G. BARTHEL, B. KUNKEL, and D. MEISSNER (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) (Hermann-Oberth-Gesellschaft, Symposium on Earth Observation and Remote Sensing by Satellites, Hanover, West Germany, May 21, 1982) Acta Astronautica (ISSN 0094-5765), vol. 11, Jan. 1984, p. 61-72. In German.

The modular optoelectronic multispectral scanner MOMS-01, which is a CCD camera based on the 'push broom' principle, is described in terms of its flight configuration. This instrument is the first European-built imaging system to be sent into space for remote sensing. Follow-on developments for the two-channel version will include a high-resolution panchromatic stereo module for thematic mapping and two additional spectral channels in the reflective infrared, offering the potential for first-rate interpretation in future missions. Three developments in the area of laser technology are envisioned: a picosecond pulsed laser system for measuring movements of the earth's crust and for geodetic applications, a CO2 laser for high-precision Doppler measurements, and a laser range finder for intersatellite distance measurements. C.D.

A84-27763*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE GEOPOTENTIAL RESEARCH MISSION - MAPPING THE NEAR EARTH GRAVITY AND MAGNETIC FIELDS

P. T. TAYLOR, T. KEATING, D. E. SMITH, R. A. LANGEL, C. C. SCHNETZLER, and W. D. KAHN (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 481-488.

The Geopotential Research Mission (GRM), NASA's low-level satellite system designed to measure the gravity and magnetic fields of the earth, and its objectives are described. The GRM will consist of two, Shuttle launched, satellite systems (300 km apart) that will operate simultaneously at a 160 km circular-polar orbit for six months. Current mission goals include mapping the global geoid to 10 cm, measuring gravity-field anomalies to 2 mgal with a spatial resolution of 100 km, detecting crustal magnetic anomalies of 100 km wavelength with 1 nT accuracy, measuring the vectors components to + or - 5 arc sec and 5 nT, and computing the main dipole or core field to 5 nT with a 2 nT/year secular variation detection. Resource analysis and exploration geology are additional applications considered. C.M.

A84-27797#

IMAGE ANALYSIS OF A DIGITAL TERRAIN MODEL (DTM) OF AUSTRALIA

R. F. MOORE and C. J. SIMPSON (Bureau of Mineral Resources, Geology and Geophysics, Canberra, Australia) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 891-901. refs

Images of the topography of Australia (DTM) have been created from a digital data file of about 320,000 topographic spot heights measured during the gravity survey of Australia, resampled on a regular grid, and manipulated with a Comtal image analysis system to enhance topograhic features. Three manipulations: pseudocolor transformation, bit-plane images, and synthetic reflectance images are discussed to give an idea of the range of computer techniques that can be used to enhance continental topography for geologic or related study, in particular the detection of linear, curvilinear, or circular features which may influence exploration strategy. Improvements are inevitable in this new technique, which is applicable to any regional data that can be digitized, such as magnetic, gravity, or radiometric data. Author

A84-28694

PREDICTION OF THE DISPLACEMENT VELOCITY OF AN OPTICAL IMAGE OBTAINED DURING REMOTE SENSING OF THE EARTH'S SURFACE [PROGNOZIROVANIE SKOROSTI SDVIGA OPTICHESKOGO IZOBRAZHENIIA PRI S'EMKE ZEMNOI POVERKHNOSTI]

A. S. BATRAKOV Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 79-85. In Russian. refs

General analytical relationships are derived for the displacement-velocity components of an image, taking into account the orientation of the photographic camera, its translational displacements and angular velocities, the shape of the earth's surface, and the mean elevation of the survey area above the reference level. Methodological errors arising due to the replacement of the terrestrial ellipsoid by a sphere are examined. B.J.

A84-28695

METHODS FOR DETERMINING THE OPTICAL PARAMETERS OF THE ATMOSPHERE FROM RESULTS OF SPACEBORNE REMOTE SENSING OF THE EARTH'S SURFACE [METODY OPREDELENIIA OPTICHESKIKH PARAMETROV ATMOSFERY PO REZUL'TATAM KOSMICHESKOI S'EMKI ZEMNOI POVERKHNOSTI]

D. A. USIKOV, M. N. FOMENKOVA, and I. V. SHIIAN (Akademiia Nauk SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 86-91. In Russian. refs

Two methods for the synchronous determination of the optical parameters of the atmosphere are described. The first method is based on the fact that one and the same surface region photographed in different spectral bands has different spatial contrasts; hence, the variation of these contrasts carries information concerning the optical properties of the atmosphere. The second method utilizes multispectral information obtained in absolute brightness values as well as the albedo of certain test areas. The methods were validated in the Bolgaria-1300-II experiment. B.J.

A84-28698

CHOICE OF SATELLITE ORBITS FOR ROUND-THE-CLOCK GLOBAL SURVEY OF THE EARTH [VYBOR ORBIT ISZ DLIA KRUGLOSUTOCHNOGO GLOBAL'NOGO OBZORA ZEMLI]

V. K. SAULSKII and E. L. LUKASHEVICH (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizvodstvennyi Tsentr Priroda, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 110-118. In Russian.

A study is made of the orbits of earth-resources satellites which are capable of observing the earth both in sunlight and in shadow. A method is proposed for calculating the height and inclination of special orbits which provide complete coverage of the earth with a minimum survey-band width. An analysis is made of errors in the computation of survey-band widths resulting from the neglect of the sphericity of the earth surface. B.J.

A84-29561*# National Aeronautics and Space Administration, Washington, D. C.

INTERNATIONAL LITHOSPHERE PROGRAM - EXPLOITING THE GEODYNAMICS REVOLUTION

E. A. FLINN (NASA, Washington, DC) Aerospace America (ISSN 0740-722X), vol. 22, Jan. 1984, p. 104-107.

After presenting a development history of the application of spacecraft technology in the field of earth dynamics, which encompasses the measurement of the motion and the large scale deformation of the tectonic plates as well as the monitoring of earth's gravity and magnetic fields, attention is given to the International Lithosphere Program (ILP). ILP studies the dynamics and evolution of the lithosphere, with a view to earth resources identification and geological hazard reduction. Among the major problems being addressed is the mechanism by which magmas are generated, extruded, and intruded, at convergent and divergent plate boundaries and within plates. By contrast to current understanding of rifting, almost nothing is known about how the process of subduction begins. The methods used to measure tectonic plate phenomena are: laser ranging to both the moon and man-made satellites, and VLBI. O.C.

N84-18727# Army Engineer Topographic Labs., Fort Belvoir, Va.

THE AI RESEARCH ENVIRONMENT AT THE US ARMY ENGINEER TOPOGRAPHIC LABORATORIES

R. D. LEIGHTY Apr. 1983 9 p

(AD-A136316) Avail: NTIS HC A02/MF A01 CSCL 08B

The U.S. Army Engineer Topographic Laboratories (USAETL) is responsible for Army research and development in the areas of mapping and terrain analysis. In general, this involves methods, techniques, and systems for information processing related to the extraction, analysis, and presentation of terrain data. Typically, the data source is aerial imagery and the real-world information processing techniques for aerial imagery are very labor-intensive. Previous research into automated techniques has not yielded

results adequate to justify significant equipment developments necessary for future Army terrain information processing requirements. Thus, USAETL is making a significant commitment in AI with expectations for new and improved terrain information processing capabilities for the Army. This paper discusses the Artificial intelligence research environment at USAETL. This includes the rationale for the USAETL AI program, the objectives and approach of the Center for Artificial Intelligence (CAI), a description of the CAI AI facilities, and a brief description of the current CAI research program. GRA

N84-19388# Army Engineer Topographic Labs., Fort Belvoir, Va.
ON GENERATION, ESTIMATION, UTILIZATION, AVAILABILITY AND COMPATIBILITY ASPECTS OF GEODETIC AND METEOROLOGICAL DATA
H. B. VONLUETZOW Aug. 1983 22 p Presented at the 18th Interdisciplinary Symp. Data Management, Intern. Union of Geodesy and Geophys. General Assembly, Hamburg, 15-27 Aug. 1983
(AD-A135844; ETL-R053) Avail: NTIS HC A02/MF A01 CSCL 22B

Following an introduction, the paper discusses in section 2 the collection or generation of final geodetic data from conventional surveys, satellite observations, satellite altimetry, the Global Positioning System, and moving base gravity gradiometers. Section 3 covers data utilization and accuracy aspects including gravity programmed inertial positioning and subterraneous mass detection. Section 4 addresses the usefulness and limitation of the collocation method of physical geodesy. Section 5 is concerned with the computation of classical climatological data. In section 6, meteorological data assimilation is considered. Section 7 deals with correlated aspects of initial data generation with emphasis on initial wind field determination, parameterized and classical hydrostatic prediction models, non-hydrostatic prediction, computational networks, and computer capacity. The paper concludes that geodetic and meteorological data are expected to become increasingly more diversified and voluminous both regionally and globally, that its general availability will be more or less restricted for some time to come, that its quality and quantity are subject to change, and that meteorological data generation, accuracy and density have to be considered in conjunction with advanced as well as cost-effective numerical weather prediction models and associated computational efforts. GRA

N84-19942 Bayerische Akademie der Wissenschaften, Munich (West Germany).
NATIONAL REPORT OF THE FEDERAL REPUBLIC OF GERMANY ON GEODETIC ACTIVITIES, 1979 - 1983
1983 251 p refs In ENGLISH and GERMAN Proc. of 18th Intern Union for Geodesy and Geophys. Gen. Assembly, Hamburg, 15-27 Aug. 1983 Original contains color illustrations
(SER-B-265; ISBN-3-7696-8558-X; ISSN-0065-5317) Avail: Issuing Activity

Horizontal geodetic control networks, leveling, geodetic astronomy, observation of satellites and VLBI, gravimetry, physical geodesy, mathematical modeling, Earth tides, and crustal movements are considered.

N84-19943 Bayerische Akademie der Wissenschaften, Munich (West Germany).
HORIZONTAL GEODESY CONTROL NETWORKS
R. KELM and H. J. KRIEFALL *In its* Natl. Rept. of The Federal Republic of Germany on Geodetic Activitie, 1979 - 1983 p 8-48 1983 refs In ENGLISH and GERMAN
Avail: Issuing Activity

The German Horizontal Geodesy Network; surveying and investigations in scientific nets; and geodetic network theory are discussed. In the German Network, 1st and 2nd order distance measurements were performed to improve quality. The European Horizontal Network (RETrig); geodynamical investigations networks; and geodetic research nets are represented. Net design; survey procedures; net adjustment; variance-covariance estimation; net transformation; representation of net quality (outliers, systematic errors, reliability); deformation analysis of nets measured at different epochs; three dimensional net computations up to integrated net adjustment; and computer programs for nets are treated. Author (ESA)

N84-19944 Bayerische Akademie der Wissenschaften, Munich (West Germany).
PRECISE LEVELING
R. STUERZER *In its* Natl. Rept. of the Federal Republic of Germany on Geodetic Activities, 1979 - 1983 p 49-64 1983 refs In ENGLISH and GERMAN
Avail: Issuing Activity

A complete resurvey of the German Precise Leveling Network (DHHN) is described. Each line of the Unified European Leveling Network was renewed. The resurvey reveals that some automatic levels are dependent on magnetic fields. The scale factor of leveling rods and vertical refraction was studied. For better interpretation of height alterations and as a designing means for vertical control nets, a map showing geological stability areas was published. Author (ESA)

N84-19946# Bayerische Akademie der Wissenschaften, Munich (West Germany).
THE OBSERVATION OF ARTIFICIAL SATELLITES AND VLBI
E. REINHART, H. SEEGER, and P. WILSON *In its* Natl. Rept. of the Federal Republic of Germany on Geodetic Activities, 1979 - 1983 p 78-109 1983 refs In ENGLISH and GERMAN
Avail: Issuing Activity

Satellite and lunar laser ranging, very long base interferometry (VLBI), and Doppler and directional measurements of satellites are described. A stationary Nd : YAG ranging system was operated. A modular transportable laser ranging system was developed. Time services based on cesium, rubidium, and Besson quartz frequency standards and a hydrogen maser are discussed. Applications of VLBI to geodesy, geophysics and astrometry are summarized. The TIMEDOC, BONDOC, WESTHARZ, ERIDOC, NIEDOC, ALGEDOP, BLNDOC and CIDOC, Doppler campaigns are outlined. Marine geodesy and ice monitoring are mentioned. Author (ESA)

N84-19947# Bayerische Akademie der Wissenschaften, Munich (West Germany).
THE GEODETIC USE OF SATELLITE OBSERVATIONS
C. REIGBER *In its* Natl. Rept. of the Federal Republic of Germany on Geodetic Activities, 1979 - 1983 p 110-126 1983 refs In ENGLISH and GERMAN
Avail: Issuing Activity

Improvements in satellite orbit determination capacity; applications of altimetry, satellite-to-satellite tracking and gradiometer data; investigations into representations of the Earth's gravity field; and use of satellite observations for precise point positioning are discussed. Satellite observations were analyzed and results obtained for regional altimeter geoids. Coordinates of the rotation pole and variations in the rate of rotation of the Earth; geocentric coordinates of tracking stations, and continental and intercontinental base-lines; and global gravity field models and shape of the Earth are considered. Author (ESA)

N84-19948 Bayerische Akademie der Wissenschaften, Munich (West Germany).
GRAVIMETRY
W. TORGE *In its* Natl. Rept. of Federal Republic of Germany on Geodetic Activities, 1979 - 1983 p 128-139 1983 refs In ENGLISH and GERMAN
Avail: Issuing Activity

Measurements in the world gravity net, West German national gravity net, and regional surveys are summarized. Instrument developments are described. High precision gravity measurements and gravity variations with time are discussed. Measurements of gravity at sea are outlined. Geodetic and geophysical evaluation of gravity data is considered. Author (ESA)

N84-19950 Bayerische Akademie der Wissenschaften, Munich (West Germany).
PHYSICAL GEODESY
E. W. GRAFAREND, E. H. KNICKMEYER, H. KREMERS, and W. LINDLOHR *In its* Natl. Rept. of Federal Republic of Germany on Geodetic Activities, 1979 - 1983 p 190-218 1983 refs In ENGLISH and GERMAN
Avail: Issuing Activity

An annotated bibliography of over 100 items on satellite altimetry, gravity gradiometry, very long base interferometry, and collocation methods for geodetic data analysis is presented. Author (ESA)

N84-19951 Bayerische Akademie der Wissenschaften, Munich (West Germany).
EARTH TIDES
M. BONATZ *In its* Natl. Rept. of Federal Republic of Germany on Geodetic Activities, 1979 - 1983 p 220-230 1983 refs In GERMAN; ENGLISH summary
Avail: Issuing Activity

Three-component-sensors, strain meters; tiltmeters and determination of systemical instrumental errors in Earth tide investigations are discussed. Data acquisition automatization, preprocessing, permanent stations; long term observation; temporary stations, and short term observation (clinometric profile and array measurements) are considered. Determination of local disturbing effects in a tunnel are described. Results of clinometric observations, strain measurements, modeling of effects of inhomogeneity are presented. Gravimetric tidal corrections, applications of tilt observation to prediction of storm surges, and earthquake research are mentioned. Tides at the South Pole, geology effects, tidal friction, dispersion effects, tidal phases and viscosity of the Earth, resonance effects of the liquid core, and determination of nontidal signals are treated. Author (ESA)

N84-19952 Bayerische Akademie der Wissenschaften, Munich (West Germany).
RECENT CRUSTAL MOVEMENTS
H. MAELZER *In its* Natl. Rept. of Federal Republic of Germany on Geodetic Activities, 1979 - 1983 p 231-251 1983 refs In ENGLISH and GERMAN
Avail: Issuing Activity

Calculation of temporal height changes for the determination of recent vertical crustal movements in northern, western, and southern Germany is described. Precise geodetic measurements and their analysis for the determination of recent crustal movements in north-eastern Iceland, western Venezuela, and central Peru are described. Determination of recent vertical crustal movements by leveling and gravity data; geodetic modeling of deformations and recent crustal movements; geodetic modeling of plate motions; and instrumental developments in geodetic measuring are discussed. Author (ESA)

N84-19993# Army Engineer Topographic Labs., Fort Belvoir, Va.
ON RECENT PROGRESS IN AND UTILIZATION OF ASTROGEODETIC-INERTIAL AND ASTROGEODETIC-GRADIOMETRIC GRAVITY VECTOR DETERMINATION
H. B. VONLUETZOW Jun. 1983 11 p Presented at FIG 17th Intern. Congr., Sofia, 19-28 Jun. 1983
(AD-A136263) Avail: NTIS HC A02/MF A01 CSCL 08E

Following an introductory status review, the paper presents a new astrogeodetic-gradiometric-inertial method for vertical deflection determination under consideration of horizontal channel interactions and suitable for the utilization of single of multiple track data in conjunction with supporting astrogeodetic deflections. It then discusses the problem of optimal deflection area adjustments under consideration of other work. Subsequently, accuracy aspects of astrogeodetic-gradiometric gravity vector determination based on the Bell gravity gradiometer, the simultaneous utilization of gradiometric and inertial data in terrestrial surveys, and potential applications are addressed. Author (GRA)

N84-22400# Technische Hogeschool, Delft (Netherlands). Dept. of Aerospace Engineering.
SOME ASPECTS OF THE HIGH EQUATORIAL ORBIT FOR THE TROPICAL EARTH RESOURCES SATELLITE (TERS)
T. VANDERPLOEG Nov. 1983 60 p refs Sponsored by Royal Netherlands Aircraft Factory Fokker
(VTH-LR-404) Avail: NTIS HC A04/MF A01

The sensitivity of the high equatorial orbit of the Tropical Earth Resources Satellite (TERS) to particular terms of the geopotential was analyzed. Results were used to define the Earth's gravity model to be applied for the analysis of the long term evolution of the mean orbital elements. A short-arc analysis was performed to study the effects of perturbing forces on the instantaneous orbital position of the satellite. The effects of injection and orbit determination errors on the along track position of the satellite were also investigated. For along track position, injection errors are more important than perturbing forces. Author (ESA)

04

GEOLOGY AND MINERAL RESOURCES

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

A84-20102
INVENTORY AND RESULTS PROVIDED BY DIFFERENT TYPES OF GEOLOGICAL SPOT SIMULATIONS FOR THE CAMARES REGION OF FRANCE [INVENTAIRE ET RESULTATS OFFERTS PAR DIFFERENTS TYPES DE SIMULATIONS SPOT EN GEOLOGIE, SUR LA REGION DE CAMARES, FRANCE]
G. GESS (Institut Francais du Petrole, Rueil-Malmaison, Val-d'Oise, France) Photo Interpretation (ISSN 0031-8523), vol. 21, Sept.-Oct. 1982, 3 p. In French, English, and Spanish.

A84-20182
RECOGNITION OF NATURAL FORMATIONS ON THE BASIS OF THEIR COLOR AND CHROMATICITY [RASPOZNAVANIE PRIRODNYKH OBRAZOVANII PO IKH TSVETU I TSVETNOSTI]
L. I. KISELEVSKII, A. A. KOVALEV, and V. E. PLIUTA (Akademiia Nauk Belorusskoi SSR, Institut Fiziki, Minsk, Belorussian SSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 273, no. 4, 1983, p. 854-857. In Russian. refs

The feasibility of the recognition of natural formations according to their color and chromaticity is examined on the basis of Salyut-4 spectrometer data in the range 0.4-0.8 micron, with a spectral resolution of 0.007 micron. Error probabilities of the classification of different types of natural formations according to their color characteristics are determined. Results indicate that color characteristics as measured from space make possible a sufficiently reliable recognition of natural formations on the earth's surface. B.J.

A84-20403
THERMAL INERTIA OF ROCKS - AN HCMM EXPERIMENT ON SARDINIA, ITALY
R. CASSINIS, N. TOSI (Milano, Universita, Milan, Italy), G. M. LECHI, P. A. BRIVIO, E. ZILIOLI (CNR, Istituto per la Geofisica della Litosfera, Milan, Italy), and A. MARINI (Cagliari, Universita, Cagliari, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Jan.-Feb. 1984, p. 79-94. refs

The usefulness of thermal inertia mapping for discriminating lithological units was investigated using Sardinia and the Gulf of Orosei as test sites. Software designed for Landsat data was modified and improved for HCMM tapes. A first attempt was made to compare the geological cross-section, the topography, the infrared radiance and the thermal inertia along selected profiles of the test site. Thermal inertia profiles appear smooth in comparison with the thermal radiance. The lowest apparent thermal inertia (ATI) was found on granitic and basaltic outcrops of sufficient

extent, while ATI is higher on carbonate and dolomitic or moist deposits. Almost every fault is marked by a jump in the ATI, the interval being sometimes of the order of 1 pixel. This seems to demonstrate the ability of ATI to detect contacts or tectonically disturbed zones with good resolution. It seems more difficult to measure the differences in ATI between homogeneous materials having different lithology. The results of ground surveys and a simulation model of diurnal temperatures of rocks having different thermal inertia are discussed. Author

A84-20575* Lunar and Planetary Inst., Houston, Tex.
RELATIONSHIPS BETWEEN MINERALIZATION AND SILICIC VOLCANISM IN THE CENTRAL ANDES
P. W. FRANCIS (Lunar and Planetary Institute, Houston, TX), C. HALLS (Imperial College of Science and Technology, London, England), and M. C W. BAKER (Hunting Geology and Geophysics, Fyshwick, Australia) Journal of Volcanology and Geothermal Research (ISSN 0377-0273), vol. 18, 1983, p. 165-190. Research supported by the Natural Environment Research Council. refs

A84-21580
SPACEBORNE INVESTIGATIONS OF THE NATURAL COMPLEXES OF SIBERIA AND THE FAR EAST [KOSMICHESKIE ISSLEDOVANIIA PRIRODNYKH KOMPLEKSOV SIBIRI I DAL'NEGO VOSTOKA]
A. L. IANSHIN, ED. and L. K. ZIATKOVA, ED. Novosibirsk, Izdatel'stvo Nauka, 1983, 178 p. In Russian.

Topics discussed include the use of aerial and spaceborne photographic data to study the structural geomorphology of Western Siberia; isometric and rectilinear elements of natural formations on spaceborne photographs of Siberia; remote-sensing studies of lakes of the southern plains of Western Siberia; and investigations of the Quaternary deposits and relief of the central part of the Western Siberian plain. Consideration is also given to the representation of the morphological structure of middle Siberia on small-scale spaceborne photographs; interpretation of TV and IR spaceborne photographs of lands adjacent to the BAM route; the use of high-precision geomagnetic measurements for the interpretation of spaceborne photographs; the utilization of remote-sensing data for hydrological studies in mountain regions; and a landscape-ecological evaluation of the effect of fires on the formation of forests. B.J.

A84-21581
MAIN TRENDS IN AERIAL AND SPACEBORNE STUDIES OF THE NATURAL COMPLEXES OF SIBERIA AND THE FAR EAST [OSNOVNY NAPRAVLENIIA AEROKOSMICHESKIKH ISSLEDOVANII PRIRODNYKH KOMPLEKSOV SIBIRI I DAL'NEGO VOSTOKA]
A. L. IANSHIN and L. K. ZIATKOVA IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 5-13. In Russian. refs

A84-21582
STRUCTURAL GEOMORPHOLOGY AND ITS MAIN PROBLEMS IN CONNECTION WITH THE UTILIZATION OF AERIAL AND SPACEBORNE PHOTOGRAPHIC DATA (ON THE EXAMPLE OF WESTERN SIBERIA) [STRUKTURNAIA GEOMORFOLOGIIA I EE OSNOVNYE PROBLEMY V SVIAZI S ISPOL'ZOVANIEM AEROKOSMICHESKOI FOTOINFORMATSII /NA PRIMERE ZAPADNOI SIBIRI/]
L. K. ZIATKOVA IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 14-29. In Russian. refs

A84-21583
ISOMETRIC (RING-SHAPED) AND RECTILINEAR ELEMENTS OF NATURAL FORMATIONS ON SPACEBORNE PHOTOGRAPHS OF SIBERIA [IZOMETRICHESKIE (KOL'TSEVYE) I SPRIAMLENNYE ELEMENTY PRIRODNYKH OBRAZOVANII NA KOSMICHESKIKH FOTOSNIMKAKH SIBIRI]
A. L. IANSHIN, L. K. ZIATKOVA, V. S. IUDIN, I. I. BELONOSOV, R. V. BEREZOVSKAIA, and A. A. MISTRIUKOV IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 35-43. In Russian. refs

Different ways in which the structural features of Siberia are reflected in spaceborne photographs are examined. A classification of ring-shaped and rectilinear elements is given, and it is noted that the investigation of these natural features can be of use in mineral exploration. B.J.

A84-21585
SOME RESULTS OF REMOTE-SENSING STUDIES OF THE QUATERNARY DEPOSITS AND RELIEF OF THE CENTRAL PART OF THE WESTERN SIBERIAN PLAIN [NEKOTORYE REZUL'TATY IZUCHENIIA CHETVERTICHNYKH OTLOZHENII I REL'EFA TSENTRAL'NOI CHASTI ZAPADNO-SIBIRSKOI RAVNINY NA OSNOVE DISTANTSIONNYKH METODOV]
I. A. VOLKOV IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 53-58. In Russian.

A84-21586
GEOMORPHOLOGICAL PROCESSES ACCORDING TO REMOTE-SENSING DATA (ON THE EXAMPLE OF THE TUVA BASINS) [GEOMORFOLOGICHESKIE PROTSESSY PO MATERIALAM DISTANTSIONNOI S'EMKI /NA PRIMERE TUVINSKIKH KOTLOVIN/]
L. S. MILIAEVA IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 5-13. In Russian. refs

Traces of exogenic processes in the Tuva basins of Siberia are examined on the basis of aerial and spaceborne photographs of different scale. The geomorphological interpretation of remote-sensing data, in combination with borehole data on friable deposits, makes it possible to elucidate the dynamics of relief formation. B.J.

A84-21587
REPRESENTATION OF THE MORPHOLOGICAL STRUCTURE OF MIDDLE SIBERIA ON SMALL-SCALE SPACEBORNE PHOTOGRAPHS [IZOBRAZHENIE MORFOSTRUKTURY SREDNEI SIBIRI NA MELKOMASSHTABNYKH KOSMICHESKIKH SNIMKAKH]
L. L. ISAEVA and M. A. KRAUSH IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 65-74. In Russian.

Fields of different phototones and image contours were delineated on small-scale Meteor-satellite photographs of middle Siberia. A comparison between these features and data of geological and topographic maps made it possible to interpret them as large morphological structures. These structures are described along with the lineaments bounding them and transformed-structure lineaments, coinciding only partially with boundaries or other relief elements. It is noted that the maximal information for the study of relief is contained in winter photographs obtained at wavelengths of 0.8-1.0 micron. B.J.

A84-21588
RESULTS OF THE INTERPRETATION OF TV AND IR SPACEBORNE PHOTOGRAPHS OF LANDS ADJACENT TO THE BAM ROUTE [REZUL'TATY DESHIFRIROVANIIA TELEVIZIONNYKH I INFRAKRASNYKH KOSMICHESKIKH SNIMKOV TERRITORII, PRILEGAIUSHCHEI K TRASSE BAM]
V. IA. EROMENKO, V. A. AMANTOV, and I. S. BOGUSLAVSKII IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 81-84. In Russian.

Geoblocks differing in the direction and amplitude of recent movements, linear and ring-shaped structures, have been delineated on TV and IR photographs of lands adjacent to the BAM route. Besides well-known northeasterly faults and their zones, a system of large northwesterly faults has been identified; these faults are not pronounced on existing geological maps but are clearly manifested in magnetic surveys. It is also shown that endogenous mineralization of considerable scale tends to be situated at points where longitudinal regional and transverse transregional faults intersect. B.J.

A84-21589
AN EFFORT TO CORRELATE AERIAL AND SPACEBORNE DATA WITH RECENT GEOLOGICAL-GEOPHYSICAL DATA OF TECTONIC STUDIES ON THE BAM ROUTE [OPYT KORRELIATSII AEROKOSMICHESKOI INFORMATSII S NOVEISHIMI GEOLOGO-GEOFIZICHESKIMI DANNYMI PRI TEKTONICHESKIKH ISSLEDOVANIIAKH NA BAM]
D. P. FOMIN and O. V. GRABKIN IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 84-92. In Russian.

Large, medium, and small scale aerial and spaceborne photographs of the southern part of the Charsk folded oval in a strip adjacent to the BAM route have been interpreted. It is shown that old faults and more recent ones manifest themselves in different ways. The interpreted faults mainly reflect the stage of Mesozoic-Cenozoic activation. Precambrian deep faults, verified on geological-geophysical data, are delineated on small-scale TV photographs. B.J.

A84-21590
THE USE OF HIGH-PRECISION GEOMAGNETIC MEASUREMENTS FOR THE INTERPRETATION OF SPACEBORNE PHOTOGRAPHS [ISPOL'ZOVANIE VYSOKOTOCHNYKH GEOMAGNITNYKH IZMERENII PRI DESHIFRIROVANII KOSMOSNIMKOV]
V. A. LARIONOV, V. S. IUDIN, P. G. DIADKOV, I. I. BELONOSOV, and A. A. MISTRIUKOV IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 101-103. In Russian. refs

High-precision geomagnetic measurements were performed in various regions of Siberia in order to establish a correlation between photoanomalies of spaceborne photographs and magnetic anomalies. The location of the anomalies approximately corresponds to structures interpreted on spaceborne photographs. It is concluded that high-precision geomagnetic measurements can be used effectively for the interpretation of spaceborne photographs of the earth's surface. B.J.

A84-21591
RESULTS OF THE COMPLEX PROCESSING AND INTERPRETATION OF SPACEBORNE PHOTOGRAPHS ON THE EXAMPLE OF DIFFERENT REGIONS OF MIDDLE ASIA [REZUL'TATY KOMPLEKSNOI OBRABOTKI I INTERPRETATSII KOSMOSNIMKOV NA PRIMERE OTDEL'NYKH RAIONOV SREDNEI AZII]
V. S. IUDIN IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 104-108. In Russian. refs

The use of geological-geophysical data during the processing of spaceborne photographs makes it possible to interpret photoanomalies with geological content. The interpretation is based on the relationships between geological-geophysical characteristics and photoanomalies of the photograph. It is concluded that the resulting information can be used to produce structural-tectonic maps. The interpretation of photographs of eastern Kyzylkumov is examined as an example. B.J.

A84-21602
COMPLEX METHODS FOR THE PROCESSING OF AERIAL AND SPACEBORNE PHOTOGRAPHIC DATA TO REVEAL CRUSTAL STRUCTURAL FEATURES IN SIBERIA AND THE FAR EAST [KOMPLEKSNYE METODY OBRABOTKI AEROKOSMICHESKOI FOTOINFORMATSII DLIA VYIAVLENIIA OSOBENOSTEI STROENIIA ZEMNOI KORY SIBIRI I DAL'NEGO VOSTOKA]
A. L. IANSHIN, L. K. ZIATKOVA, V. N. SHARAPOV, P. M. BONDARENKO, Z. M. KHVOROSTOVA, V. S. IUDIN, A. S. ALEKSEEV, V. P. PIATKIN, and N. V. KULKOV IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 11-24, 179-184. In Russian. refs

A program complex for the preliminary processing of spaceborne remote-sensing images is described. The complex processing of Meteor-satellite TV images of the Altai-Saian mountain region and Kamchataka is characterized, with attention given to the application of the CONTRE, STEFOTO, FILTR, CONTUR, and VYDGTs subroutines. B.J.

A84-21603
A TECHNIQUE FOR COMPILING SPACE-GEOLOGICAL MAPS (ON THE EXAMPLE OF A SPACE-GEOLOGICAL MAP OF THE KRASNOIARSK REGION AND THE TUVINSKAIA ASSR) [O METODIKE SOSTAVLENIIA KOSMOGEOLOGICHESKIKH KART /NA PRIMERE KOSMOGEOLOGICHESKOI KARTY KRASNOIARSKOGO KRAIA I TUVINSKOI ASSR/]
IU. M. MALTSEV and A. K. MKRTYCHIAN IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 24-33. In Russian. refs

A84-21604
RIVER VALLEYS AND STRCTURAL-GEOMORPHOLOGICAL ANALYSIS WITH THE USE OF AERIAL AND SPACEBORNE PHOTOGRAPHIC DATA (ON THE EXAMPLE OF WESTERN SIBERIA) [RECHNYE DOLINY I STRUKTURNO-GEOMORFOLOGICHESKII ANALIZ S PRIMENENIEM AEROKOSMICHESKOI FOTOINFORMATSII /NA PRIMERE ZAPADNOI SIBIRI/]
L. K. ZIATKOVA IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 33-41, 185, 186. In Russian. refs

A84-21606
DETERMINATION OF THE FEATURES OF MANIFESTATION OF GEOLOGICAL FORMATIONS ON A SPACEBORNE PHOTOGRAPH IN GEOPHYSICAL FIELDS AND THEIR USE IN THE ANALYSIS OF THE STRUCTURAL CHARACTERISTICS OF THE TERRITORY UNDER STUDY [OPREDELENIE PRIZNAKOV PROIAVLENIIA GEOLOGICHESKIKH OBRAZOVANII NA KOSMOSNIMKE V GEOFIZICHESKIKH POLIAKH I IKH ISPOL'ZOVANIE PRI ANALIZE STRUKTURNYKH OSOBENNOSTEI ISSLEDUEMOI TERRITORII]
V. S. IUDIN IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 49-52. In Russian. refs

A84-21607
MULTIPLE-ASPECT UTILIZATION OF THE METEOR SYSTEM TO SOLVE CERTAIN GEOLOGICAL PROBLEMS [MNOGOASPEKTNOE ISPOL'ZOVANIE SISTEMY 'METEOR' DLIA RESHENIIA NEKOTORYKH GEOLOGICHESKIKH ZADACH]
L. I. MOROZOVA IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 52-57, 187-190. In Russian.

The paper outlines the advantages of using Meteor-satellite photographs in various spectral ranges (especially the 8-13 micron region) in order to interpret landscape elements and to study the dynamics of geological processes. Results are presented pertaining to the utilization of multispectral photographs for the interpretation of the southern Ural region and for the analysis of cloud-cover dispersion over the main Ural fault. B.J.

A84-21608
AERIAL AND SPACEBORNE METHODS AND MATERIALS FOR THE INVESTIGATION OF EXOGENIC PROCESSES IN BAM MOUNTAIN REGIONS [AEROKOSMICHESKIE METODY I MATERIALY V IZLUCHENII EKZOGENNYKH PROTSESSOV /EGP/ GORNYKH RAIONOV BAM]
L. A. PLASTININ, V. M. PLIUSNIN, and V. P. STUPIN IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 57-63. In Russian.

A84-21613
RELIABILITY OF THE INTERPRETATION OF SPACEBORNE PHOTOGRAPHS ACCORDING TO DIRECT AND INDIRECT FEATURES [DOSTOVERNOST' DESHIFRIROVANIIA I INTERPRETATSII KOSMOSNIMKOV PO PRIAMYM I KOSVENNYM PRIZNAKAM]
A. M. BOROVIKOV IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 83-100. In Russian.

The reliability of interpretation of spaceborne photographs is examined with reference to geological mapping. Consideration is given to the main interpretation effectiveness indicators; sources of interpretation unreliability; generalization, reliability, and fullness of interpretation; logical grouping as a type of generalization and its uniqueness; the general significance of various types of generalizations; direct and indirect features from the standpoint of the reliability of geological interpretation; and different categories of direct and indirect indicators. It is concluded that a specific group of universal procedures and approaches has been presented which is connected with the mapping problem in the most general way. B.J.

A84-21618
IDENTIFICATION AND DELINEATION OF GEOLOGICAL FORMATIONS IN THE INTERACTIVE MODE [IDENTIFIKATSIIA I VYDELENIE GEOLOGICHESKIKH OBRAZOVANII V DIALOGOVOM REZHIME]
V. A. IVANOV and S. V. CHASHCHIN IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 132-135. In Russian.

The paper examines methods for the automated processing of images which have been tested on ring structures and linear relief elements. Specifically, consideration is given to the joint processing (identification and delineation) of spaceborne images of geological features on the Zenith-2 image processing system. It is shown that the Zenith-2 system makes possible the interactive mode of image processing; software has been devised which is sufficiently universal in the sense that it can be used not only for the processing of geological data but also for the preliminary analysis of fragments of images of sufficiently large format. B.J.

A84-22455
METHODOLOGICAL FEATURES OF LINEAMENT ANALYSES IN GEOLOGICAL VALUATIONS OF PHOSPHORITE DEPOSITS [OSOBENNOSTI METODIKI LINEAMENTNOGO ANALIZA PRI GORNO-GEOLOGICHESKOI OTSENKE MESTOROZHDENII FOSFORITOV]
O. G. SHEREMET, IU. S. PERFILEV, and V. M. MORALEV (Akademiia Nauk SSSR, Institut Litosfery, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 30-38. In Russian. refs

Digital processing of a lineament network obtained by interpreting aircraft and satellite photos is employed in a comparison of geological surveys. The surveys differ in the lineament density and in the extent and thickness of the phosphorite beds. The method proposed here comprises three sequential steps. The first involves measuring the lineaments and parameters of the phosphorite beds and choosing representative segments as standards. The second consists in deciding upon indicators which impart the greatest amount of information and provide an optimal classification of the representative segments and then comparing all the phosphorite-bearing segments with the standards. In the third step, synthesized quantitative valuations are calculated in order to distinguish the phosphorite-bearing segments. C.R.

A84-22456
THE USE OF SATELLITE PHOTOS FOR RECONSTRUCTING A RECENT TECTONIC STRESS FIELD [ISPOL'ZOVANIE KOSMICHESKIKH SNIMKOV DLIA REKONSTRUKTSII NOVEISHEGO POLIA TEKTONICHESKIKH NAPRIAZHENII]
V. E. GONIKBERG (Akademiia Nauk SSSR, Institut Litosfery, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 39-51. In Russian. refs

Methodological aspects of using satellite photos for analyzing recent deformations of the earth's crust are considered. Photographs on various scales of the Saian-Tuva region of the USSR are used to reconstruct a Pliocene-Quaternary stress field which gives a satisfactory explanation of the aggregate of recent structures revealed on space photos. It is assumed that the stress field reflects a leftsided displacement of the Eurasian platform relative to geoblocks of southeastern Asia. This displacement was furthered by the action of dispersed mantle masses on the earth's crust. C.R.

A84-22457
THE GEOLOGICAL INTERPRETATION OF PHOTOGRAPHIC IMAGERY FROM SPACE OF ANTARCTICA [GEOLOGICHESKOE DESHIFRIROVANIE KOSMICHESKIKH SNIMKOV ANTARKTIDY]
V. M. BUDKO (Proizvodstvennoe Geologicheskoe Ob'edinenie Aerogeologiia, Laboratoriia Aerometodov, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 52-59. In Russian. refs

The possibility of using photographic images obtained from space for discerning geological features underneath an ice cover is considered. It is found that the topography of a glacier bed in smooth form finds reflection at the surface of an ice cover when this cover does not exceed 1.5 km in thickness. This makes it possible, in regions hidden by continental glaciation, to distinguish geological features on the basis of indicators appearing on space photos. In the region in question, dislocations with a break in continuity are detected from interpretations of space photos. In addition, ring structures are detected, and determinations are made of the signs and amplitudes of the motions of tectonic blocks. C.R.

A84-22458
THE GEOLOGICAL NATURE OF THE PARALLEL BANDED PATTERN REVEALED ON AEROSPACE PHOTOIMAGES OF REGIONS OF ANCIENT CONTINENTAL GLACIATION [O GEOLOGICHESKOI PRIRODE PARALLEL'NO-POLOSCHATOGO RISUNKA AEROKOSMICHESKOGO FOTOIZOBRAZHENIIA OBLASTEI DREVNEMATERIKOVOGO OLEDENENIIA]
V. N. GUBIN (Belorusskaia Geologopoiskovaia Ekspeditsiia, Minsk, Belorussian SSR) and E. A. LEVKOV (Akademiia Nauk Belorusskoi SSR, Institut Geokhimii i Geofiziki, Minsk, Belorussian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 60-65. In Russian.

A84-22459
METHODS FOR QUANTITATIVELY EVALUATING THE GEOLOGICAL EFFECTIVENESS OF THE INTERPRETATION GIVEN TO SPACE PHOTOS IN PREDICTING MINERALIZATION [METODIKA KOLICHESTVENNOI OTSENKI GEOLOGICHESKOI EFFEKTIVNOSTI DESHIFRIROVANIIA KOSMICHESKIKH SNIMKOV PRI PROGNOZIROVANII ORUDENENIIA]
M .A. BELOBORODOV and V. S. KOGEN (Proizvodstvennoe Geologicheskoe Ob'edinenie Aerogeologiia, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 66-72. In Russian.

A84-22460
THE VALUE OF SYNTHESIZING SATELLITE IMAGES IN METALLOGENIC ANALYSES (ON THE EXAMPLE OF THE CAUCASUS) [ZNACHENIE GENERALIZATSII KOSMICHESKIKH IZOBRAZHENII PRI METALLOGENICHESKOM ANALIZE /NA PRIMERE KAVKAZA/]
V. Z. SAKHATOV (Proizvodstvennoe Geologicheskoe Ob'edinenie Aerogeologiia, Laboratoria Aerometodov, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 73-82. In Russian. refs

The use of satellite photos in regional metallogenic analyses is discussed. The information provided depends on the generalizations drawn from the images, and these generalizations in turn depend on the scales and types of images. It is shown that by using a series of satellite photos on global, regional, and local scales, principles governing geological structures can be discerned, as can the conditions for the formation and distribution of endogenic mineralization. C.R.

A84-22765
DEPENDENCE OF THE AVERAGE TRANSVERSE MOMENTUM ON THE MULTIPLICITIES IN NUCLEUS-NUCLEUS COLLISIONS
C. PAJARES and A. V. RAMALLO (Santiago de Compostela, Universidad, Santiago de Compostela, Spain) Physical Review Letters (ISSN 0031-9007), vol. 52, Feb. 6, 1984, p. 407-409. refs

Two cosmic-ray events with very large reported multiplicities and very large values of average transverse momentum (550 plus or minus 50, and 700 plus or minus 50 MeV/c for Si+Ag and Ca+C, respectively) in ultrarelativistic high-energy nucleus-nucleus collisions are investigated. The value of average multiplicity/D is related to the increase of the average transverse momentum with increasing multiplicity. Thus, the rise is smaller for total nucleus-nucleus events than for proton-proton events, though the rise is very fast for central nucleus-nucleus collisions due to the associated large value of average transverse momentum/D. J.N.

A84-23244
PASSIVE MICROWAVE RADIOMETRY IN THE GOBI-DESERT REGION
X. TENG, C. SHI, H. PENG (Chinese Academy of Sciences, Physics Institute, Changchun, Jilin, People's Republic of China), J. XIAO, Z. LAI, and B. YANG (Chinese Academy of Sciences, Geochemistry Institute, Guiyang, Guizhou, People's Republic of China) Remote Sensing of Environment (ISSN 0034-4257), vol. 15, Feb. 1984, p. 37-46. refs

This paper summarizes preliminary results of remote sensing test with an airborne microwave radiometer, in the Gobi-desert region. The relationship between microwave signature and complex dielectric constant for various rocks and minerals is analyzed. The possibilities of exploring for water and mineral resources in this arid region by means of passive microwave radiometry are discussed. Author

A84-23677#
SMALL-SCALE FEATURES IN THE EARTH'S MAGNETIC FIELD OBSERVED BY MAGSAT
J. C. CAIN, D. R. SCHMITZ, and L. MUTH (U.S. Geological Survey, Denver, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, Feb. 10, 1984, p. 1070-1076. refs

A spherical harmonic expansion to degree and order 29 is derived using a selected magnetically quiet sample of Magsat data. Global maps representing the contribution due to terms of the expansion above n = 13 at 400 km altitude are compared with previously published residual anomaly maps and shown to be similar, even in polar regions. An expansion with such a high degree and order displays all but the sharpest features seen by the satellite and gives a more consistent picture of the high-order field structure at a constant altitude than do component maps derived independently. Author

A84-24727* Lunar and Planetary Inst., Houston, Tex.
RELATIONSHIPS BETWEEN MINERALIZATION AND SILICIC VOLCANISM IN THE CENTRAL ANDES
P. W. FRANCIS (Lunar and Planetary Institute, Houston, TX), C. HALLS (Imperial College of Science and Technology, London, England), and M. C. W. BAKER (Hunting Geology and Geophysics, Fyshwick, Australia) Journal of Volcanology and Geothermal Research (ISSN 0377-0273), vol. 18, 1983, p. 165-190. Research supported by the Natural Environment Research Council. refs

Existing models for the genesis of porphyry copper deposits indicate that they formed in granodioritic stocks located in the infrastructure of andesitic stratovolcanoes. It is noted that sites of porphyry-type subvolcanic tin mineralization in the Eastern Cordillera of Bolivia are distinguished by the absence of such andesitic structures. The surface expression of a typical subvolcanic porphyry tin deposit is thought to be an extrusive dome of quartz latite porphyry, sometimes related to a larger caldera structure. Evidence from the El Salvador porphyry copper deposit in the Eocene magmatic belt in Chile indicates that it too may be more closely related to a silicic volcanic structure than to an andesitic stratovolcano. The dome of La Soufriere, Guadeloupe is offered as a modern analog for the surface expression of subvolcanic mineralization processes, with the phreatic eruptions there indicating the formation of hydrothermal breccia bodies in depths. It is pointed out that the occurrence of mineralized porphyries, millions of years after caldera formation, does not necessarily indicate that tin intrusions and mineralization are not genetically related to the subcaldera pluton, but may be a consequence of the long thermal histories (1-10 million years) of the lowermost parts of large plutons. C.R.

A84-24916
STRUCTURAL STYLE OF THE MONTALBAN REGION (SPAIN) AND A MODEL FOR ITS DEVELOPMENT
H. E. C. VAN DER MEER MOHR (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 214-222. refs

A structural model is presented for the Iberian mountain chains in the Montalban-Teruel structural province, whose Mesozoic rock

sequence shows classical detached structures with thrust-folds arranged in long, sinuous belts that are repeated in closely spaced, wavelike bands. Basement involvement is suggested to involve tilting along two sets of near-perpendicular basement faults, and left-lateral wrenching in a broad belt that extends between Montalban and Morella. The combined basement kinematics of faulting, tilting and warping, together with wrench faulting, appear to constitute an adequate mechanism for the formation of specific local styles in the Mesozoic detached sequence. O.C.

A84-24918
SIR-A AND LANDSAT IMAGERY INTERPRETATION OF SIERRA VELAZCO, LA RIOJA PROVINCE, ARGENTINA
C. A. CANOBA (Rosario, Universidad Nacional, Cordoba, Argentina) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 232-237. refs

Analysis of SIR-A data for an area in western Argentina indicated that the synoptic view of regional structures and patterns allows the direct elaboration of preliminary geologic/geomorphologic maps at small scale without a complete cartographic process of generalization from larger scale maps. Used in conjunction with aerial photographs, SIR-A data were found to be a valuable tool for reconnaissance surveys. Author

A84-24919
RADAR IMAGERY INTERPRETATION OF NORTHERN GREECE
I. K. KARFAKIS (Institute of Geology and Mineral Exploration, Athens, Greece) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 238-240.

SIR-A data for an area in northwestern Greece were compared with existing geologic and Landsat data to evaluate their merits for geologic mapping. SIR-A data were not found very useful for identifying lithologic units but proved valuable for mapping linear features. They are also very useful in areas masked by clouds and/or vegetation. Radar data can be most usefully employed when combined with other remote sensing data and data from geologic maps. Author

A84-24920
SPACEBORNE SAR IMAGERY INTERPRETATION, BAHIA AREA, BRAZIL
A. J. PEDREIRA (Companhia de Pesquisa de Recursos Minerais, Bahia, Brazil) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 241-245.

The interpretation of SAR (L-band) imagery of an area with a moist climate, both natural and cultivated vegetation, and frequent cloud cover, shows that the features detected coincide quite well with imagery of other remote sensors, such as X-band SAR, Landsat MSS Band 7, and conventional aerial photographs. Because of larger scale and stereoscopy, the photos give sharper details of lithologies and structures. Combined with fieldwork, the SAR imagery proved to be a useful tool for investigation of vegetated areas. Author

A84-24921
INTERPRETATION OF SIR-A IMAGERY OF SOUTHEASTERN TURKEY
I. HENDEN and M. BALCI (Mineral Research and Exploration Institute, Ankara, Turkey) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 246-249.

SIR-A imagery obtained during the second Shuttle mission over southeast Turkey was used for geologic mapping. The imagery covers a 50 km wide zone where the Arabian continental plate subducts under the Anatolian plate. The two plates differ greatly in geologic and tectonic characteristics. East-west thrusting and extensive NE-SW and NW-SE fault systems have developed in the subduction zone. These linear features are readily mappable from the SIR-A imagery, as are the volcanic craters which have developed along this zone. Differences in drainage pattern and textural features make separation of lithologic units possible to a certain extent. Author

A84-24922
LANDSAT AND SIR-A INTERPRETATION OF THE KALPIN CHOL AND CHONG KORUM MOUNTAINS OF CHINA
T. WOLDAI (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 250-252.

Landsat MSS and SIR-A imagery have been used in the geologic study of the Kalpin Chol and Chong Korum mountains in Xinjian Uygur province in China. The two show both signifiant similarities and differences. Well-bedded sedimentary sequences extending from the Ordovician to Permian can be recognized on the basis of their strike ridge patterns on both Landsat and radar. In terms of interpretability, the SIR-A imagery allows better delineation of the various rock units. A number of folds and major and minor lineaments were identified which have not been previously accounted for in any available geologic and tectonic maps. Folds and faults are generally consistent on both Landsat and radar. Author

A84-24923
LOP-NUR (CHINA) STUDIED FROM LANDSAT AND SIR-A IMAGERY
T. WOLDAI (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 253-257. refs

Landsat and SIR-A imagery, together with the few available geologic maps, have been used to study the remote, little known Lop-Nur area in the Xinjian Uygur province of China. In addition to conventional interpretation techniques using tone, texture, drainage characteristics and geomorphologic expressions, false color composites were used. These are noted to be more effective than other techniques for the interpretation of soil and water bodies. The entire study area is found to be affected by climatic changes and neotectonic movements. Attention is given to the possibility of using SIR-A imagery for geologic mapping. O.C.

A84-24924
THE SHUTTLE IMAGING RADAR OVER SOUTH PENINSULAR THAILAND. I RADAR GEOLOGICAL INTERPRETATION OF THE TAKUA PA-SONGKHLA AREA
S. MUENLEK (Department of Mineral Resources, Geological Survey Div., Bangkok, Thailand) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 258-263.

Space Shuttle radar images at a scale of 1:500,000 are subjected to geologic interpretation by visual means. These images cover the Takua pa/Songkhla region of peninsular Thailand. Lineament analysis results from SIR-A data have been compared with those from Landsat MSS data, as well as the lineaments appearing on an existing geologic map on which 15 deg is the preferential lineament direction. Many more directional classes are obtained with the radar and Landsat interpretations, in which the influence of radar look direction, Landsat MSS scan direction, and solar azimuth direction are taken into consideration. Quantitatively, the SIR-A radar interpretation yields the greatest number of lineaments. O.C.

A84-24925
THE SHUTTLE IMAGING RADAR OVER SOUTH PENINSULAR THAILAND. II LINEAMENT ANALYSIS FROM SIR-A AND LANDSAT IMAGERY INTERPRETATION
B. N. KOOPMANS (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 264-269. refs

Space Shuttle SIR-A imagery of peninsular Thailand was photographically enlarged to a scale of 1:250,000 for interpretation and lineament analysis. Considerable differnces are noted in comparisons of the SIR-A lineament rose diagrams with those derived from Landsat imagery and from an existing geologic map. It is noted that the detectability of lineaments on radar imagery will be low if lineaments are oriented parallel to the radar look direction. Landsat scan direction and solar azimuth direction negatively influence lineament detectability. The complementarity of SIR-A and Landsat scanning methods allows a general lineament

analysis to be made, though not without substantial prior knowledge of the structural framework of the study region. O.C.

A84-25144
REQUIREMENTS ON THE CONTENT OF TOPOGRAPHIC MAPS USED FOR A DETAILED MORPHOMETRIC ANALYSIS OF RELIEF [TREBOVANIIA K SODERZHANIIU TOPOGAFICHESKIKH KART, ISPOL'ZUEMYKH DLIA DETAL'NOGO MORFOMETRICHESKOGO ANALIZA REL'EFA]
V. I. MIKHAILOV and I. A. TIASHKEVICH (Belorusskii Politekhnicheski Institut, Minsk, Belorussian SSR) Geodeziia i Aerofotos'emka (ISSN 0536-101X), no. 4, 1983, p. 118-124. refs

A84-26839
APPLICATIONS OF REMOTE SENSING TECHNIQUES TO GEOLOGY
S. K. BHAN (National Remote Sensing Agency, Geosciences Div., Hyderabad, India) and K. KRISHNANUNNI (Geological Survey of India, Calcutta, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Dec. 1983, p. 297-311. refs

Developments in remote sensing techniques are examined in relation to geological applications and mineral exploration. Geological, lithologic, structural, and geomorphological mapping has benefitted from Landsat imagery. Landsat data have been used to produce a 1:2 million scale lineament map of India. Mineral exploration is also discussed in relation to Landsat data, which was used to identify features directly related to mineralization (e.g., alteration zones and gossans) and indicative of mineral location (e.g., folds, faults, and fractures). Two areas for improvement in satellite data are indicated: poor resolution and lack of stereoscopy. C.M.

A84-27388
RADARGEOLOGIC INTERPRETATION OF SEASAT IMAGERY OF ICELAND
M. MCDONOUGH and P. H. A. MARTIN-KAYE (Hunting Geology and Geophysics, Ltd., Boreham Wood, Herts., England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 433-450. refs

A geologic interpretation of a 1:500,000 scale mosaic of optically correlated Seasat SAR imagery showed that 14 of the 17 major units mapped by the Geological Survey of Iceland could be recognized although it was not possible to close all the radar geologic boundaries. Interactive work with computer correlated imagery produced no additional information significant to mapping at that scale. Comparison with Landsat revealed that the radar produced more data on ice type, alluvial categories and upon lineaments but the overall interpretative value of Landsat was clearly the better of the two. The results of local coregistering Landsat and Seasat were interesting but did not cause any modification of the regional interpretation. Author

A84-27394
MULTIBAND THERMAL INFRARED IMAGERY AS A DISCRIMINANT FOR SURFACE ROCK TYPES
M. E. BARNETT (Imperial College of Science and Technology, London, England), A. C. BIRD (PNC/UK/, Ltd., London, England), and M. C. DAWES (Wimpey Laboratories, Ltd., Hayes, Middx., England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 511-515. refs

Multispectral thermal infrared imagery has been acquired during a night-time airborne survey in Southern California. The imagery emphasizes emissivity variations of the surface rocks. Comparison with the available geological data indicates that such imagery can be a useful tool in the revision and refinement of geological maps. Author

A84-27726
INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, SECOND THEMATIC CONFERENCE: REMOTE SENSING FOR EXPLORATION GEOLOGY, FORT WORTH, TX, DECEMBER 6-10, 1982, PROCEEDINGS. VOLUMES 1 & 2
Symposium sponsored by the Environmental Research Institute of Michigan, Texas Christian University, Champlin Petroleum Co., et al. Ann Arbor, MI, Environmental Research Institute of Michigan, 1983. Vol. 1, 533 p.; vol. 2, 473 p.

State of the art applications of remote sensing in exploration programs are discussed along with research and development activities aimed at increasing the future capabilities of this technology for exploration geology. The topics addressed include: an introduction to geologic remote sensing, electromagnetic properties of surface materials, hydrocarbon and mineral case studies, geobotanical remote sensing, data integration and applications, noimaging remote sensing, engineering and logistics, and advanced sensors and systems. C.D.

A84-27727#
FUTURE APPLICATIONS OF REMOTE SENSING TO RESOURCE EXPLORATION
D. L. PECK (U.S. Geological Survey, Reston, VA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 3-10.

The potential use in remote sensing of new spectral bands and tools and the application of relatively unknown remote data sets are briefly considered. Digital elevation models produced by the U.S. Geological Survey can be used as a valuable complement to Landsat images for which solar azimuth and elevation angle are fixed by the time of satellite overpass without regard to structural orientation. A new ability to map alteration zones is a major step forward in remote sensing as applied to mineral resource exploitation. Imaging spectroscopy holds great promise for the identification of lithologies. The use of the thermal infrared spectral region for compositional remote sensing and the use of radar to explore for water resources and natural gas are discussed. C.D.

A84-27728#
BASIC CONCEPTS IN DIGITAL IMAGE PROCESSING AND GEOLOGIC DATA INTEGRATION
K. M. MORGAN (Texas Christian University, Fort Worth, TX) and D. R. MORRIS-JONES (Michigan, Environmental Research Institute, Ann Arbor, MI) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 11-23. refs

A great deal of interest has recently been focused on the use of remote sensing as an exploration tool. In this paper, basic concepts in digital image processing and geologic data integration are discussed as important exploration techniques for energy companies. In summary, digital image processing techniques provide powerful and useful means of radiometric and geometric correction and enhancement of remote sensing and geologic data. Through the use of computer geographic information systems and exploration models, remote sensing and other types of geologic data (e.g., seismic, magnetics, gravity, etc.) can be integrated to improve understanding of the processes controlling mineral or hydrocarbon accumulation. Remote sensing analysis and geologic data integration facilitate identification of prospect areas and encourage efficient planning of the more expensive phases of exploration. An example project in the Gulf Coast region of the United States is presented. Author

A84-27729#
APPLICATION OF REFLECTANCE SPECTROMETRY TO CLAY MINERAL DETERMINATION IN GEOLOGICAL MATERIALS USING PORTABLE RADIOMETERS
D. R. GLADWELL (Barringer Magenta, Ltd., Rexdale, Ontario, Canada) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 29-38.

An initial attempt is described to deconvolute overlapping reflections spectra of kaolinite, montmorillonite, muscovite, illite, and chlorite by spectral ratio measurement in the 2.65-2.82 micron region. The observed linear relationship between modal percent mineral and spectral ratio response was used to develop a BASIC computer algorithm for providing estimates of modal percent mineral content. The algorithm was tested on mixtures of kaolinite, muscovite, and chlorite, and the results showed that the algorithm is applicable to samples containing absorption feature-producing minerals accounted for in the deconvolution model. Subsequent testing of the algorithm on a suite of soil samples for which X-ray diffraction mineralogical analyses were available showed that the presence of large amounts of a feature-producing mineral not included in the model leads to large errors in analysis. C.D.

A84-27730#
EXTRACTION OF GEOLOGIC INFORMATION FROM LANDSAT MULTISPECTRAL SCANNER AND THEMATIC MAPPER SIMULATOR DATA FROM THE UINTA AND PICEANCE BASINS, UTAH AND COLORADO
G. B. BAILEY (U.S. Geological Survey, EROS Data Center, Sioux Falls, SD), J. R. FRANCICA, J. L. DWYER (Technicolor Government Services, Inc., EROS Data Center, Sioux Falls, SD), and M. S. FENG IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 43-70. Sponsorship: U.S. Geological Survey. refs
(Contract USGS-14-08-0001-20129)

A84-27731#
LANDSAT APPLICATION FOR GEOPHYSICAL FIELD OPERATIONS
J. VANDENAKKER (Chevron Overseas Petroleum, Inc., San Francisco, CA) and J. RYAN (ESL, Inc., Sunnyvale, CA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 71-74.

Chevron Overseas Petroleum Inc. has used Landsat imagery since it became available in 1973. Initially, it was used for geological and planimetric mapping purposes. In large mosaic format it served to initiate structural and conceptual geologic models. Recently, in areas of adverse terrain conditions, Landsat has become a valuable tool for assisting COPI's geophysical field operations in the Democratic Republic of Sudan. Initially, digitally enhanced, black and white Landsat imagery, in conjunction with air photos, was used to produce soil and vegetation maps as well as geological maps. As a second step, enlarged digitally enhanced, false color imagery was used to produce a more detailed terrain map showing the wetness conditions in the Sudd swamp. As a further refinement the Interactive Digital Image Manipulation System (IDIMS) of ESL Inc., a subsidiary of TRW, in Sunnyvale, California, has been used to produce highly detailed vegetation classification maps of the Sudd swamp. The resulting vegetation maps are used by Chevron as an aid in directing the acquisition of seismic data. Author

A84-27732*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE RESPONSE OF VEGETATION TO GEOCHEMICAL CONDITIONS
D. A. MOUAT (NASA, Ames Research Center, Moffett Field, CA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 75-84. refs

An understanding of the factors of vegetation response to changes in the geochemistry of the environment may give exploration geologists and other researchers an additional and effective tool for rock type discrimination. The factors of vegetation response can be grouped into three principal categories: structural or morphological factors, taxonomic factors which include indicator flora as well as vegetation assemblages, and spectral factors which represent the manner in which the vegetation interacts with electromagnetic radiation. The response of these factors over areas of anomalous mineralization is often unique and may be due to nutrient deficiencies and/or imbalances, toxicity and stress caused by anomalous mineral concentrations in the soil, low water retention, and plant competition. The successful use of geobotanical techniques results from the integration of the geobotanical observations with other techniques. The use of remote sensing in such a program must be predicated on those factors which can be discriminated within the constraints of the spatial, spectral, radiometric, and temporal resolutions of the sensing system and with appropriate analytical techniques. Author

A84-27733#
PRACTICAL REQUIREMENTS FOR OPERATIONAL USE OF GEOBOTANY AND BIOGEOCHEMISTRY IN MINERAL EXPLORATION
R. J. P. LYON, C. ELVIDGE (Stanford University, Stanford, CA), and J. G. LYON (Ohio State University, Columbus, OH) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 85-95. refs

Operational aspects of geobotany and biogeochemistry are briefly addressed. Vegetation indicators in mineral exploration are summarized, and small format cameras in operational geobotany are surveyed, mentioning camera types particularly suitable for various missions. Operational tradeoffs with costs are discussed, including those pertaining to higher spatial resolution, narrower spectral resolutions, simpler and less costly R&D, and timeliness of data collection. C.D.

A84-27736#
LOCATION OF ECONOMIC GYPSUM DEPOSITS BY INTEGRATION OF MULTISPECTRAL, MULTITEMPORAL, GEOPHYSICAL, GEOCHEMICAL, GEOBOTANICAL AND GEOLOGICAL DATA
T. H. F. REIMCHEN (Pegasus Earth Sensing Corp., North Vancouver, British Columbia, Canada) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 119-132.

An interpretation technique was developed for the evaluation of Landsat digital data for gypsum in the Southern Canadian Rockies. The technique is based on a supervised classification of glacial and residual soils rich in disseminated calcium sulphates. Integration of geobotanical and geochemical data with multitemporal Landsat data resulted in the discovery of several gypsum occurrences. Geological mapping, reconnaissance drilling, geophysics and deep trenching have proven 100,000,000 tonnes of economic grade gypsum inone of these occurrences. Author

A84-27737#
IMAGE-BASED GEOGRAPHIC INFORMATION SYSTEMS FOR MINERAL EXPLORATION - THE BROKEN HILL PROJECT
J. F. OCALLAGHAN (Commonwealth Scientific and Industrial Research Organization, Div. of Computing Research, Canberra, Australia) and K. N. OSULLIVAN (CRA Exploration Pty., Ltd., Canberra, Australia) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 133-136.

The tasks of image-based geographic information systems are to integrate different kinds of geographic data and to permit analysis, interrogation and display of the data sets. An experimental system has been developed for the Broken Hill area (Australia) to support the interpretation of remotely sensed data for mineral exploration. Applications have concentrated on the enhancement and display of Landsat, topographic and geophysical data sets. The results have demonstrated the potential of image processing techniques for geophysical data interpretation. Author

A84-27738#
EXTRACTING GEOLOGICAL INFORMATION FROM RESAMPLED LANDSAT DATA, BAKER LAKE, NORTHWEST TERRITORIES, CANADA
G. F. BONHAM-CARTER (Geological Survey of Canada, Ottawa, Canada) and A. N. RENCZ (Canadian Centre for Remote Sensing, Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 139-148.

A84-27739#
INTEGRATED ANALYSIS OF HIGH RESOLUTION FIELD AND AIRBORNE SPECTRORADIOMETER DATA FROM AN EPITHERMAL GOLD DISTRICT
J. B. MCKEON and S. E. MARSH (Gulf Research and Development Co., Pittsburgh, PA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 151-172. refs

This study presents the results of the investigation into the development and application of high spectral-resolution field and airborne infrared spectroradiometers for mapping mineral alteration. The study demonstrates that these prototype field and airborne systems can identify individual alteration minerals and assemblages, and thus provide the exploration geologist with detailed reconnaissance information on surface alteration. Field and airborne spectral surveys were carried out over the Oatman epithermal gold deposit in northwest Arizona. The high-resolution systems have demonstrated the ability to delineate pervasive argillic and wall-rock phyllic and propylitic alteration at this test site. Discrimination of these zones rests upon the ability to correctly identify the dominant alteration minerals - alunite, illite (mica), and chlorite. Use of both advanced field and airborne remote sensing systems have, for the first time, helped to create accurate alteration maps based upon the identification of specific minerals characteristic of the hydrothermal alteration zones. Though we still have much to learn about the capabilities of these systems, their ultimate application to reconnaissance exploration mapping is established. Author

A84-27740*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MAPPING HYDROTHERMAL ALTERATION USING AIRCRAFT VNIR SCANNERS AT THE ROSEMONT PORPHYRY COPPER DEPOSIT
R. M. SADOWSKI (AMAX Exploration, Inc., Tucson, AZ) and M. J. ABRAMS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 175-188. refs

Two Visible-Near Infrared (VNIR) scanners, the NS-001 and the M2S, were flown over the Rosemont porphyry copper deposit as part of the NASA/JPL/GEOSAT test site program. This program was established to determine the feasibility and limitations of mapping hydrothermal alteration with multispectral scanners. Data from the NS-001 at 0.83 and 2.2 microns were used to identify Fe(3+) and OH enriched outcrops. These areas were then correlated with three alteration assemblages. The first correlation, hematite-epidote, was the most obvious and appeared as a strong ferric iron signature associated with hematite stained Cretaceous arkoses and andesites. The second correlation, qtz-sericite, showed a combined ferric-hydroxyl signature for a phyllicly altered quartz monzonite. The third correlation, skarn, was identified only after a review of calc-silicate mineral VNIR spectra. Altered limestones that outcrop west of the deposit have a similar ferric iron-hydroxyl signature as the quartz-sericite altered quartz monzonite. This skarn signature has been interpreted to indicate the presence of andradite, hydro-grossularite and idocrase. Data from the second scanner, M2S, was used to search for variation in ferric iron mineral type. Resulting imagery data indicated that hematite was the dominant ferric iron mineral present in the Rosemont area.
Author

A84-27741#
UTILITY OF SLR IN HYDROCARBON EXPLORATION - AN APPRAISAL BASED ON CASE HISTORIES
J. V. GARDNER (Mars Associates, Inc., Phoenix, AZ) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environomental Research Institute of Michigan, 1983, p. 191-198. refs

In appraising the utility of side looking radar imagery (SLR) in hydrocarbon exploration, a survey study and evaluation was conducted which focused on SLR applications and interpretation techniques. In addition to a critical review of published and unpublished information, numerous discussions were conducted with remote sensing geoscientists in U.S. oil companies. Moreover, nearly 20 case histories were evaluated and a wide range of interpretation examples and imagery was examined. Specific applications and interpretation techniques, which were used in these case studies, were compiled in order to evaluate uses and interpretation techniques. Evaluation of the case histories revealed that radar has demonstrated its success in practical exploration situations. SLR is cost effective, produces new information, is useful in different phases of exploration and development, is easily merged with other data and requires little processing and/or hardware for interpretation. A limitation is lack of global coverage. Author

A84-27742#
CRREL INVESTIGATIONS RELEVANT TO OFFSHORE PETROLEUM PRODUCTION IN ICE-COVERED WATERS
W. B. TUCKER, III (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 207-215. refs

The U.S. Army Cold Regions and Engineering Laboratory has studied the sea ice environment of the Beaufort Sea for many years. Offshore development is now proceeding beyond the barrier islands and many of these studies have relevance to the planned activities. Sea ice presents a formidable hazard to the design and construction of production platforms and sea floor pipelines. CRREL investigations have addressed a number of the problems associated with these activities and remote sensing has played a major role in some of these studies. Specific efforts at CRREL have addressed the measurement of ice motion, the distribution and morphology of pressure ridges and shore ice pile-ups, ice conditions and thickness, the determination of ice strength, ice crystal structure, and the modeling of ice dynamics and thermodynamics. Author

A84-27744#
RADAR REMOTE SENSING IN SUPPORT OF ARCTIC OIL EXPLOITATION
R. T. LOWRY (Intera Environmental Consultants, Ltd., Ottawa, Canada), J. B. MERCER (Dome Petroleum, Ltd., Calgary, Alberta, Canada), and A. L. GRAY (Canada Centre for Remote Sensing, Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 237-251. refs

A84-27745#
REMOTE SENSING - HOW REMOTE?
H. A. KUEHNERT (Phillips Petroleum Co., Bartlesville, OK) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 253-257.

The utility of satellite remote sensing methods for resource exploration and the problems associated with integrating remote sensing in an exploration organization are considered. The acquisition and implementation of in-house satellite computer processing facilities and requisite supporting services is discussed, and arguments supporting this commitment cite competitive advantage, impact on profitability, and cost effectiveness. Another benefit of implementation of the discussed remote sensing service is the readiness to realize the advantages of future, more sophisticated satellite technology. J.N.

A84-27747#
A SYSTEMATIC APPROACH TO MANUAL ANALYSIS AND INTERPRETATION OF LANDSAT IMAGERY OF THE LADAKH HIMALAYA
J. R. FRANCICA (Technicolor Government Services, Inc., Sioux Falls, SD) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 279-291. Sponsorship: U.S. Geological Survey. refs
(Contract USGS-14-08-0001-20129)

The Ladakh Himalaya of northern India and northeastern Pakistan was used as an example for documenting one method for extracting the maximum amount of geologic information from a Landsat, band 7 image. This approach uses photogeologic techniques for geologic maping and to formulate the general geologic history of the region. Author

A84-27748#
EXAMINATION OF SOME FACTORS USED IN SELECTING LANDSAT IMAGERY FOR LINEAMENT INTERPRETATION
B. S. LARSON (Colorado State University, Fort Collins, CO) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 293-302.

For a selection of the optimum Landsat imagery for lineament analysis, a partial evaluation of the influence of product type, scale, and time of year on lineament interpretation using four scenes of an area in eastern Montana is presented. One scene was recorded on January 19, 1977 and the balance on June 14, 1980. The present methodology of lineament analysis involves: (1) overlaying and registering a mylar or acetate sheet to the image, (2) locating geographic control points, (3) interpretation of image for linear features, (4) digitizing the endpoints of linear features, and (5) generating and editing the linear feature maps. Statistics based on the interpretations were generated, and the interpretations were then compared and evaluated. It was found that interpretations from a winter scene with sufficient snowfall and a summer large-scale false color composite will provide optimal information for the interpretation of topographic and vegetational/soil/lithologic lineaments. J.N.

A84-27749#
COOPERATIVE REGIONAL SURVEYS FOR MINERAL EXPLORATION WITH RED-ENHANCED FILM IN A 70 MM CAMERA
D. M. SLAYMAKER (Exploration Laboratory, Tucson, AZ) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 305-309.

Five 70 mm films were tested with different processing techniques to produce a more saturated color negative with higher contrast than the standard Aerocolor product and an exaggerated red color response. Ektachrome MS developed to a negative in a modified C-22 process was then used in Hasselblad cameras to fly several regional surveys, including a large portion of the Arizona Overthrust belt, for a consortium of twelve exploration firms. Some preliminary evaluations can be drawn from this work about the relative utility of regional surveys using the 70 mm format, as compared to 9 inch square coverage and space imagery. Most consortium members purchased complete coverage in a reduced 5 inch square prints-in-notebooks format and used it in conjunction with orbital coverage. Users also preferred the exaggerated color of these prints to 9 inch camera coverage available to them, in spite of the lower resolution of the smaller negative. Author

A84-27750*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL INERTIA MAPPING - A PROMISING NEW TOOL FOR MINERAL EXPLORATION
N. M. SHORT (NASA, Goddard Space Flight Center, Geophysics Branch, Greenbelt, MD) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 311-319.

The Heat Capacity Mapping Mission (HCMM) is a NASA-sponsored program designed to acquire day visible and day and night thermal IR imagery from a satellite launched on April 26, 1978 into a near polar orbit at 620 km altitude. The data are used to produce temperature difference (12 or 36 hour interval) and apparent thermal inertia (ATI) images or numerical data sets for selected areas within much of North America, Europe, North Africa, and Australia. These data are being applied to rock type discrimination, soil moisture detection, assessment of vegetation states, thermal current monitoring in water bodies, urban heat island analysis and other multidisciplinary studies. Key geological

results include (1) groups of dissimilar rock materials and some individual rock types can be separated and sometimes identified by their satellite-determined thermal inertias (dependent on their albedos, densities, and conductivities), (2) large lineaments (including some faults) are often recognized by their thermal signatures (may relate to moisture content and/or reduced bulk density), and (3) visually striking expressions of geomorphic units (types) at a regional scale are especially enhanced in the night IR imagery. Author

A84-27751*# Lamar-Merifield, Santa Monica, Calif.
IDENTIFICATION OF ACTIVE FAULTS IN ENLARGED STEREO MODELS OF SKYLAB S-190B PHOTOGRAPHS
P. M. MERIFIELD (Lamar-Merifield, Geologists, Santa Monica; California, University, Los Angeles, CA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 323-330. refs
(Contract JPL-955773)

Most of the physiographic indicators of recent movement known to be present along the Indio Hills segment of the San Andreas fault zone can be identified on enlarged Skylab S-190B stereo photographs. These include offset streams, beheaded streams, offset fans, shutter ridges, linear valleys, scarps and vegetation anomalies. Where physiographic indicators of recent movement are present, the S-190B system affords the necessary resolution and stereoscopy for distinguishing activate from inactive faults. Author

A84-27752#
THE THERMAL INFRARED PROSPECTING IN GEOTHERMAL EXPLORATION
G. BOLZAN, P. A. BRIVIO, and E. ZILIOLI (CNR, Istituto per la Geofisica della Litosfera, Milan, Italy) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 331-340. refs

Geothermal energy is a promising unconventional energy source especially in those countries where heat flow from the earth is already known to be anomalous and greater than 1 HFU. A geothermal reservoir of even marginal size, temperature and depth would produce steady-state thermal anomalies at the surface. The limits and constraints of the thermal sensitivity in the employed aerial thermographic devices in relation to the very small values of heat out-flow difference occurring in the geothermal fields are one of the main problems. Hence, the introduction of derived quantities acquainted by analogue and digital processing of the primary remotely sensed data such as 'thermal inertia', 'temperature gradient', 'entropy variation', seems to give new opportunities and more credit to this kind of geophysical prospecting. The test area which considered corresponds to the well known geothermal field of Travale, in Tuscany, where multitemporal and multispectral surveys have recently been realized. Author

A84-27753#
MULTISENSOR ANALYSIS FOR GEOLOGIC MAPPING IN THE WIND RIVER RANGE, WYOMING
C. S. SOUTHWORTH (U.S. Geological Survey, Reston, VA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 345-354. refs

Landsat MSS band 7, Landsat 3 RBV, and Seasat SAR image data for the Wind River Range, a northwest-trending asymmetrical anticline with a Precambrian crystalline core, were analyzed to evaluate their potential for structural and lithologic mapping. Complementary data for lineament analysis was provided by differences in spatial resolution of the sensor and variation of the illumination (solar azimuth, and elevation and radar look direction and angle). Rose diagrams of lineament frequency and lineament length were constructed from lineament maps as well as known faults for comparative analysis. Digital elevation model data at 1:24,000- and 1:250,000-scale were used to derive shaded relief images and isometric profile plots, providing a unique and manipulative data base for structural enhancement. Preliminary results of computer processing of Landsat MSS data reveal no lithologic or mineralized zone discrimination. J.N.

A84-27754#
QUANTITATIVE EVALUATION OF THE INFORMATION LEVELS FROM RADAR IMAGERY FOR GEOLOGIC EXPLORATION
P. J. CANNON (Planetary Data, Fairbanks, AK) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 355-363.

For an understanding of the relationship between the quantitative values and the geologic information necessary for exploration, three evaluation methods for the usefulness of radar imagery data are presented: number of linear features, orientation of linear features, and quantitative measurements of drainage basin elements. Maps showing the major structural features of the study area, the Alaskan Peninsular priority one subarea, were compiled from real aperture radar (RAR) imagery, synthetic radar aperture (SAR) imagery, and Landsat MSS imagery. Quantitative measurements of a high relief drainage basin and of a low relief drainage basin are compared with values taken from topographic maps, aerial photographs, and other radar imaging systems. The total number of structural features mapped on the RAR imagery was 782,20 percent higher than that for the SAR imagery. Only 389 structural features were mapped on Ladsat MSS imagery. The stream detail provided by SAR imagery for the drainage net of a section of the low relief drainage basin is nearly twice that seen on RAR imagery. J.N.

A84-27755#
GEOLOGIC REMOTE SENSING IN 'DIFFICULT TERRAIN' PHOTOGEOMORPHOLOGY AND PHOTOGEOLOGY IN THE HUMID TROPICS. D. K. Erb (Waterloo, University, Waterloo, Ontario, Canada). In: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 (A84-27726 11-43). Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 365-374. 30 refs.

A84-27756#
THE INTERPRETATION OF GEOLOGICAL STRUCTURES FROM LANDSAT IMAGES IN THE DU-AN REGION OF KWANGSI CHUANG AUTONOMOUS REGION OF CHINA
M. A. NAI (Beijing, University, Beijing, People's Republic of China) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 375-383. Research supported by the Ministry of Geology and Mineral Resources of the People's Republic of China.

A84-27757#
STRUCTURAL ANALYSIS OF A DIVERGENT PLATE BOUNDARY TERRAIN - A LANDSAT PERSPECTIVE
N. MAMULA (U.S. Geological Survey, Reston, VA; Texas A'& M University, College Station, TX) and B. VOIGHT (Pennsylvania State University, University Park, PA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 385-416. refs
(Contract NSF EAR-79-04268)

Landsat digital data for a rhombic shaped sector of northeastern Iceland, about 250 km long and 180 km wide, is analyzed in conjunction with field studies. The eastern Iceland rift zone lies in the center and is bounded successively by lateral strips of Plio-Pleistocene lavas and hyaloclastites. Analysis of the digital data processed in the derivative image mode demonstrated significant potential for the investigation of Iceland tectonics, as well as other plate boundary terrains. Two significant intensely developed lineament trends (west-northwest and north) are interpreted in terms of superposition of classical Riedel deformation along narrow bands and approximately 'simple shear' regional Riedel deformation. It is alternately proposed that both lineament trends may be of primary extensional origin. Maximum lineament frequency occurs in dissected Tertiary terrain west of the neovolcanic zone, and it is suggested that increased deformation strain has occurred in the western areas. A 20-km wide band of west-northwest trending lineaments appears to mark an onshore continuation of the Grimsey submarine fault. J.N.

A84-27758#
SUPERVISED MAXIMUM-LIKELIHOOD CLASSIFICATION AND POST-CLASSIFICATION FILTERING USING MSS IMAGERY FOR LITHOLOGICAL MAPPING IN THE OMAN OPHIOLITE
D. A. ROTHERY (Open University, Milton Keynes, Bucks., England) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 417-426. refs

A84-27762#
ANALYSIS OF AIRBORNE MAGNETIC ANOMALIES - DETERMINATION OF CURIE DEPTH FOR GEOTHERMAL RECONNAISSANCE (A PROGRESS REPORT)
Y. MIYAZAKI and R. J. P. LYON (Stanford University, Stanford, CA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 455-465. Research supported by the Union Oil Co., U.S. Bureau of Mines, U.S. Geological Survey, and U.S. Bureau of Land Management. refs

Long Valley, California is one of the potential hot water geothermal areas, and U.S.G.S. has conducted detailed geothermal investigations since 1972. There is really good evidence now that there is magma moving around at depth and U.S.G.S. has issued a notice of Potential Volcanic Hazard for this area. The objective of this study was to use aeromagnetic data, combined with Landsat and Digital Elevation Models, for the Curie point isothermal mapping and to gain an understanding of the nature and extent of the Long Valley geothermal system at depth. A preliminary calculation of Curie depth gave very encouraging results which are consistent with deep drilling wells and vertical temperature gradient expected from heat flow data. Author

A84-27764#
RECONNAISSANCE GEOLOGIC MAPPING IN NORTH-CENTRAL COLORADO USING MULTISPECTRAL GAMMA-RAY DATA
S. H. MOLL (Colorado State University, Fort Collins, CO) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 489-497. refs

A rapid means has been developed to quickly map the geology of large areas utilizing readily available gamma-ray spectrometric data and straightforward statistical methods. False color images of an area can be generated front potassium, equivalent uranium, equivalent thorium and their ratios which show the distributions of rock units. Principal components analysis can combine the radioelement data to allow the generation of single-variate maps. In a test case in the northern Colorado Front Range these maps were used successfully to clarify geologic relations. Author

A84-27766#
CORRELATION OF REFLECTANCE VALUES OF SOME INDIAN ROCKS AND MINERALS OBTAINED FROM FIELD AND LABORATORY DATA
R. NAGARAJAN, S. VISWANATHAN, P. K. GUPTA, and V. SHREEDHARA (Indian Institute of Technology, Bombay, India) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 507-517. Research supported by the Indian Institute of Technology.

Field and laboratory measurements of reflectance values of major rocks and mineral deposits from three different regions in India were obtained. The wavelength range on the radiometric and spectrometer corresponds to 0.5-1.1 microns and 0.4-2.4 microns respectively. A very common feature is the appearance of OH, stretching at 1.4 and 1.9 microns and Fe-OH and Mg-OH bonding modes near 2.2 and 2.3 microns. The absorbance of Fe(2+) and Fe(3+) ion in minerals is conspicuous in the following wavelengths: 0.43, 0.45, 0.30, 0.55 and 1.4 microns for Fe(2+); and 0.40, 0.45, 0.49, 0.70 and 0.87 micron for Fe(3+). It is interesting to note that physical parameters like porosity and chemical characteristics such as the dominance of iron are indicated by low reflectance. Again grain size seems to influence the reflectance of rocks. It is found that the bands 4 and 7 in addition to 4/7 and 5/6 of Landsat 2 and Bands 1 and 2 in conjunction with 1/7 and 2/7 are best suited to bring out lithological diversity, in Landsat 4. Author

A84-27767#
APPLICATION OF NOAA AVHRR DATA TO GEOLOGIC MAPPING
F. R. HONEY (Commonwealth Scientific and Industrial Research Organization, Div. of Groundwater Research, Wembley, Australia) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 519-525. refs

The 1.1 km resolution, five spectral band data from the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA-7 polar orbiting weather satellite is being studied to determine the value of the data for regional geologic, geomorphologic and soils mapping, and for the delineation of large structural features. The two thermal channels on the instrument have been used to discriminate several rock units in north-west Western Australia. Several large, previously unmapped linear features have been identified, and a paleoriver mapped in the Canning Basin. The existence of this river had been postulated previously, but no direct evidence of its precise location had been presented. Most of the features which have been observed on the NOAA imagery can not be positively identified on the Landsat imagery. Possible explanations for this are discussed. Author

A84-27769#
SEEING THROUGH CLOUDS - GEOLOGICAL INTERPRETATION OF THE MOUNTAINOUS TERRAIN OF TAIWAN FROM SLAR IMAGERY
J.-K. LIU, W.-J. YUAN, and W.-T. CHENG (Industrial Technology Research Institute, Mining Research and Service Organization, Shin-Chu, Republic of China) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 543-554. refs

A84-27770#
EVALUATION OF IMAGE PROCESSING OF LANDSAT DATA FOR GEOLOGIC INTERPRETATIONS OF THE QAIDAM BASIN, CHINA
G. B. BAILEY (U.S. Geological Survey, EROS Data Center, Sioux Falls, SD), J. L. DWYER, J. R. FRANCICA (Technicolor Government Services, Inc., Sioux Falls, SD), W. Y. WANG, J. G. SONG, J. ZHANG, C. W. FAN, T. X. WANG (Ministry of Petroleum Industry, Scientific Research Institute for Petroleum Exploration and Development, Beijing, People's Republic of China), and M. S. FENG IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 555-577. Sponsorship: U.S. Geological Survey. refs
(Contract USGS-14-08-0001-20129)

A84-27771#
THE USE OF LANDSAT DATA FOR DETECTION OF BURIED AND OBSCURED GEOLOGIC STRUCTURES IN THE EAST TEXAS BASIN, U.S.A.
Z. BERGER (Exxon Production Research Co., Houston, TX) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 579-589. refs

A84-27772#
REMOTE SENSING AND THERMAL INERTIA MAPPING AND LIKELY APPLICATIONS TO GEOLOGICAL EXPLORATION
T. J. MAJUMDAR, V. L. SWAMINATHAN, D. S. KAMAT (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), D. S. MITRA, and K. VARADARAJAN (Oil and Natural Gas Commission, K. D. Malavia Institute of Petroleum Exploration, Dehra Dun, India) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 591-598. refs

A84-27773#
NATURAL FRACTURE SYSTEMS FOR HYDROCARBON EXPLORATION IN NORTHERN ARKANSAS USING SLAR AND AERIAL PHOTOGRAPHY
W. G. WELLENDORF (Mars Associates, Inc., Phoenix, AZ) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 599-604. refs

A84-27774#
LANDSAT ANALYSIS IN STRUCTURAL DELINEATION FOR HYDROCARBON EXPLORATION IN PARTS OF PRANHITA-GODAVARY VALLEY (INDIA) - A CASE STUDY
R. P. AGARWAL (Oil and Natural Gas Commission, K. D. Malavia Institute of Petroleum Exploration, Dehra Dun, India) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 605-614. refs

A84-27775*# National Aeronautics and Space Administration. Goddard Space Flight Center, Albuquerque, N. Mex.
REMOTE SENSING TECHNIQUES USED IN HYDROCARBON EXPLORATION - A STATE-OF-THE-ART REVIEW
R. W. GONZALES (NASA, Technology Application Center, Albuquerque, NM) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 615-624. refs

Lintz (1972) has defined remote sensing for petroleum exploration as the detection from a distance of variations of the earth's surface or properties. Possibilities foreseen by Lintz could be realized with the Lander satellite. When used in 'phase-one' exploration programs, Landsat data have been effective in 'zeroing-in' on potential hydrocarbon traps, and later, when supplemented by more conventional exploration procedures, have led to the discovery of these resources. The present investigation is concerned with an overview of the methods utilized in 'phase-one' hydrocarbon exploration programs. The considered methods are to serve as an initial tool to aid the more conventional exploration procedures. Attention is given to visual interpretations, digital image processing, lineament analysis, surface anomalies, and geomorphology and topography. G.R.

A84-27776#
AN EVALUATION OF SEAST SAR DATA AS A TOOL FOR GEOLOGIC MAPPING IN THE OVERTHRUST BELT OF WYOMING-UTAH-IDAHO
K. I. JOHNSON, E. S. KASISCHKE, and B. A. BURNS (Michigan, Environmental Research Institute, Ann Arbor, MI) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 625-636. refs

A84-27777#
INTERPRETATION OF LANDSAT MSS DATA FOR IDENTIFICATION OF GEOLOGICAL FEATURES AND THEIR CORRELATION WITH BOUGUER GRAVITY DATA IN GOA AND PARTS OF KARNATAKA, INDIA
A. B. INAMDAR, G. VENKATARAMAN, S. VISWANATHAN (Indian Institute of Technology, Bombay, India), and K. MALLICK IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 641-650.

A84-27778#
LATE CENOZOIC TECTONIC EVOLUTION OF THE GREAT BASIN IMPLICATIONS FOR HYDROCARBON EXPLORATION
R. F. LIVACCARI, R. MICHAEL, and J. R. EVERETT (Earth Satellite Corp., Chevy Chase, MD) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 651-657. refs

A preliminary interpretation of Landsat data for the Great Basin is used to construct a tectonic model of late Cenozoic evolution.

NNE-trending shear-related basins and ranges of the western Great Basin are both cross-cut and bounded by complex systems of NW-trending right-slip and conjugate NE-trending left-slip structures. These NW-trending lineaments may represent important right-slip structures that evolved within a regional right-lateral shear system. This implies that similar structural analogs with producing oil fields in Railroad Valley may be found in other shear-related valleys of west-central Nevada. J.N.

A84-27779#
EFFECT OF VEGETATION ON AIRBORNE THEMATIC MAPPER IMAGERY OF THE KALAMAZOO PORPHYRY COPPER DEPOSIT, ARIZONA
C. D. ELVIDGE (Stanford University, Stanford, CA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 661-667. Research supported by the Shell Companies Foundation. refs

Ground spectra, biometrics, soil analyses and airborne Thematic Mapper imagery have been used to contrast unaltered and propylitically altered areas of quartz monzonite and granodiorite porphyry at the surface of the Kalamazoo deposit. The biometrics show no change in the overall percent perennial cover with increasing soil Cu, though there are marked changes in species composition. The quantity of spring annual plant drops sharply above 120 ppm Cu. In color ratio composite imagery, the altered areas show up as low in biomass (0.83/0.66) and high in iron staining (0.66/0.48 and 1.65/0.48 microns). The ratios 1.65/0.48 (for iron staining) and 1.65/2.22 microns (for clays) can both be severely affected by the spectral characteristics of vegetation. The evidence from the Kalamazoo imagery suggests that such vegetation effects on the 1.65/0.48 and 1.65/2.22 microns ratios are not pronounced at vegetative covers of up to 20 percent. The ratio 0.66/0.48 micron minimizes the spectral effect of vegetation in mapping iron staining due to intense plant pigment absorptions in both bands. Author

A84-27782*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MINERALOGICAL REMOTE SENSING OF SURFACE EXPRESSIONS OF DEEP-SEATED PORPHYRY COPPER DEPOSITS AT SAFFORD MINING DISTRICT, ARIZONA
M. ABRAMS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA), L. READDY (GEA, Kirkland, WA), and L. K. LEPLEY IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 693-704. refs
(Contract NAS7-100)

A84-27783#
INTERACTIVE ENHANCEMENT OF LANDSAT IMAGERY FOR STRUCTURAL MAPPING IN TIN-TUNGSTEN PROSPECTING - A CASE HISTORY OF THE S. W. ENGLAND OREFIELD (U.K.)
J. M. MOORE (Imperial College of Science and Technology, London, England) and S. CAMM (Billiton Exploration U.K., Ltd., Truro, England) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 727-740. refs

A84-27784#
EXTRACTION OF GEOLOGICAL FEATURES BY PROCESSING OF LANDSAT CCT DIGITAL DATA
T. K. GHOSH and G. T. MARATHE (Indian Institute of Technology, Bombay, India) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 743-752.

The geological features have been brought out after determining the grey level cooccurrences and the trend of the texture., The trends are determined in the directions N-S, E-W, NNE-SSW and NNW-SSE. The measures of contrast, entropy, angular second moment and correlation estimate the texture. Author

A84-27785#
A SIGNIFICANT REMOTE SENSING ROLE IN PREDICTING HAZARDOUS ROOF CONDITIONS IN COAL MINES - THE SYDNEY BASIN TECTONIC STUDY
J. F. HUNTINGTON, A. J. MAUGER, and J. CREASEY (Commonwealth Scientific and Industrial Research Organization, Div. of Mineral Physics, Sydney, Australia) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 753-756.

Remotely sensed imagery, including Landsat, HCMM and SIR-A, have formed the basis of a tectonic study of the Sydney Basin, New South Wales, Australia. Integrated with air photo interpretation, outcrop studies and underground mapping in coal mines, satellite imagery has proved indispensable for locating previously unrecognized major fracture zones manifest in the Triassic sandstones. The fracture zones can be up to 30 km long, are usually meridional in orientation, appear to influence the regional joint pattern and when manifest underground cause severe mining problems in roof control. It is postulated that these zones have their origins in the pre-Permian basement. To assist in the analysis of these structures a field methodology and a suite of fracture analysis computer programs have been developed. The results of our research are being used by coal mining companies through the provision of fracture zone prediction maps of the coalfield and individual colliery leases. Author

A84-27789#
A COMPARISON OF LANDSAT AND SEASAT IMAGERY FOR GEOLOGICAL MAPPING IN DIFFICULT TERRAIN
J. R. HARRIS (F. G. Bercha and Associates, Ltd., Ottawa, Canada) and V. R. SLANEY (RADARSAT Project Office, Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 805-814. refs

Landsat multitemporal data and a Seasat-SAR digitally processed image of a heavily vegetated and glaciated environment in Central Ontario, Canada were compared for geological information content. Both visual and digital interpretive techniques were used. The SAR image in general provided greater structural detail (folds, foliation, lineaments). Although both allowed for the mapping of posible rock boundaries, exact lithologic identification was not possible. In general, boundaries interpreted from the SAR image conformed more closely to the published geology. Digital processing revealed more structural detail than could be obtained if visual analysis were used exclusively. The early summer Landsat (DICS) and SAR-Landsat digitally processed combinations provided the greatest structural detail. Geological mapping in heavily vegetated and glaciated terrain requires the use of both MSS and RADAR to maximize geological information. Author

A84-27791#
STRUCTURAL EVALUATION OF THE EASTERN GRAND CANYON REGION, ARIZONA, USING LANDSAT-3 RBV/MSS STANDARD AND DIGITALLY ENHANCED IMAGES
G. L. BERLIN and P. S. CHAVEZ, JR. (U.S. Geological Survey, Flagstaff, AZ) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 827-842. refs

Landsat-3 RBV (Return Beam Vidicon) and MSS (Multispectral Scanner) digital image data of the eastern Grand Canyon region were filtered with high-pass spatial algorithms to enhance structural geologic features characterized by certain spatial frequency ranges. On the basis of rating detectability for 37 structural features, the RBV image incorporating edge enhancement contained the highest level of structural detail. Results indicate that processed RBV images can be useful to the exploration geologist in both regional and detailed mapping projects. Author

A84-27792#
AN INTEGRATED LANDSAT-GEOLOGICAL-GEOPHYSICAL-GEOCHEMICAL VEY FOR MINERAL OCCURRENCE IN WEST-CENTRAL UTAH
R. A. MARSTON, P. C. GOODELL, R. L. HOFFER, and G. R. KELLER (Texas, University, El Paso, TX) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 843-851. refs

West-central Utah is choosen as a study area to demonstrate the utility of integrated surveys for mineral occurrence with enhanced Landsat imagery and substantial geochemical and geophysical data recently compiled for that region by the authors. Mining districts in the region are classified according to probable genetic type and expected Landsat response. Landsat lineaments and circular features are related to previously mapped faults and mineral deposits within the east-trending Blue Ribbon structural zone, Wah Wah-Tushar mineral belt, and Deep Creek-Tintic mineral belt. The belts are more clearly identified by aligned anomalies on gravity and aeromagnetic maps than on Landsat imagery. Of particular interest are Landsat circular features explained as caldera structures with associated uranium deposits of volcanogenic origin. Landsat analyses for mineral occurrence provide the most unique and useful information only when near surface geology reflects the dominant mineralization process. Author

A84-27793#
LANDSAT DATA CLASSIFICATION FOR LITHOLOGICAL MAPPING USING AN EFFICIENT IMPROVED SUPERVISED ALGORITHM
P. R. SARAPH, S. VISWANATHAN, G. VENKATARAMAN, and R. NAGARAJAN (Indian Institute of Technology, Bombay, India) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 853-860.

An attempt is made to demonstrate the use of an efficient, improved, supervised algorithm for Landsat MSS data classification of major lithological units, using Landsat data integration by ratioing. For spectral band ratioing, the ratio index is defined to help in selection of different band sets. This ratio is derived from the eigenstructure and the distribution of the data. Transform ratioed refined data have been classified by supervised classification, using Mahalanobis distance as a qualifying likelihood discrimination. Author

A84-27794#
EXTRACTION OF TEXTURE INFORMATION FROM SAR DATA - APPLICATION TO ICE AND GEOLOGICAL MAPPING
B. A. BURNS, E. S. KASISCHKE (Michigan, Environmental Research Institute, Ann Arbor, MI), and D. R. NUESCH (Zuerich, Universitaet, Zurich, Switzerland) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 861-868. refs

The application of a simple texture extraction technique to synthetic aperture radar (SAR) data is evaluated for its utility in discriminating sea ice types and in mapping geologic units and structural features. When applied to aircraft SAR data of ice covered regions in the Beaufort Sea, this algorithm, based on local gray level statistics, performed almost as well in classifying major ice types as did the spatial gray level dependence method, and with much less computation time. Application of this technique to Seasat imagery of semi-mountainous terrain did not result in any enhancement of subtle structural trends or lithologic differences. For this application, the presence of specular returns must be addressed and additional texture measures considered. Author

A84-27795#
EXPLORING FOR GEOTHERMAL ENERGY ON THE ISLAND OF KYUSHU, JAPAN BY INTEGRATING GEOPHYSICAL AND LANDSAT DATA
H. HASE, H. KAMATA (New Energy Development Organization, Japan), Y. YAMAGUCHI, Y. KINUGASA, H. MURAOKA (Geological Survey of Japan, Tokyo, Japan), J. DYKSTRA, and R. STASKOWSSKI (Earth Satellite Corp., Chevy Chase, MD) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 869-872.

Japan is pursuing an exhaustive nationwide geothermal exploration program as part of a larger design to increase Japan's energy self-sufficiency. Interpretation of conventional aeromagnetic and gravity data is being combined with photogeologic interpretation of Landsat and SLAR imagery for the purpose of selecting geothermal prospects. Detailed lineament and geologic analysis of the Landsat data suggests that the northern and southern portions of the island are being affected by markedly different directions of maximum compressive stress. Geologic observations made from the Landsat imagery agree well with those drawn from the other data sets. The integration of this wide spectrum of geophysical data is proving to be a useful approach for geothermal exploration. Author

A84-27796#
EVALUATION OF SHUTTLE SIR-A IMAGERY FOR GEOLOGICAL AND GEOMORPHIC MAPPING IN N.W. WESTERN AUSTRALIA
F. R. HONEY and I. J. TAPLEY (Commonwealth Scientific and Industrial Research Organization, Wembley, Australia) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 873-884. refs

The SIR-A imagery, acquired from Shuttle in November 1981, has been evaluated for an area in the north-west of Western Australia. The region chosen for evaluation spans several major geological units, and presents a wide range of geologic, geomorphic and vegetation units which have been previously mapped at varying levels of detail. Landsat-2 MSS and Landsat-3 RBV imagery was available for part of the area studied, and was compared with the SIR-A imagery. Several geologic features, not identified on existing maps, or only partially indicated, were identified. Drainage networks were most apparent, and some indications of structural control of drainage lines were noted. Author

A84-27798#
ESTIMATING THE RELATIVE PERCENTAGES OF MINERAL SALTS IN SALINE DEPOSITS OF SOUTHERN TUNISIA USING REMOTELY SENSED DATA
T. J. MUNDAY (Imperial College of Science and Technology, London, England) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 903-914. refs

A84-27799*# Wyoming Univ., Laramie.
A STUDY IN PROGRESS
J. E. MARKS and R. W. MARRS (Wyoming, University, Laramie, WY) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 915-924. NASA-supported research. refs

A84-27800*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
APPLICATION OF THEMATIC MAPPER-TYPE DATA OVER A PORPHYRY-MOLYBDENUM DEPOSIT IN COLORADO
D. L. RICKMAN (NASA, National Space Technology Laboratories, Earth Resources Laboratory, Bay St. Louis, MS) and R. M. SADOWSKI (AMAX Exploration, Inc., Tucson, AZ) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 925-934. refs

The objective of the study was to evaluate the utility of thematic mapper data as a source of geologically useful information for mountainous areas of varying vegetation density. Much of the processing was done in an a priori manner without prior ground-based information. This approach resulted in a successfull mapping of the alteration associated with the Mt. Emmons molybdenum ore body as well as several other hydrothermal systems. Supervised classification produced a vegetation map at least as accurate as the mapping done for the environmental impact statement. Principal components were used to map zones of general, subtle alteration and to separate hematitically stained rock from staining associated with hydrothermal activity. Decorrelation color composites were found to be useful field mapping aids, easily delineating many lithologies and vegetation classes of interest. The factors restricting the interpretability and computer manipulation of the data are examined. V.I.

A84-27801*# Dartmouth Coll., Hanover, N.H.
LANDSAT MAPPING OF ROCKS ASSOCIATED WITH COPPER MINERALIZATION, NORTHERN BAHIA STATE, BRAZIL
T. A. STONE, R. W. BIRNIE, and H. ZANTOP (Dartmouth College, Hanover, NH) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 935-946. Research supported by Dartmouth College. refs
(Contract NAG5-159; NCC5-22)

This project has applied Landsat digital data to a study of the geology of a mineralized zone in northern Bahia State, Brazil. The study accomplished two tasks: (1) production of a 1:100,000 geologic map of approximately 3300 sq km and (2) development of a two tiered geobotanical index that exploits increased vegetation density and decreased soil brightness on the mafic rock units.
Author

A84-27802#
A TELEDETECTIVE STUDY OF KIMBERLITE REGIONS IN N. AMEMRICA (COLORADO-WYOMING), E. AFRICA (MWADUI), AND SIBERIA (MIR)
T. L. WOODZICK and M. E. MCCALLUM (Colorado State University, Fort Collins, CO) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 955-964. Research supported by the Colorado School of Mines. refs

A84-27803#
LANDSAT EXPLORATION FOR PRECIOUS METALS AND MOLYBDENUM IN EAST-CENTRAL IDAHO
J. D. HERMAN, R. K. VINCENT (Geospectra Corp., Ann Arbor, MI), and J. HUSPENI (Newmont Exploration, Ltd., Brewer, ME) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 965-974. refs

Landsat ratio images (R5/4) which display the ratio of channel 5 to channel 4 can reveal orange-red hydrothermally altered rock or soils associated with oxidized sulfides. A specially processed R5/4 ratio image was used to delineate oxidized hydrothermal alteration zones in the Yankee Fork mining district of Custer County, Idaho. A color level slice of the ratio image was processed in which the very highest R5/4 values appeared dark purple to black on the image. These highest R5/4 values highlighted the most intense red zones in the area imaged. More than 100 anomalies or suspected zones of hydrothermal alteration were delineated by this technique. Subsequent field examination of 47 anomalies revealed that 42 percent of them were oxidized hydrothermally altered rocks. This percentage did not include those anomalies associated with known ore deposits and prospects. Assay results of rocks from 3 of the anomalies yielded anomalous values of Au (0.035 to 3.6 ppm), Ag (0.8 to 3.2 ppm), Mo (20 to 250 ppm), As (320-338 ppm), Hg (100-240 ppb), and W (4-13 ppm). Author

A84-27804#
USE OF TEXTURAL DISCRIMINATION TECHNIQUE IN LANDSAT DIGITAL ANALYSIS FOR PHYSICAL FEATURE IDENTIFICATION IN MINERALIZED ZONES
P. R. SARAPH and A. B. INAMDAR (Indian Institute of Technology, Bombay, India) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 977-985.

Textural discrimination has been attempted for various geological and other landcovers of an area in Goa, India. Textural information used for the discrimination purpose was that of angular second moment, contrast, correlation, variance, entropy based on the co-occurrence of textural elements of mega and micro textures corresponding to the scale of geological interpretations sought. The textural features which were obtained by ratioing the above mentioned elements obtained from cluster analysis were utilized for classification of the area for two different textural block sizes, using nearest neighbor classification. Author

A84-27895
FAULT TECTONICS OF THE WESTERN SHELF OF THE SOUTH CASPIAN SEA ACCORDING TO SPACE-GEOLOGY DATA [RAZLOMNAIA TEKTONIKA ZAPADNOGO SHEL'FA IUZHNOGO KASPIIA PO KOSMOGEOLOGICHESKIM DANNYM]
F. S. MAGERRAMOVA and V. A. OGADZHANOV (Nauchnyi Tsentr Geofizika, Azerbaidzhan SSR) Akademiia Nauk Azerbaidzhanskoi SSR, Doklady (ISSN 0002-3078), vol. 39, no. 9, 1983, p. 65-69. In Russian. refs

A84-28166
PRELIMINARY GEOLOGICAL INTERPRETATION OF SIR-A RADAR IMAGES OF THE BEIRUT-DAMASCUS REGION - COMPARISON WITH LANDSAT IMAGES [INTERPRETATION GEOLOGIQUE PRELIMINAIRE DE L'IMAGERIE RADAR SIR-A DE LA REGION DE BEYROUTH-DAMAS - COMPARAISON AVEC L'IMAGERIE LANDSAT]
P. MASSON (Paris XI, Universite, Orsay, Essonne, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 92, 1983-1984, p. 23-31. In French. refs

A84-28167
PRELIMINARY RESULTS OF A STUDY OF SIR-A IMAGES OF THE REGION OF YAOUNDE, CAMEROON [RESULTATS PRELIMINAIRES DE L'ETUDE DES IMAGES SIR-A DE LA REGION DE YAOUNDE/CAMEROUN/]
G. CHAMPETIER DE RIBES (Laboratoire Central des Ponts et Chaussees, Paris, France) and J.-Y. SCANVIC (Bureau de Recherches Geologiques et Minieres, Orleans, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 92, 1983-1984, p. 33-42. In French.

A84-28168
EVALUATION OF THE APPLICATION OF SIR-A RADAR IMAGES TO GEOLOGY: COMPARISON WITH LANDSAT IMAGES AND AERIAL PHOTOGRAPHY - THE CASE OF THE REPUBLIC OF MALI; EXAMPLES FROM ASIA AND AMERICA [EVALUATION DE L'APPORT DES RADARGRAPHIES SIR-A EN GEOLOGIE: COMPARAISON AVEC LES IMAGES LANDSAT ET LES PHOTOGRAPHIES AERIENNES - CAS DE LA REPUBLIQUE DU MALI; EXEMPLES EN ASIE ET EN AMERIQUE]
G. WEECKSTEEN (Bureau de Recherches Geologiques et Minieres, Orleans, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 92, 1983-1984, p. 43-62. In French.

A84-28687
SEISMOTECTONIC NATURE OF CERTAIN RINGSHAPED PHOTOANOMALIES REVEALED BY REMOTE SENSING [O SEISMOTEKTONICHESKOI PRIRODE NEKOTORYKH KOL'TSEVYKH FOTOANOMALII, FIKSIRUEMYKH DISTANTSIONNYMI METODAMI]
V. I. POPKOV (Kazakhskii Gosudarstvennyi Nauchno-Issledovatel'skii i Proektnyi Institut Neftianoi Promyshlennosti, Shevchenko, Kazakh SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 38-40. In Russian. refs

Satellite remote-sensing data on ringshaped photoanomalies are examined. It is shown that some of these anomalies are traces of the relaxation of tectonic strains occuring in subsurface levels of the earth. B.J.

A84-28688
PREDICTION OF FRACTURE ZONES IN SUBSALT DEPOSITS OF THE CASPIAN DEPRESSION OF THE BASIS OF SPACE REMOTE-SENSING DATA AND GEOLOGICAL-GEOPHYSICAL DATA [PROGNOZIROVANIE ZON TRESHCHINOVATOSTI PODSOLEVYKH OTLOZHENII PRIKASPISKOI VPADINY NA OSNOVE KOSMICHESKOI INFORMATSII I GEOLOGO-GEOFIZICHESKIKH DANNYKH]
I. N. KAPUSTIN (Vsesoiuznyi Nauchno-Issledovatel'skii Geologorazvedochnyi Neftianoi Institut, Moscow, USSR) and S. E. PETROV Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 41-50. In Russian. refs

A84-28692
ASSESSMENT OF THE EFFICIENCY OF THE UTILIZATION OF SPACE DATA IN THEMATIC HYDROGEOLOGICAL STUDIES [OTSENKA EFFEKTIVNOSTI ISPOL'ZOVANIIA KOSMICHESKOI INFORMATSII PRI TEMATICHESKIKH GIDROGEOLOGICHESKIKH ISSLEDOVANIIAKH]
I. M. GALPERIN and IU. L. OBEDKOV (Akademiia Nauk SSSR, Institut Vodnykh Problem, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 68-72. In Russian. refs

A84-28788*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RAPID DISCRIMINATION OF GRANITIC ROCK COMPOSITIONS BY LOW-RESOLUTION NEAR-INFRARED REFLECTANCE
A. K. BAIRD (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; Pomona College, Claremont, CA) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, April 10, 1984, p. 2491-2496. NASA-supported research. refs

The slopes of near-infrared spectra between approximately 1 and 2 microns from quartz-bearing plutonic rocks are strongly correlated with rock chemistry determined by X-ray spectrometry. The empirically derived predictive equations provide compositional data of adequate precision and resolution to discern patterns of regional geochemical variation in granitic batholithic rocks of southern California. As an analytical method, infrared spectrometry is rapid and inexpensive, and the method has potential in applications to direct field measurements and to data from aircraft and spacecraft scanner systems of relatively low spectral and spatial resolution, provided vegetative cover and surface alteration are not prohibitively masking. Author

N84-16391*# Chevron Oil Field Research Co., La Habra, Calif.
GEOLOGIC APPLICATION OF SPACEBORNE RADARS
F. F. SABINS, JR. *In* JPL Spaceborne Imaging Radar Symp. p 5-9 1 Jul. 1983 refs Prepared in cooperation with California Univ., Los Angeles
Avail: NTIS HC A08/MF A01 CSCL 17I

Geologic applications of spaceborne radar images, specifically SEASAT in southern California and SIR-A in Indonesia are illustrated. Author

N84-16393*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
USE OF COREGISTERED RADAR, VISIBLE AND IR IMAGES FOR GEOLOGIC REMOTE SENSING
D. L. EVANS *In its* Spaceborne Imaging Radar Symp. p 13-16 1 Jul. 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 17I

The Shuttle Imaging Radar (SIR-A) obtained images over the southern portion of the San Rafael Swell in eastern Utah. SEASAT SAR and LANDSAT MSS images and thermal inertia data from the Heat Capacity Mapping Mission (HCMM) were correlated with the SIR-A data. Radar images obtained with different incidence angles and different illumination directions were compared with images obtained in other portions of the spectrum for geologic remote sensing. Author

N84-16401*# Hunting Geology and Geophysics Ltd., Boreham Wood (England).
SIR-A AIDS REGIONAL GEOLOGY: COMPARISONS OF SIR-A IMAGERY WITH SLAR AND LANDSAT OVER GUYANA, VENEZUELA, NICARARGUA AND MALI
P. H. A. MARTIN-KAYE and G. M. LAWRENCE *In* JPL Spaceborne Imaging Radar Symp. p 56-72 1 Jul. 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 05B

Shuttle Imaging Radar-A (SIR-A) data from contrasted regions of rain forest and desert and the results of experiments in the combination of SIR-A with SLAR and with LANDSAT imagery are considered. Author

N84-16402*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
USE OF RADAR IMAGE TEXTURE IN GEOLOGIC MAPPING
T. G. FARR *In its* Spaceborne Imaging Radar Symp. p 73-75 1 Jul. 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 08B

Large slope angle radar and small slope angle radar techniques are discussed. The techniques are developed to aid in the geologic interpretation of synthetic aperture radar (SAR) images. The application presented is for heavy vegetation and where very little other data can be obtained directly from remote sensing images. To understand the relationships between image texture, topography, lithology, geomorphology, and climate improves, textural information from SAR images are used for the identification of rock types to discriminate units. An active program is to integrate textural information from radar images directly with backscatter data from the same images, and with compositional information derived from visible near infrared sensors such as LANDSAT is explored. The role of quantitative textural information in this type of multisensor analysis which promises to be significant is outlined. E.A.K.

N84-16405*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SIR-A ATLAS
J. P. FORD *In its* Spaceborne Imaging Radar Symp. p 83-85 1 Jul. 1983
Avail: NTIS HC A08/MF A01 CSCL 05B

The scientific payload on the Space Shuttle Columbia carried into Earth orbit is discussed. Part of the payload was the Shuttle Imaging Radar system (SIR-A). The objectives of the SIR-A experiment were to acquire radar images of a wide variety of different geologic terrains around the Earth, to demonstrate the capability of the Shuttle as a platform for conducting spaceborne scientific investigations, and to analyze and interpret the data in the radar images. The SIR-A sensor imaged about 10 million sq km of the Earth's surface. High resolution images were acquired over portions of every continent and some of the oceans between latitudes 41 N and 35 S. The SIR-A incidence angle ranges from 47 deg to 53 across an image swath of approximately 50 km. E.A.K.

N84-16617*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MULTISEASONAL AND GEOBOTANICAL APPROACH IN REMOTE DETECTION OF GREISENIZATION AREAS IN THE SERRA DA PEDRA BRANCA GRANITE, GOIAS STATE, BRAZIL
N. D. J. PARADA, Principal Investigator and R. ALMEIDAFILHO Dec. 1983 23 p refs Submitted for publication Sponsored by NASA Original contains imagery. Original photography may be purchased at the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E84-10070; NASA-CR-173220; NAS 1.26:173220; INPE-2990-PRE/445) Avail: NTIS HC A02/MF A01 CSCL 08B

Multiseasonal analysis of LANDSAT multispectral images in CCT format permitted the mapping of lithologic facies in the Pedra Branca Granite, using geobotanical associations, which occur in the form of variations in the density of cerrado vegetation, as well as the predominance of certain distinctive vegetation species. Dry season images did not show very good results in lithological differentiation due to anomalous illumination conditions related to the low solar elevation and the homogeneity in the vegetation cover, specially the grasses that become dry during this season. Rainy season image, on the other hand, allowed the separation of the lithological types, a fact that can be attributed to a greater differentiation among the geobotanical associations. As a result of this study, the muscovite-granite facies with greisenization zones, which are lithological indicators of important tin mineralization within the Serra da Pedra Branca Granite, were mapped. This methodology can be sucessfully applied to similar known granite bodies elsewhere in the Tin Province of Goias. M.G.

N84-16625*# Geological Survey, Denver, Colo.
APPLICATION OF HEAT CAPACITY MAPPING MISSION DATA TO REGIONAL GEOLOGIC ANALYSIS FOR MINERAL AND ENERGY RESOURCE EVALUATION Final Report
K. WATSON, Principal Investigator, S. HUMMER-MILLER, D. H. KNEPPER, JR., M. D. KROHN, M. H. PODWYSOCKI, H. H. POHN, G. L. RAINES, and L. C. ROWAN Dec. 1983 121 p refs Prepared in cooperation with Geological Survey, Reston, Va. Original contains imagery. Original imagery may be purchased from NASA Goddard Space Flight Center, (code 601), Greenbelt, Md. 20770. Domestic users send orders to 'Attn: National Space Science Data Center'; non-domestic users send orders to 'Attn: World Data Center A for Rockets and Satellites'. HCMM
(Contract NASA ORDER S-79678-B)
(E84-10078; NASA-CR-173228; NAS 1.26:173228) Avail: NTIS HC A06/MF A01 CSCL 08B

Heat Capacity Mapping Mission thermal-inertia images of a diversity of terrains and geologic settings were examined in conjunction with topographic, geologic, geophysical, and LANDSAT data. The images were found to have attributes similar to bedrock maps. In the Cascades region, two new features were identified and a method was developed to characterize regional terranes using linear feature data. Two northeast-trending Lineaments were discovered in the Overthrust Belt of Montana and Idaho. The longer of the two extends from the Idaho-Oregon border, through the Idaho batholith and across the Lewis thrust. It coincides, along segments, with mapped faults and an aeromagnetic pattern change. A major lineament crossing the Colorado Plateau and the Southern Rocky Mountians was detected on several thermal-inertial images and evidence was found for the existence of a geologic discontinuity. Vegetation-covered areas in Richfield and the Silver City quadrangle (Arizona and New Mexico) displayed thermal-inertia differences within heavily vegetation areas although no apreciable correlation was found between vegetation cover and thermal inertia. Resistant ridges and knolls have high thermal inertias and thermal-inertia contrasts occurred at lithologic and fault contacts. In the heavy vegetated Pinaleno Mountains, Arizona, a Lithologic unit obscured on LANDSAT MSS data due to the vegetation cover, exhibited a thermal-inertia contrast with its surroundings. M.G.

N84-16703*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EVALUATION OF THERMAL DATA FOR GEOLOGIC APPLICATIONS
A. B. KAHLE, F. D. PALLUCONI, C. J. LEVINE, M. J. ABRAMS, D. B. NASH, R. E. ALLEY, and J. P. SCHIELDGE Dec. 1982 115 p refs Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-173211; JPL-PUB-83-56; NAS 1.26:173211) Avail: NTIS HC A06/MF A01 CSCL 08G

Sensitivity studies using thermal models indicated sources of errors in the determination of thermal inertia from HCMM data. Apparent thermal inertia, with only simple atmospheric radiance corrections to the measured surface temperature, would be sufficient for most operational requirements for surface thermal inertia. Thermal data does have additional information about the nature of surface material that is not available in visible and near infrared reflectance data. Color composites of daytime temperature, nighttime temperature, and albedo were often more useful than thermal inertia images alone for discrimination of lithologic boundaries. A modeling study, using the annual heating cycle, indicated the feasibility of looking for geologic features buried under as much as a meter of alluvial material. The spatial resolution of HCMM data is a major limiting factor in the usefulness of the data for geologic applications. Future thermal infrared satellite sensors should provide spatial resolution comparable to that of the LANDSAT data. A.R.H.

N84-17657# Technische Univ. Munich, Garching (West Germany). Inst. Fuer Allgemeine und Angewandte Geodaesie.
REQUIREMENTS FOR SPACEBORNE REMOTE SENSING IN GEOLOGY
J. BODECHTEL *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 53-57 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

Requirements for Earth resources monitoring based on Landsat MSS data are defined. No monitoring is required, but large areal coverage and a multisensor approach are indispensable. Data acquisition under differing seasonal, meteorological and climatological conditions, and multitemporal and repeating coverage are required to trace subsurface geology dependent indicators, such as vegetation stress. Direct identification or classification of lithological, petrographic or mineralization units; of structural phenomena and of geological units using tracers or indicators such as vegetation and soil moisture are necessary. An optical sensor system requires 4 spectral bands ranging from 0.5 to 2.3 microns, with 7 bit radiometric resolution, and 20 to 30m ground pixel size in the visible spectrum, 120 to 150m in IR.
Author (ESA)

N84-17668# Technische Univ. Munich, Garching (West Germany). Inst. fuer Allgemeine und Angewandte Geodaesie.
REMOTE SENSING FOR GEOLOGY
H. KAUFMANN and F. JASKOLLA *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 151-157 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

LANDSAT digital image processing techniques used in geology are described. By using a color coding concept, which describes a color in terms of its intensity, hue, and saturation (IHS), it is possible to combine Heat Capacity Mapping Mission (HCMM) day and night thermal IR recordings with LANDSAT. This could be achieved by treating the high resolution LANDSAT image as intensity, the HCMM night IR image as hue and the corresponding day IR as saturation. Another approach merges different data sets via a quasi topography, generated through a synthetic stereo effect. The algorithm is based on a simple geometrical relationship, described by the parallax formula. The already known heights are given by the pixel values of the HCMM day IR: the higher the day time temperature the greater the offset of the corresponding pixels and therefore the higher the topography. Topography can be seen as a function of emissivity rate and used for mapping temperature variations. Author (ESA)

N84-17672# Army Engineer Topographic Labs., Fort Belvoir, Va.
EVALUATION OF PUBLISHED CRITERIA FOR IDENTIFYING METAMORPHIC ROCKS ON AIR PHOTOS: TWO CASE STUDIES IN THE NORTHEASTERN UNITED STATES
J. EHLEN May 1983 127 p
(Contract AF PROJ. 4A1-61102-B-52-C)
(AD-A135451; ETL-0326) Avail: NTIS HC A07/MF A01 CSCL 08G

Published criteria for identifying metamorphic rocks by air photo patterns were systematically tested on regionally metamorphosed rocks in west-central Vermont and near West Point, New York, and were found inadequate for use a predictive tools. Mapping units were discriminated on the air photos by evaluating the pattern elements of landform, drainage-plan, drainage-cross section, photo tone, and photo texture. They were identified by comparing each pattern element to its counterpart for each rock type in the published criteria. The most common pattern element rock name was selected as the name for the mapping unit. To avoid bias, geological data were not obtained until after the identification process was completed. The predicted rocks names were then compared to geologic maps and field data to determine their accuracy. Only 20 of the 74 verifiable predictions were correct. Probable causes for these results are (1) that the published criteria are incomplete and internally inconsistent and do not include all the rocks types found in the study areas; (2) that climatic and structural, or tectonic, factors, apparently not considered in the published criteria, play a significant role in determining rock type photo pattern; and (3) that the glacial history of these areas has affected the characteristic photo patterns of the rocks encountered. Moderate success was achieved, however, where lithologic diversity and morphic rocks of higher grade and/or sedimentary origin. Similar techniques have proven successful for identifying igneous and sedimentary rocks on air photos, so development of more accurate criteria for metamorphic rocks, taking these factors into consideration, is continuing. GRA

N84-17675# Army Engineer Topographic Labs., Fort Belvoir, Va.
THE CLASSIFICATIONS OF METAMORPHIC ROCKS AND THEIR APPLICATIONS TO AIR PHOTO INTERPRETATION PROCEDURES
J. EHLEN Sep. 1983 47 p
(Contract DA PROJ. 4A1-61102-B-52-C)
(AD-A134965; ETL-0341) Avail: NTIS HC A03/MF A01 CSCL 08G

Although there are stated Army needs for rock-type information, there are as yet few reliable procedures for obtaining much of this information, particularly for metamorphic rocks, via remote sensing. The three common classifications of metamorphic rocks, i.e., textural, facies, and formational, were evaluated in terms of their usefulness in predicting metamorphic rock types using air photo interpretation procedures. Areas in the northeastern United States containing a wide range of metamorphic rocksphoto interpretation procedures exists. The textural classification was found most useful, primarily because criteria for identifying metamorphic rocks on air photos using this classification were developed previously. Although using the facies classification has potential, it is unlikely that it can be used routinely in conjunction with air photo interpretation procedures because of the high degree of skill required to identify metamorphic facies. The formational classification was found to be useful because it identifies metamorphic rocks by mapping unit, but it does not provide a mechanism for naming the rock units. GRA

N84-20041*# Johns Hopkins Univ., Baltimore, Md.
THE MAGNETIC PETROLOGY OF THE DEEP CRUST AND THE INTERPRETATION OF REGIONAL MAGNETIC ANOMALIES Ph.D. Thesis
C. M. SCHLINGER 1983 254 p refs
(NASA-CR-175407; NAS 1.26:175407) Avail: Issuing Activity CSCL 04A

Rocks from Lofoten and Vesteraalen, Northern Norway, a high-grade province of deep seated origin with associated regional magnetic and gravity anomalies are studied. These rocks have a bulk magnetic character of surprising uniformity, with susceptibilities, hysteresis, and Curie temperatures, defined solely by nearly pure magnetite. Stable remanence is observed only in samples from SW Lofoten and is never of significant magnitude. The carrier of this remanence invariably appears to be hematite with 5 to 10 mole percent ilmentite in solution. Contrary to speculation the thermal enhancement of magnetic susceptibility, the Hopkinson effect, is not important in type lithologies. Rocks from the deepest part of the section have the largest average susceptibilities, .005 (c.g.s. Gaussian units), and magnitudes of nrm (natural remanent magnetization), .0004 emu/g. Author

N84-20944# Geological Survey, Washington, D. C.
THE MARINE GEOLOGY PROGRAM OF THE US GEOLOGICAL SURVEY
N. T. EDGAR 1983 27 p refs
(USGS-CIRC-906) Avail: NTIS HC A03/MF A01

The U.S. Geological Survey and charged it with the responsibility for the classification of public lands and examination of the geologic structure, mineral resources and products of the national domain.

The national domain for seabed resources was extended to 200 nautical miles offshore. This United States Exclusive Economic Zone (EEZ), a marine domain surrounding the continental U.S., Hawaii, and U.S. related islands, constitutes an area about one and two thirds larger than the size of the onshore area. In this vast domain lie resources of immense importance to the Nation: an estimated 35 percent of the economically recoverable oil and gas yet to be found in the United States; major resources of strategic metals like cobalt, manganese, and nickel in seafloor crusts, pavements, and modules; massive sulfide deposits actively forming today; and major concentrations of heavy minerals in nearshore sand bodies. Author

N84-21918*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PERFORMANCE EVALUATION AND GEOLOGIC UTILITY OF LANDSAT-4 TM AND MSS DATA Quarterly Report, Dec. 1983 - Mar. 1984
E. D. PAYLOR Mar. 1984 10 p ERTS
(Contract NAS7-918)
(E84-10099; NASA-CR-173368; NAS 1.26:173368) Avail: NTIS HC A02/MF A01 CSCL 08G

Radiometric calibration accuracy of TM data, radiometric comparison of A-, B-, and P-format data, and geometric registration accuracy of the TM data at enlarged scales were analyzed. Radiometric analysis of the Wind River Basin, Wyoming scene demonstrates that the TM system can be used to extract image reflectance spectra from ground targets following calibration of the system. It was also demonstrated that: (1) image DN (radiance values) vs. ground reflectance calibration scatterplots yield parameters which can be used to constrain atmospheric models and can determine TM radiometric sensitivity; (2) no significant degradation occurs as a result of radiometric and geometric correction by SCROUNGE processing; and (3) TM data can be enlarged to 1:24000 with no major geometric distortions or misregistration problems to USGS topographic maps. M.G.

N84-21928*# Columbia Univ., New York. Lab. of Applied Geophysics.
DETECTION OF HIDDEN MINERAL DEPOSITS BY AIRBORNE SPECTRAL ANALYSIS OF FOREST CANOPIES Final Report
W. COLLINS, S. H. CHANG, and J. T. KUO 1984 79 p refs
Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NSG-5222; NSF DAR-78-16320)
(E84-10110; NASA-CR-175210; NAS 1.26:175210) Avail: NTIS HC A05/MF A01 CSCL 02F

Data from field surveys and biogeochemical tests conducted in Maine, Montana, and Washington strongly correlate with results obtained using high resolution airborne spectroradiometer which detects an anomalous spectral waveform that appears definitely associated with sulfide mineralization. The spectral region most affected by mineral stress is between 550 nm and 750 nm. Spectral variations observed in the field occur on the wings of the red chlorophyll band centered at about 690 nm. The metal-stress-induced variations on the absorption band wing are most successfully resolved in the high spectral resolution field data using a waveform analysis technique. The development of chlorophyll pigments was retarded in greenhouse plants doped with copper and zinc in the laboratory. The lowered chlorophyll production resulted in changes on the wings of the chlorophyll bands of reflectance spectra of the plants. The airborne spectroradiometer system and waveform analysis remains the most sensitive technique for biogeochemical surveys. A.R.H.

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OCEANOGRAPHY AND MARINE RESOURCES

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

A74-20413
SMALL DOPPLER SHIFTS ON LOW LATITUDE TRANSEQUATORIAL PATH VLF SIGNALS
M. K. ANDREWS (Physics and Engineering Laboratory, Lower Hutt, New Zealand) Journal of Atmospheric and Terrestrial Physics, vol. 36, Feb. 1974, p. 335-341. refs

Observations of VLF signals on a transequatorial path indicate that a fraction of the signal received may suffer a Doppler shift less than that generally produced by magnetospherically ducted propagation, and arrive along a path displaced a few degrees from the great circle direction. It is suggested that such signals have crossed the Equator in the whistler mode at ionospheric heights. (Author)

A84-20401
THE SEA SURFACE THERMAL BOUNDARY LAYER AND ITS RELEVANCE TO THE MEASUREMENT OF SEA SURFACE TEMPERATURE BY AIRBORNE AND SPACEBORNE RADIOMETERS
I. S. ROBINSON, N. C. WELLS, and H. CHARNOCK (Southampton, University, Southampton, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Jan.-Feb. 1984, p. 19-45. Sponsorship: Natural Environment Research Council. refs
(Contract NERC-F60/G6/06)

It is pointed out that the measurement of sea surface temperatures (SST) from space using satellite-borne infrared (IR) radiometers is now an operational reality. The radiometers measure the temperature of the surface skin, including the water within the first 0.1 mm of depth, which may differ by a few tenths of a degree from the temperature of the water a few centimeters below, which corresponds to the 'sea surface temperature' determined in situ by conventional ship- or buoy-mounted thermometers. The present investigation is concerned with a reappraisal of the significance of the thermal boundary of the ocean surface, taking into account information available in the scientific literature. It appears that the surface skin of the ocean is typically 0.2-0.5 deg K lower than the bulk SST, but there is still a lack of consistent observations on which to base any attempts to predict the effect. G.R.

A84-20406
A TWO-SATELLITE METHOD FOR MEASUREMENT OF SEA SURFACE TEMPERATURE
R. J. HOLYER (U.S. Navy, Naval Ocean Research and Development Activity, Bay St. Louis, MS) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Jan.-Feb. 1984, p. 115-131. refs

Demands for quantitative sea surface temperature satellite data are increasing. However, difficulties with respect to obtaining accurate sea surface temperatures on the basis of satellite data arise because of the effects of the intervening atmosphere. A number of approaches have, therefore, been considered for correcting the data with respect to atmospheric effects. The present investigation is concerned with an additional method for achieving spatially variant atmospheric corrections. This method is based on the utilization of simultaneous coverage by two satellites, taking into account a simplified atmospheric radiative transfer model. The new method has been employed to retrieve sea surface temperatures which show good agreement with surface truth. G.R.

A84-20410
ATMOSPHERIC CORRECTION TO AVHRR BRIGHTNESS TEMPERATURES FOR WATERS AROUND GREAT BRITAIN
R. D. CALLISON and A. P. CRACKNELL (Dundee, University, Dundee, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Jan.-Feb. 1984, p. 185-198. refs

The method and computer program developed by Weinreb and Hill (1980) for the atmospheric correction of AVHRR thermal infrared data has been used. The method has been applied to a cloud-free scene of 17 May 1980 using radiosonde data from five stations around Great Britain on that date. Significantly different corrections to the brightness temperatures for the sea surface were obtained for the five different stations. The results have been compared with 5-day-mean sea surface temperature charts obtained from the Meteorological Office. It is suggested that further refinements of the technique are necessary. Author

A84-20954* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GLOBAL MEASUREMENTS OF SEA SURFACE TEMPERATURE, WIND SPEED AND ATMOSPHERIC WATER CONTENT FROM SATELLITE MICROWAVE RADIOMETRY
E. G. NJOKU and L. SWANSON (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) Monthly Weather Review (ISSN 0027-0644), vol. 111, Oct. 1983, p. 1977-1987. NASA-supported research. refs

The Scanning Multichannel Microwave Radiometer (SMMR) was launched on the Seasat and Nimbus 7 satellites in 1978. The SMMR has the ability to measure sea surface temperature and wind speed with the aid of microwaves. In addition, the instrument was designed to measure water vapor and cloud liquid water with better spatial resolution than previous microwave radiometers, and to make sea-ice measurements with higher precision. A description is presented of the results of global analyses of sea surface temperature, wind speed, water vapor, and cloud liquid water, taking into account data provided by the SMMR on the Seasat satellite. It is found that the SMMR data show good self-consistency, and can usefully measure global distributions of sea surface temperatures, surface winds, water vapor, and cloud liquid water. G.R.

A84-21467* New South Wales Univ., Sydney (Australia).
A COMPARATIVE STUDY ON SYNTHETIC APERTURE RADAR AND OPTICAL IMAGERY OF OCEAN WAVES
M. L. BANNER (New South Wales, University, Sydney, Australia), A. JAIN, and W. STROMBERG (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) Boundary-Layer Meteorology (ISSN 0006-8314), vol. 27, Oct. 1983, p. 115-128. NASA-supported research. refs

The ocean imaging capability of synthetic aperture radar (SAR) is examined in terms of an intercomparison between simultaneous, spatially collocated images of a coastal ocean scene, as recorded by aerial photography and aircraft-borne SAR. Based on a detailed study of these images, this paper examines various local features of oceanographic interest as they are imaged by the two methods. This provides information not available in the usual comparisons of normalized SAR and single point buoy spectra. In addition, aspects of the intensity wavenumber spectra of the two images are examined and discussed. An interesting and surprising conclusion arising from the comparison study is the ability of the SAR to image accurately non-uniform (possibly nonlinear) wave features which are imaged by the aerial photography. This result should have important implications on the development of SAR imaging models and the interpretation of the effect of ocean surface motion on the SAR images. Author

A84-21570
OPTICS OF THE OCEAN: APPLIED OCEAN OPTICS. VOLUME 2 [OPTIKA OKEANA: PRIKLADNAIA OPTIKA OKEANA. VOLUME 2]
A. S. MONIN, ED. Moscow, Izdatel'stvo Nauka, 1983, 240 p. In Russian.

The application of optical methods to oceanology is treated, with separate sections on optical oceanography and optical methods in oceanology and marine engineering. The optical characteristics of the oceans are described and classified. Attention is also given to hydrophysical and biological factors determining the optical properties of ocean water and to the distribution of these factors. A detailed treatment is given of various problems relating to the use of optical methods in the physics, geology, and biology of the oceans. A description is also given of remote optical methods for use in space-based oceanology. No individual items are abstracted in this volume C.R.

A84-21577
SATELLITE HYDROPHYSICS [SPUTNIKOVAIA GIDROFIZIKA]
B. A. NELEPO, IU. V. TEREKHIN, V. K. KOSNYREV, and B. E. KHMYROV Moscow, Izdatel'stvo Nauka, 1983, 256 p. In Russian. refs

Results obtained from recent investigations carried out by the Marine Hydrophysical Institute of the Ukrainian Academy of Sciences are summarized. The field of space-based oceanography is then surveyed. The physical principles underlying the study of the ocean through remote sensing methods are then presented. Material is presented from oceanographic experiments carried out with the satellites Cosmos 1076, Cosmos 1151 and Seasat. C.R.

A84-22464
AN INTERACTIVE ANALYSIS OF SATELLITE IMAGES OF AN ICE COVER [OB INTERAKTIVNOM ANALIZE SPUTNIKOVYKH IZOBRAZHENII LEDIANOGO POKROVA]
S. A. KLEPIKOV, M. NAZIROV, and P. A. NIKITIN (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 97-101. In Russian.

A method is outlined for classifying the characteristics of an ice cover on the basis of information obtained from interactive processing of satellite data. It is shown that if brightness and structural indicators are used simultaneously, information which is qualitatively new can be obtained. It is assumed that in the optical region of the spectrum coonsidered here, the snow-ice cove reflects energy orthotropically. C.R.

A84-23342
TEXTURAL ANALYSIS AND REAL-TIME CLASSIFICATION OF SEA-ICE TYPES USING DIGITAL SAR DATA
Q. A. HOLMES (Applied Intelligent Systems, Inc., Ann Arbor, MI), D. R. NUEESCH (Zuerich, Universitaet, Zurich, Switzerland), and R. A. SHUCHMAN (Michigan, Environmental Research Institute, Ann Arbor, MI) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-22, March 1984, p. 113-120. refs
(Contract N00014-81-C-0295)

Discrimination and mapping of ice types are carried out using digital measures of synthetic-aperture radar (SAR) image texture and the local approximation to the mean value of individual ice types. Before carrying out the textural analysis, a digital filter algorithm is developed that minimizes the effect of radar-system-generated coherent speckle and produces an image approximating local tone while preservng edge definition. This image is used in the analysis to separate image tone from image texture. The textural analysis, which includes a calculation of the entropy and inertia of the image, suggests that first- and multiyear, smooth- and rough-ice types could be distinguished on the basis of the textural values obtained from the data with an overall accuracy of 65 percent. Consideration is also given to the use of cellular operations based on neighborhood transformations to calculate the textural values. C.R.

A84-23345*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RETRIEVAL OF OCEAN SURFACE PARAMETERS FROM THE SCANNING MULTIFREQUENCY MICROWAVE RADIOMETER (SMMR) ON THE NIMBUS-7 SATELLITE
T. T. WILHEIT, JR., J. R. GREAVES, J. A. GATLIN (NASA, Goddard Space Flight Center, Greenbelt, MD), D. HAN, B. M. KRUPP, A. S. MILMAN, and E. S. CHANG (Systems and Applied Sciences Corp., Riverdale, MD) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-22, March 1984, p. 133-142. refs

Sea-surface temperature retrievals have been tested on 2 months of Nimbus-7 scanning multichannel microwave radiometer data. Using the prelaunch versions of the instrument calibration and geophysical parameter retrieval algorithms the initial results were poor. Improved algorithms produced substantially better results. It appears that at least for the night-Southern Hemisphere portion of the Nimbus-7 orbit, a rms measurement accuracy of 1.45 C has been achieved. Similar tests with wind speed retrievals yield an accuracy of 2.7 m/s rms with no substantial differences between day and night measurements but limited by availability of surface observations to the Northern Hemisphere. Moreover, it appears that the retrieved wind speed is more nearly related to the square of the wind observed at the surface than to the wind itself. Author

A84-23646* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STATISTICAL EXAMINATION OF NIMBUS-7 SMMR DATA AND REMOTE SENSING OF SEA SURFACE TEMPERATURE, LIQUID WATER CONTENT IN THE ATMOSPHERE AND SURFACE WIND SPEED
C. PRABHAKARA, A. T. C. CHANG, P. GLOERSEN (NASA, Goddard Space Flight Center, Greenbelt, MD), and I. WANG (NASA, Goddard Space Flight Center, Greenbelt; Computer Sciences Corp., Silver Spring, MD) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 22, Dec. 1983, p. 2023-2037. refs

Nimbus 7 Scanning Multichannel Microwave Radiometer (SMMR) brightness temperature measurements over the global oceans have been examined with the help of statistical and empirical techniques. Such analyses show that zonal averages of brightness temperature measured by SMMR over the oceans on a large scale are primarily influenced by the water vapor in the atmosphere. Liquid water in the clouds and rain, which has a much smaller spatial and temporal scale, contributes substantially to the variability of the SMMR measurements within the latitudinal zones. The surface wind not only increases the surface emissivity, but through its interactions with the atmosphere produces correlations in the SMMR brightness temperature data that have significant meteorological implications. It is found that a simple meteorological model can explain the general characteristics of the SMMR data. With the help of this model, methods to infer over the global oceans, the surface temperature, liquid water content in the atmosphere, and surface wind speed are developed. Monthly mean estimates of the sea surface temperature and surface winds are compared with the ship measurements. Estimates of liquid water content in the atmosphere are consistent with earlier satellite measurements. Previously announced in STAR as N83-19187 Author

A84-24647#
IMPROVED OCEAN SURFACE TEMPERATURES FROM SPACE - COMPARISONS WITH DRIFTING BUOYS
A. E. STRONG and E. P. MCCLAIN (NOAA, National Environmental Satellite, Data and Information Service, Suitland, MD) American Meteorological Society, Bulletin (ISSN 0003-0007), vol. 65, Feb. 1984, p. 138-142. refs

Multiwindow infrared measurements, together with visual channel observations, enable relatively high-resolution and accurate local, regional, and global retrievals of ocean surface temperatures to be repetitively and routinely obtained from operational environmental satellites. Drifting buoys appear to be the best means to date of validating the satellite estimates. Root mean square differences of about 0.6 C are found between satellite and drifter, whereas with ships-of-opportunity they are 1.8 C. Fixed buoy comparisons fall between these extremes. Author

A84-26836
SURVEY OF SATELLITE METEOROLOGY
R. K. GUPTA (Indian Institute of Remote Sensing, Dehradun, India) and U. V. G. RAO (National Remote Sensing Agency, Hyderabad; Indian Meteorological Department, New Delhi, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Sept. 1983, p. 255-277. refs

The history of satellite meteorology is reviewed, with emphasis placed on important developments in sensing systems, data products, and their use. The synoptic use of weather satellite imagery over a period of two decades is illustrated. Quantitative products are discussed in detail, with particular attention given to the estimation of sea surface temperature, humidity and temperature profiles, cloud level winds, precipitation, and thunderstorm growth parameters. The utility of weather satellites in defense operations (specifically, in the erosion estimation for advanced ballistic re-entry systems) is pointed out. Finally, the expected future developments in satellite-based meteorology are examined. V.L.

A84-27174#
OBSERVATIONS OF LONGITUDINAL ROLLS IN A NEAR NEUTRAL ATMOSPHERE
B. A. WALTER, JR. and J. E. OVERLAND (NOAA, Pacific Marine Environmental Laboratory, Seattle, WA) Monthly Weather Review (ISSN 0027-0644), vol. 112, Jan. 1984, p. 200-208. Navy-supported research. refs

Aircraft and satellite data are used to study the structure of longitudinal roll vortices in a nearly neutral boundary layer over the ice-covered Bering Sea during February 1982. Steam fog, formed over cracks and leads in the ice, was used as a tracer to delineate the various scales of roll motion seen in satellite images. The satellite information combined with aircraft data collected by the NOAA P-3 indicated the presence of a hierarchy of roll vortex motions. It is suggested that interactions of the various scales of motion resulted in certain scales dominating in one area and other scales dominating in another. Two-kilometer wavelength variations are attributed to the inflection point instability mechanism, while 12-15 km variations seem to have been reinforced by the upstream topography on the Chukotka Peninsula. Organization of the fog banks on scales of 30 km was also present and may be attributable to resonant subharmonics of the basic boundary layer instability or to a mesoscale entrainment instability. Author

A84-27383
THE INFORMATION CONTENT OF DIFFERENT OPTICAL SPECTRAL RANGES FOR REMOTE CHLOROPHYLL ESTIMATION IN COASTAL WATERS
J. F. R. GOWER (Institute of Ocean Sciences, Sidney, British Columbia, Canada), G. A. BORSTAD (Seakem Oceanography, Ltd., Sidney, British Columbia, Canada), and S. LIN International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 349-363. Research supported by the Department of Fisheries and Oceans of Canada. refs

An eigenvector analysis is conducted for 56 sea surface water reflectance spectra obtained with a multichannel silicon diode spectrometer over the period July 29-October 15, 1981. Four eigenvectors suffice to account for over 99 percent of the variance in all cases, and the effects of phytoplanktonic chlorophyll absorption, particulate scattering, and chlorophyll fluorescence are evident in all eigenvectors. Algorithms obtained through the use of linear combinations of associated scaling factors as estimators are derived for different spectral ranges in the data. The results are compared with those from the presently employed radiance ratio and fluorescent line height algorithms. The analysis is found to derive as good a correlation with chlorophyll a, using data from the red spectral region, as from the blue/green region, indicating that information is present at longer wavelengths despite lower

signal levels, so that a suitably designed spectral scanner should be able to make use of such information in improved remote mapping of surface chlorophyll a concentrations in oceans and lakes. O.C.

A84-27385
SEASAT MEASUREMENTS OF WIND AND WAVES ON SELECTED PASSES OVER JASIN
T. D. ALLAN and T. H. GUYMER (Institute of Oceanographic Sciences, Wormley, Surrey, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 379-408. Research supported by the University of Washington. refs

An analysis is made of Seasat's ability to measure surface wind and wave fields over the area of the Joint Air-Sea Interaction (JASIN) experiment by means of its radar altimeter, microwave radiometer, scatterometer and synthetic aperture radar (SAR). Eight passes are selected to provide a range of surface conditions from light winds (4 m/s) to moderately strong winds (16-20 m/s). Seasat sensors are compared with one another, and comparisons are made with observations from research vessels and buoys. It is found that a description as accurate as surface observations but with considerably better resolution is achieved. The performance of the SAR is the most difficult to assess. Even though regular swell patterns are revealed on five of the passes examined, it is not clear from the evidence available if certain wavelengths are selectively imaged while others are suppressed. Neither are the limiting conditions of waves and winds for producing imaged wave trains known with certainty. C.R.

A84-27743*# Environmental Research Inst. of Michigan, Ann Arbor.
REMOTE SENSING OF OCEANOGRAPHIC PARAMETERS PERTINENT TO HYDROCARBON RESOURCE DEVELOPMENT
E. S. KASISCHKE and D. R. LYZENGA (Michigan, Environmental Research Institute, Ann Arbor, MI) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 217-236. Research supported by the U.S. Defense Mapping Agency, U.S. Navy, NASA, and NOAA. refs

Information obtained from remotely sensed imagery which is potentially useful to hydrocarbon resource development is discussed in this paper. Oceanic phenomena presented include surface gravity waves, detection of bathymetric features, and deep ocean internal waves. Techniques used to extract data are presented along with pertinent examples. Author

A84-27768#
SYNTHETIC APERTURE RADAR IMAGERY OF OCEAN WAVES IN SEA ICE
J. D. LYDEN, B. A. BURNS, R. A. SHUCHMAN, D. R. LYZENGA, R. W. LARSON (Michigan, Environmental Research Institute, Ann Arbor, MI), and R. T. LOWRY (INTERA Environmental Consultants, Ltd., Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 527-539. refs
(Contract N00014-81-C-0295)

The pressure for energy independence and the natural resources of the Arctic make year-round geological exploration in this region a high priority. A major obstacle to the achievement of this goal is the lack of real-time information on sea ice, including its dimensions and dynamics. The age or thickness of ice determines the class of ship or icebreaker needed to safely navigate and its fuel consumption. The movement of ice masses will influence decisions regarding location and scheduling of drilling operations, as well as actions to suspend activity at certain ice-threatened sites. This movement of sea ice can be caused by wind shear, ocean currents, surface gravity waves, or a combination of all three. This paper investigates the ability of synthetic aperture radar (SAR) to image ocean surface gravity waves as they propagate into and through sea ice. Also presented are brief discussions on the ability of SAR to detect ice types of various thicknesses and icebergs. Author

A84-28296
COASTAL UPWELLINGS AND RHONE RIVER EXTENSION IN THE GULF OF LIONS (MEDITERRANEAN SEA) - VISUALIZATION BY ANALYSIS OF CHLOROPHYLL FRONTAL BOUNDARIES ON THE BASIS OF NIMBUS-7 CZCS RADIOMETER DATA [UPWELLINGS COTIERS ET EXTENSION DES EAUX DU RHONE DANS LE GOLFE DU LION (MEDITERRANEE) - VISUALISATION PAR ANALYSE DES FRONTS CHLOROPHYLLIENS A PARTIR DU RADIOMETRE NIMBUS 7 CZCS]
D. CARAUX and R. W. AUSTIN (California, University, La Jolla, CA) Photo Interpretation (ISSN 0031-8523), vol. 21, Nov.-Dec. 1982, p. 2.1-2.6. In French, English, and Spanish.

A84-28297
SIMULATED SPOT DATA APPLIED TO REMOTE SENSING IN THE INTERTIDAL ZONE - SPECIFIC APPLICATION TO THE POINTE SAINT-GILDAS REGION (LOIRE-ATLANTIC, FRANCE) [APPLICATION DES DONNEES SIMULEES SPOT ALA TELEDETECTION DU MILIEU INTERTIDAL - APPLICATION PARTICULIERE ALA REGION DE LA POINTE SAINT-GILDAS (LOIRE-ATLANTIQUE, FRANCE)]
L. LOUBERSAC and G. BELBEOCH (Centre National pour l'Exploitation des Oceans, Centre Oceanologique de Bretagne, Brest, France) Photo Interpretation (ISSN 0031-8523), vol. 21, Nov.-Dec. 1982, p. 3.1-3.6. In French, English, and Spanish.

A84-28569
THE NEED FOR SATELLITE OCEAN COLOR MEASUREMENTS IN FISHERIES RESEARCH AND RELATED ACTIVITIES
R. M. LAURS (NOAA, National Marine Fisheries Service, La Jolla, CA) IN: Advanced remote sensing; Proceedings of the Meeting, San Diego, CA, August 26, 27, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 11, 12.

Quantitative determinations of ocean color on the basis of data obtained with the aid of satellites have applications related to the utilization and the management of fishery resources. Examples of such applications include investigations of phytoplankton distribution, migration studies of mobile species such as tuna and marine mammals, fish stock assessment, and fishery-pollution interaction studies. Attention is given to the ocean color data needed, approaches for preprocessing ocean color data, data format requirements, and aspects of spatial and temporal coverage in response to U.S. fishery needs. G.R.

A84-28684
DRIFTING ICE AS A TRACER IN THE STUDY OF THE CHARACTERISTICS OF SEA WATER CIRCULATION [DREIFUIUSHCHII LED KAK TRASSER PRI ISSLEDOVANII OSOBENNOSTEI TSIRKULIATSII VOD OKRAINNYKH MOREI]
N. P. KUZMINA and V. E. SKLIAROV (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 16-25. In Russian. refs

Space photographs of drifting sea ice taken from Meteor satellites in the visible (0.5-0.7 micron) and near-IR (0.7-1.1 micron) bands are used to investigate eddies of different scale. Eddies observed in the Sea of Okhotsk are classified according to drifting-ice patterns, and estimates are made of such eddy parameters as the characteristic formation time, the orbital velocity, and the diffusion coefficients. Satellite data with drifting ice as a tracer are shown to be useful for obtaining information on riptide phenomena. B.J.

A84-28782
MESOSCALE FEATURES ALONG THE FIRST OYASHIO INTRUSION
A. C. VASTANO (Texas A & M University, College Station, TX) and R. L. BERNSTEIN (California, University, La Jolla, CA) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, Jan. 20, 1984, p. 587-596. Research supported by the University of California. refs
(Contract NSF OCE-80-26037; NOAA-MO-A01-78-00-4329)

The Oyashio Front and the evolution of mesoscale features dominating the surface layer circulation east of northern Honshu and Hokkaido, Japan, are the subject of satellite and hydrographic observations obtained during May, 1981 to determine surface and subsurface temperature structures. NOAA6 satellite Advanced Very High Resolution Radiometer IR images and sea surface temperature distributions identified specific eddies and fronts, which appeared as banded cold and warm regions in bathythermograph sections. The satellite-derived temperature estimates exhibited an 0.8 C rms scatter about an 0.6 C warm bias, relative to the bathythermograph data. This map displays the intense mesoscale sea surface temperature variability in the region around the Oyashio Front and within the subarctic regime. O.C.

A84-28783* Princeton Univ., N. J.
THERMOHALINE CIRCULATION BELOW THE ROSS ICE SHELF - A CONSEQUENCE OF TIDALLY INDUCED VERTICAL MIXING AND BASAL MELTING
D. R. MACAYEAL (Princeton University, Princeton, NJ) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, Jan. 20, 1984, p. 597-606. NOAA-supported research. refs
(Contract NGT-31-001-800; NSF DPP-81-19863)

The warmest water below parts of the Ross Ice Shelf resides in the lowest portion of the water column because of its high salinity. Vertical mixing caused by tidal stirring can thus induce ablation by lifting the warm but dense water into contact with the ice shelf. A numerical tidal simulation indicates that vertically well-mixed conditions predominate in the southeastern part of the sub-ice shelf cavity, where the water column thickness is small. Basal melting in this region is expected to be between 0.05 and 0.5 m/yr and will drive a thermohaline circulation having the following characteristics: high salinity shelf water (at - 1.8 C), formed by winter sea ice production in the open Ross Sea, flows along the seabed toward the tidal mixing fronts below the ice shelf; and meltwater (at -2.2 C), produced in the well-mixed region, flows out of the sub-ice shelf cavity along the ice shelf bottom. Sensitivity of this ablation process to climatic change is expected to be small because high salinity shelf water is constrained to have the sea surface freezing temperature. Author

A84-28784* Princeton Univ., N. J.
NUMERICAL SIMULATIONS OF THE ROSS SEA TIDES
D. R. MACAYEAL (Princeton University, Princeton, NJ) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, Jan. 20, 1984, p. 607-615. refs
(Contract NGT-31-001-800; NSF DPP-81-19863)

Tidal currents below the floating Ross Ice shelf are reconstructed by using a numerical tidal model. They are predominantly diurnal, achieve maximum strength in regions near where the ice shelf runs aground, and are significantly enhanced by topographic Rossby wave propagation along the ice front. A comparison with observations of the vertical motion of the ice shelf surface indicates that the model reproduces the diurnal tidal characteristics within 20 percent. Similar agreement for the relatively weak semidiurnal tides was not obtained, and this calls attention to possible errors of the open boundary forcing obtained from global-ocean tidal simulations and to possible errors in mapping zones of ice shelf grounding. Air-sea contact below the ice shelf is eliminated by the thick ice cover. The dominant sub-ice-shelf circulation may thus be tidally induced. A preliminary assessment of sub-ice-shelf conditions based on the numerical tidal simulations suggests that (1) strong barotropic circulation is driven along the ice front and (2) tidal fronts may form in the sub-ice-shelf cavity where the water column is thin and where the buoyancy input is weak. Author

A84-28785*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANTARCTIC SEA ICE MICROWAVE SIGNATURES AND THEIR CORRELATION WITH IN SITU ICE OBSERVATIONS
J. C. COMISO (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, MD), S. F. ACKLEY (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH), and A. L. GORDON (Lamont-Doherty Geological Observatory, Palisades, NY) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, Jan. 20, 1984, p. 662-672. NASA-Navy-supported research. refs
(Contract NSF DPP-80-05765; NSF DPP-80-06922)

The general characteristics and microwave radiative properties of sea ice in the Weddell Sea region during the onset of spring are studied by using the Nimbus 7 Scanning Multichannel Microwave Radiometer (SMMR) and other satellite sensors, in conjunction with in situ observations from the Mikhail Somov. The position of the ice edge, the gradient of ice concentration, and the width of the Marginal Ice Zone are inferred from the microwave data, and are found to be consistent with ship observations, especially at 18 GHz. The sensitivities of the various SMMR frequencies to surface and other effects are investigated by using multispectral cluster analysis. The results show considerable variability in emissivity, especially at 37 GHz, likely associated with varying degrees of surface wetness. Ice concentrations are derived by using two methods: one that assumes fixed emissivities for consolidated ice and an iterative procedure that accounts for the variable emissivities observed. Using the procedure that allows the emissivities to be variable gives ice concentrations that are more consistent with qualitative field observations. Author

A84-29722
ORIENTATION PROBLEM OF TWO MEDIA PHOTOGRAPHS WITH CURVED BOUNDARY SURFACES
A. OKAMOTO (Kyoto University, Kyoto, Japan) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, March 1984, p. 303-316. refs

In the usual analysis of photographs taken of coastal underwater areas, the sea surface may be approximated by a horizontal plane at the mean height of the wave crests and troughs. However, position errors due to this approximation are not negligibly small, in particular, in deep underwater areas or for photography from low altitude (Okamoto, 1982). The analytical orientation problem of two-media photographs having wave surface so as to correct the approximation errors is discussed. First, this problem is considered theoretically by representing the sea surface with simple mathematical functions. The orientation methods proposed, however, can readily be extended to the actual sea surface expressed with complicated mathematical functions such as a Fourier series. Next, the orientation techniques presented are tested with simulated two-media photographs in order to clarify the difficulties when applying them to practical case. Author

A84-29917* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTERNAL WAVES IN THE GULF OF CALIFORNIA - OBSERVATIONS FROM A SPACEBORNE RADAR
L.-L. FU and B. HOLT (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, March 20, 1984, p. 2053-2060. NASA-supported research. refs

Pronounced signatures of internal waves were detected repeatedly in the Gulf of California by the Seasat synthetic aperture radar (SAR). A series of nine images with exactly repeating ground coverage was used to study the temporal variability of the internal wave field in the area. It was found that the number of observed wave groups was highly correlated with the strength of the local tides: the maximum number occurred during spring tides and the minimum number occurred during neap tides, indicating that the internal waves were tidally forced. Most of the wave activity was

found to the north of 28 deg N where the tides were the strongest in the Gulf. The application of a simple, nonlinear internal wave model to the observations indicated that the peak-to-peak amplitude of the observed waves was about 50 m with an uncertainty of a factor of 2. The estimated upper bound for the rate of the loss of tidal energy to internal waves was about 5 x 10 to the 15th erg/s, representing only 10 percent of the rate of the dissipation of the dominant M2 tide in the Gulf. Author

A84-29919
SPRING BREAKUP AND FLUSHING OF AN ARCTIC LAGOON ESTUARY
J. B. MATTHEWS and W. J. STRINGER (Alaska, University, Fairbanks, AK) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, March 20, 1984, p. 2073-2079. Research supported by the U.S. Bureau of Land Management and Alaska State Legislature. refs

Measurements made in Egg Island Channel, a major channel of the Simpson Lagoon complex, during two breakup seasons using conventional oceanographic equipment are reported. It is noted that at these high latitudes the river discharge begins while the fast ice is still in the lagoon. The discharge flows into the bay on top of this fast ice and can easily be seen on satellite near-infrared images. These images are used to extend the observation of the spring discharge to cover a 9-year period. Satellite images are also used in determining the date when ice was last seen in the lagoon. It is found that meltwaters persist in the Egg Island Channel at least as long as the ice cover in Simpson Lagoon prevents free passage of marine waters. The ice cover over the lagoon vanishes on July 10 + or - 8 days. It is also found that once ice has been removed from Simpson Lagoon, reintroduction of marine waters into the Egg Island Channel occurs when wind-induced currents flush the lagoon with Beaufort Sea waters. C.R.

N84-16412*# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
SPACEBORNE SAR AND SEA ICE Status Report
W. F. WEEKS *In* JPL Spaceborne Imaging Radar Symp. p 113-115 1 Jul. 1983
Avail: NTIS HC A08/MF A01 CSCL 17I

A number of remote sensing systems deployed in satellites to view the Earth which are successful in gathering data on the behavior of the world's snow and ice covers are described. Considering sea ice which covers over 10% of the world ocean, systems that have proven capable to collect useful data include those operating in the visible, near-infrared, infrared, and microwave frequency ranges. The microwave systems have the essential advantage in observing the ice under all weather and lighting conditions. Without this capability data are lost during the long polar night and during times of storm passage, periods when ice activity can be intense. The margins of the ice pack, a region of particular interest, is shrouded in cloud between 80 and 90% of the time. E.A.K.

N84-16413*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR IMAGE INTERPRETATION TECHNIQUES APPLIED TO SEA ICE GEOPHYSICAL PROBLEMS
F. D. CARSEY *In its* Spaceborne Imaging Radar Symp. p 116-117 1 Jul. 1983
Avail: NTIS HC A08/MF A01 CSCL 17I

The geophysical science problems in the sea ice area which at present concern understanding the ice budget, where ice is formed, how thick it grows and where it melts, and the processes which control the interaction of air-sea and ice at the ice margins is discussed. The science problems relate to basic questions of sea ice: how much is there, thickness, drift rate, production rate, determination of the morphology of the ice margin, storms feeling for the ice, storms and influence at the margin to alter the pack, and ocean response to a storm at the margin. Some of these questions are descriptive and some require complex modeling of interactions between the ice, the ocean, the atmosphere and the radiation fields. All involve measurements of the character of the ice pack, and SAR plays a significant role in the measurements. E.A.K.

N84-16414*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OBSERVATIONS OF INTERNAL WAVES IN THE GULF OF CALIFORNIA BY SEASAT SAR
L. L. FU and B. HOLT *In its* Spaceborne Imaging Radar Symp. p 118-120 1 Jul. 1983
Avail: NTIS HC A08/MF A01 CSCL 17I

Internal waves which are among the most commonly observed oceanic phenomena in the SEASAT SAR imagery are discussed. These waves are associated with the vertical displacements of constant water density surfaces in the ocean. Their amplitudes are maximum at depths where the water density changes most rapidly usually at depths from 50 to 100 m, whereas the horizontal currents associated with these waves are maximum at the sea surface where the resulting oscillatory currents modulate the sea surface roughness and produce the signatures detected by SAR. E.A.K.

N84-16415*# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
900 KM OF DIGITAL OCEAN WAVE SPECTRA FROM THE SEASAT SAR
R. C. BEAL *In* JPL Spaceborne Imaging Radar Symp. p 121-123 1 Jul. 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 08J

One of the primary reasons for including the SAR in the complement of ocean microwave instruments on SEASAT was the global ocean wave spectra. An accurate, timely, and global knowledge of the full two dimensional or directional surface wave spectra has great value in both operational wave forecasting and in wave climatology, especially in the Southern Oceans. The sparse sampling obtainable from a single orbiting SAR would by itself be inadequate to reconstruct a global wave field, but when supplemented with auxiliary knowledge of the winds, the SAR might provide essential updates to a global wave model. E.A.K.

N84-16416*# Stanford Univ., Calif. Center for Radar Astronomy.
MECHANISMS FOR SAR IMAGING OF OCEAN SURFACE PHENOMENA: THEORY AND EXPERIMENT
J. F. VESECKY *In* JPL Spaceborne Imaging Radar Symp. p 124-127 1 Jul. 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 17I

Understanding the SAR response to surface wave is a central issue in the analysis of SAR ocean images. The imaging mechanism for gravity waves and the practical question of just which characteristics of the ocean wave field can be measured remotely using SAR were examined. Assessments of wave imaging theory are based primarily on comparisons of the directional wave height variance spectrum psi (K) measured by in situ buoys with estimates from SAR images. Other criteria are also recommended, e.g., the effects of focus adjustments. It is assumed that fluctuations in SAR image intensity are proportional to fluctuations in ocean surface height. If this were true, the Fourier power spectrum of a SAR image and corresponding surface measurements of psi would coincide. Differences between SAR estimates based on this hypothesis and buoy measurements of psi are then used to begin the assessment of rival wave imaging theories. E.A.K.

N84-16419*# European Space Agency, Toulouse (France).
EUROPEAN SPACE AGENCY, ERS-1 PROGRAM
A. HASKELL *In* JPL Spaceborne Imaging Radar Symp. p 140-142 1 Jul. 1983
Avail: NTIS HC A08/MF A01 CSCL 17I

The objectives selected for ERS-1 which are primarily intended to facilitate the exploitation of coastal oceans, including ice infested waters, and to facilitate the development of improved global weather information through the provision of information on the weather conditions over the oceans of the word are outlined.

Additionally, land objectives will be addressed using the synthetic aperture radar incorporated in the payload. E.A.K.

N84-16534# Naval Research Lab., Washington, D. C.
A COMPARISON OF SMMR (SCANNING MULTICHANNEL MICROWAVE RADIOMETER) AND AIRBORNE MICROWAVE MEASUREMENTS DURING GOASEX (GULF OF ALASKA EXPERIMENT) Final Report
B. E. TROY, JR., J. P. HOLLINGER, and R. C. LO 30 Sep. 1983 49 p
(Contract DA PROJ. W05-24)
(AD-A134514; NRL-MR-5169) Avail: NTIS HC A03/MF A01 CSCL 08J

The microwave brightness temperature (T sub B) of the open ocean was measured during September 1978 in a series of aircraft flights as part of the Gulf of Alaska Experiment (GOASEX). The purpose of GOASEX was to evaluate the performance of the remote sensors aboard SEASAT. One of the SEASAT sensors was the Scanning Multichannel Microwave Radiometer (SMMR), which measured the ocean T sub B at five microwave frequencies from 6.6 to 37 GHz. The NRL flights were performed to validate the SMMR microwave measurements. The aircraft measurements and the SMMR measurements were made at different but overlapping frequency ranges, and slightly different incidence angles. In order to compare the two sets of measurements, an estimate of the SMMR T sub B's at satellite altitude is derived from the aircraft measurements. Corrections for differences in altitude, frequency and incidence angle are made by the NRL Environmental Model, which is used to compute the atmospheric microwave parameters necessary for the correction based on the meteorological conditions at the time of the measurements. The results show that the SMMR T sub B's are in error at most frequencies, being generally smaller than the aircraft T sub B's. Biases which must be added to the SMMR T sub B's to bring them into agreement with the aircraft T sub B's are approximately the same as empirically derived biases from correcting the SMMR T sub B's prior to using them in geophysical algorithms. GRA

N84-16624*# City Coll. of the City Univ. of New York. Inst. of Marine and Atmospheric Sciences.
OCEANOGRAPHIC AND METEOROLOGICAL RESEARCH BASED ON THE DATA PRODUCTS OF SEASAT Semiannual Progress Report
W. J. PIERSON, Principal Investigator 31 Mar. 1983 57 p ERTS
(Contract NAGW-266)
(E84-10077; NASA-CR-173227; NAS 1.26:173227) Avail: NTIS HC A04/MF A01 CSCL 05B

De-aliased SEASAT SASS vector winds obtained during the GOASEX (Gulf of Alaska SEASAT Experiment) program were processed to obtain superobservations centered on a one degree by one degree grid. The results provide values for the combined effects of mesoscale variability and communication noise on the individual SASS winds. Each grid point of the synoptic field provides the mean synoptic east-west and north-south wind components plus estimates of the standard deviations of these means. These superobservations winds are then processed further to obtain synoptic scale vector winds stress fiels, the horizontal divergence of the wind, the curl of the wind stress and the vertical velocity at 200 m above the sea surface, each with appropriate standard deviations for each grid point value. The resulting fields appear to be consistant over large distances and to agree with, for example, geostationary cloud images obtained concurrently. Their quality is far superior to that of analyses based on conventional data. M.G.

N84-16744*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REPORT OF THE NASA WORKSHOP ON TIDAL RESEARCH
M. E. PARKE, ed. and D. B. RAO, ed. (NASA. Goddard Space Flight Center) 15 Apr. 1983 49 p refs Presented at NASA Tides Workshop, Chicago, 12-13 Apr. 1982
(Contract NAS7-100)
(NASA-CR-173204; JPL-PUB-83-71; NAS 1.26:173204) Avail: NTIS HC A03/MF A01 CSCL 08C

The state of tidal research and the relationship of tides to altimeter data was discussed. It was decided that tides should be recognized as a separate objective for altimetric research. An altimetric satellite such as TOPEX which is designed for separation of tidal signals in conjunction with surface measurements can significantly improve knowledge of the deep sea tide. Information gained in this way will be directly applicable to all other altimetric satellites. E.A.K.

N84-16748# Coast Guard Research and Development Center, Groton, Conn.
MOVEMENT OF SATELLITE-TRACKED BUOYS IN THE BEAUFORT SEA (1979-1981) Interim Report
D. L. MURPHY, I. M. LISSAUER, and J. C. MYERS Jun. 1983 59 p
(AD-A133159; CGR/DC-4/83; USCG-D-30-83) Avail: NTIS HCA04/MFA01 CSCL 08C

As part of an investigation into the fate of potential ARctic oil spills, the U.S. Coast Guard Research and Development Center and Canadian Marine Drillings Ltd (CANMAR) released satellite-tracked platforms at the Canadian offshore drilling sites in the southeastern Beaufort Sea. During the first three years of joint research effort, which began in 1979, 21 trajectories were compiled, 15 from oceanographic drifters released in summer open water conditions and 6 from platforms deployed onto Arctic Ocean sea ice. The movement of the 15 oceanographic drifters showed considerable interannual variability. In 1979 the buoys moved offshore and to the west, paralleling the Alaskan coast, a direction which is consistent to the east-to-west motion of the southern portion of the Beaufort Sea Gyre. The 1980 and 1981 drift data show no such consistent behavior. In 1980 the buoys first moved to the east; three of the buoys then reversed directions and moved to the west in response to persistent winds from the east and northeast. The 1981 data exhibited the most dramatic easterly movement with five buoys grounding on or near the Tuktoyaktuk Peninsula, a short distance from the release site. Despite this remarkable yearly variability, at least one buoy drifted into U.S. waters in each of the first three years of the study. This, in addition to the fact that the ice movement data show a net westward motion, suggests that the Alaskan coast could be affected by a major uncontained blowout during Canadian offshore operations. GRA

N84-17661# Centre Oceanologique de Bretagne, Brest (France).
COASTAL ZONES INVENTORY BY HIGH RESOLUTION SATELLITES
L. LOUBERSAC *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 87-94 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

The use of satellite remote sensing data for coastal inventories (baselines) and monitoring (if high spatial and temporal resolutions are yield compatible); sensors; and constraints linked to the different resolutions are exposed. High resolution data are very sensitive to luminance variations from pixel to pixel and to association of pixels. The pixel must not be considered alone with its own radiometric counts but considered with respect to its environment. Texture analysis is expected to benefit from higher resolution. Facies discrimination, facies structural analysis, and geomorphological investigations should benefit from mixing data from various sources, e.g., passive radiometric data with active sources such as SAR. Author (ESA)

N84-17663# Dundee Univ. (Scotland). Carnegie Lab. of Physics.
APPLICATIONS FOR FISHERIES
A. P. CRACKNELL *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 101-114 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

The use of remote sensing to provide information on weather, sea state (including data on sea ice) and the location of shoals of fish, is discussed and an experimental program for fishery operations is described. Problems associated with satellite remote sensing data for fisheries include availability of data; extraction of required information; atmospheric effects on signals from the surface of the sea; relationships between marine physical and biological parameters and the migratory habits of fish; processing and interpretation of the data, within the timescale necessary; and the dissemination of the results. The satellite experiment provided ships with information on sea surface temperatures, mixed layer depth, winds and wind derivatives, wave heights and directions, and ocean color zones and boundaries. Author (ESA)

N84-17664# Bergen Univ. (Norway). Norwegian Maritime Remote Sensing Program (NORMARSEN).
REMOTE SENSING OF SEA ICE
E. SVENDSEN *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 115-127 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

An algorithm for estimating total and multiyear sea ice concentration from passive microwave and surface air temperature measurements was developed, using 5 to 100 GHz emissivity spectra. Comparison between Nimbus 7 SMMR and aircraft microwave measurements indicates that estimates of total ice concentration are accurate to + or - 3% and those of multiyear ice concentration to + or - 10%. These accuracies are not valid during the melt season when the snow on the ice is wet. The SMMR locates the sea ice edge accurately to within 10 km and the ability of the SMMR to follow moving patches of multiyear ice is demonstrated. The need for accurate concentration estimates for reliable heat budget estimates in the Arctic is discussed. Mesoscale features along the ice edge are revealed by a 1.215 GHz SAR. Author (ESA)

N84-17665# Det Norske Veritas, Hovik. Section of Environmental Loads.
SEA STATE MONITORING AND APPLICATIONS
A. G. KJELAAS *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 129-133 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

Imaging radar, altimeter, and scatterometer techniques for sea surface monitoring are discussed. Remote sensing and in situ techniques are compared, but it is not possible to say whether discrepencies are due to satellite or in situ measurement errors. Satellite data contributions to ocean circulation models, wave models, numerical weather forecasting, mesoscale eddy studies, and storm surge investigations are listed. Commercial applications in the offshore oil and gas industry, fisheries, mining, environmental monitoring, and marine transportation are summarized. Seasat and GEOS-3 data demonstrate that significant wave height, wave direction and surface wind vector can be measured from space. Development of satellite oceanography depends on improved algorithms for deriving the geophysical parameters of interest, and real time data processing and dissemination for commercial users. Author (ESA)

N84-17681# Bayerische Akademie der Wissenschaften, Frankfurt am Main (West Germany).
VALIDATION OF SEASAT-1 ALTIMETRY USING GROUND TRUTH IN THE NORTH SEA REGION
J. BRENNECKE, ed., D. LELGEMANN, ed., W. TORGE, ed., and H. G. WENZEL, ed. Inst. fuer Angewandte Geodaesie 1982 125 p refs Sponsored by Deutsche Forschungsgeneinschaft
(SER-B-263-MITT-166; ISSN-0071-9196) Avail: NTIS HC A06/MF A01

Data evaluation shows that the precision of mean sea surface determination in regional areas using SEASAT-1 altimetry is +or-0.1m, which agrees with the noise level of the altimeter. An excellent tidal model and a high quality altimetry adjustment model must be used. Verification of high precision tidal models is possible at the subdecimeter level, if altimeter data from a sufficient number of collinear passes are available. Accuracy validation of SEASAT-1 altimetry is restricted by the limited accuracy of the gravimetric ground truth; even with a refined computational model it is impossible to determine a gravimetric geoid with 0.10 m accuracy due to the limited accuracy of the available 1 x1 deg gravity anomalies. SEASAT-1 altimetry accuracy is proved to be +or-0.24 m by comparison with the gravimetric geoid GGNS3; much of the discrepancy between SEASAT-1 mean sea surface heights and the gravimetric geoid is produced by errors of the 1 x1 deg gravity anomalies. Author (ESA)

N84-17683# University Coll., London (England). Mullard Space Science Lab.
A STUDY OF SATELLITE RADAR ALTIMETER OPERATION OVER ICE-COVERED SURFACES
C. G. RAPLEY, H. D. GRIFFITHS, V. A. SQUIRE (Scott Polar Research Inst.), M. LEFEBVRE (CNES, Toulouse, France), A. R. BIRKS (Science Research Council, Chilton, England), A. C. BRENNER (EG and G Washington Analytical Services Center, Inc., Riverdale, Md.), C. BROSSIER (CNES, Toulouse, France), L. D. CLIFFORD, A. P. B. COOPER (Scott Polar Research Inst.), A. M. COWAN (Scott Polar Research Inst.) et al. Paris ESA May 1983 234 p refs
(Contract ESA-5182/82/F-CG(SC))
(ESA-CR(P)-1810) Avail: NTIS HC A11/MF A01

The importance of the cryosphere and its interaction with other natural systems is described, and the potential contribution of radar altimetry to the understanding of cryospheric processes is outlined. The principles of radar altimetry are discussed, and beam-limited and pulse-limited modes of operation are compared. Pulse-limited operation over simple and complex surfaces, and performance requirements of an altimeter for ice studies are considered. Facets of the technical design of the SEASAT altimeter are shown to have reduced performance over ice. Modifications are described and the results of tests using ice surface and instrument simulation software are given. Author (ESA)

N84-17773# Wisconsin Univ., Madison. Space Science and Engineering Center.
ENHANCEMENT OF SEASAT WIND-STRESS MEASUREMENTS USING DATA FROM GOES Final Report, 1 Oct. 1978 - 31 Dec. 1981
V. E. SUOMI, B. B. HINTON, and D. P. WYLIE Aug. 1983 72 p refs
(Contract MO-A01-78-00-4331)
(PB84-111244; NOAA-83102503) Avail: NTIS HC A04/MF A01 CSCL 04B

This report summarizes work done at the Space Science and Engineering Center from 1 October 1978 to 30 December 1981 to study the relationships of low level cloud motions to near surface winds over the oceans, and in particular the near surface winds measured by the active microwave scatterometer on SEASAT-A. This report largely discusses comparisons of data, and simple methods of handling the data. Specifically, this report discussed the relationship of winds at cloud level with mast level winds as observed by island-based radiosonde stations, cloud motions, sun glint, and ships as well as SEASAT. GRA

N84-17781# National Environmental Satellite Service, Washington, D. C.
NOAA (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION) SATELLITE PROGRAMS BRIEFING
Aug. 1983 209 p
(PB84-108349; NOAA-83101903) Avail: NTIS HC A10/MF A01 CSCL 04B

There are two types of civil operational remote sensing satellites in use today, polar orbiting and geostationary. Two U.S. polar orbiting weather satellites monitor weather and surface conditions over the entire globe. Two U.S. geostationary weather satellites observe, respectively, the Atlantic Ocean and East and Gulf Coasts and the Pacific Ocean and West Coast. A single U.S. Earth resources satellite, called LANDSAT, is also in polar orbit. These United States systems are complemented by a number of foreign Earth observing satellites, and more foreign satellites will be launched in the latter half of the 1980's. GRA

N84-17784*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FLIGHT MEASUREMENT AND ANALYSIS OF AAFE RADSCAT WIND SPEED SIGNATURE OF THE OCEAN
L. C. SCHROEDER, W. L. JONES (Satellite Television Corp.), P. R. SCHAFFNER (Research Triangle Inst.), and J. L. MITCHELL (Kentron International, Inc.) Jan. 1984 148 p refs
(NASA-TM-85646; L-15651; NAS 1.15:85646) Avail: NTIS HC A07/MF A01 CSCL 08J

The advanced aerospace flight experiment radiometer scatterometer (AAFE RADSCAT) which was developed as a research tool to evaluate the use of microwave frequency remote sensors to provide wind speed information at the ocean surface is discussed. The AAFE RADSCAT helped establish the feasibility of the satellite scatterometer for measuring both wind speed and direction. The most important function of the AAFE RADSCAT was to provide a data base of ocean normalized radar cross section (NRCS) measurements as a function of surface wind vector at 13.9 GHz. The NRCS measurements over a wide parametric range of incidence angles, azimuth angles, and winds were obtained in a series of RADSCAT aircraft missions. The obtained data base was used to model the relationship between k sub u band radar signature and ocean surface wind vector. The models developed therefrom are compared with those used for inversion of the SEASAT-A satellite scatterometer (SASS) radar measurements to wind speeds. E.A.K.

N84-18257# Joint Publications Research Service, Arlington, Va.
NELEPO DESCRIBES INTERCOSMOS-BLACK SEA EXPERIMENT
B. NELEPO *In its* USSR Rept.: Space (JPRS-USP-84-001) p 70-73 26 Jan. 1984 Transl. into ENGLISH from Pravda (Moscow), 9 Oct. 1983 p 3
Avail: NTIS HC A06

Many specialists asserted that light scattering by the atmosphere certainly creates an impenetrable curtain for observation of processes at the ocean surface, much less in its deeper layers. But a series of excellent photographs of dynamically active regions of the ocean, obtained from orbit, made possible a new approach to the problem of observing them from great altitudes. Despite the influence of the atmosphere the study of the ocean from space in the visible range of the spectrum is possible under definite observation conditions. In order to clarify these conditions the oceanographic satellites Cosmos-1076 and Cosmos-1151 were launched, carrying automatic instruments aboard intended for study of optical phenomena in the ocean-atmosphere system. During this same period the multichannel MKS spectrometer, operated excellently in orbit. At the same time principles were formulated for the analysis of images obtained from satellites of the Meteor series and the best conditions were clarified for carrying out observations in the visible range. Author

N84-18258# Joint Publications Research Service, Arlington, Va.
COSMOS-1500 SLR USED FOR ARCTIC ICE RECONNAISSANCE
V. SHMYGANOVSKIY *In its* USSR Rept.: Space (JPRS-USP-84-001) p 74-76 26 Jan. 1984 Transl. into ENGLISH from Izv. (Moscow), 6 Nov. 1983 p 6
Avail: NTIS HC A06

The very difficult present navigation in the eastern part of the Arctic has required the use of the latest achievements of science and the most efficient technical facilities--primarily for the purpose of ice reconnaissance. Striking results were achieved using a side-looking radar for remote sounding of the environment, developd at the Ukrainian SSR Academy of Sciences Institute of Radio Physics and Electronics (Kharkov) and mounted aboard the Cosmos-1500 satellite. Neither snow storms nor the polar night can stop it from conducting strategic reconnaissance of the ice fields in the grimmest of the oceans. Author

N84-18517# Naval Postgraduate School, Monterey, Calif.
INTERPRETATION OF A SAR (SYNTHETIC APERTURE RADAR) IMAGE OF THE BAY OF BISCAY M.S. Thesis
J. F. SOUBRIER Sep. 1983 136 p
(AD-A135981) Avail: NTIS HC A07/MF A01 CSCL 17I

On August 20, 1978, the Synthetic Aperture Radar (SAR) on board the satellite SEASAT, gave evidence of high energy internal oceanic activity at the shelfbreak in the northern part of the Bay of Biscay. Quantitive spatial measurements of internal wave patterns were correlated with conventional, quasi-synoptic in situ data and yielded phase speeds of 0.55M/S for high frequency, nonlinear internal waves, generated in groups at the canyons indenting the shelfbreak and at the time of low tide in Brest. Their periods were found to be of 70MIN and their amplitudes estimated to be 15M. Ocean swell refraction, observed on the SAR image, together with a localized significant increase in wave height detected by the SEASAT altimeter, was related to the shear of a northwestward geostrophic jet (ca. 0.5M/S) at the break. Possible operational consequences of these features are summarized as an assessment of a SAR's capability to give tactical as well as scientific real-time information on the internal ocean. Author (GRA)

N84-18522# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
THE GRAND BANKS EXPERIMENT: A SATELLITE/AIRCRAFT/SHIP EXPERIMENT TO EXPLORE THE ABILITY OF SPECIALIZED RADARS TO DEFINE OCEAN FRONTS Final Report
P. E. LAVIOLETTE Jul. 1983 132 p
(AD-A136181; NORDA-49) Avail: NTIS HC A07/MF A01 CSCL 17I

At various times during 1978-1979, a joint U.S.-Canadian experiment involving ships, buoys, aircraft, and satellites was conducted in the waters southeast of the Grand Banks. The purpose was to determine the ability of satellite- and aircraft-specialized radars (SAR and SLAR) to monitor ocean fronts. The experiment results, detailed in this report, show that these radars are capable of defining thermal fronts under most weather conditions. The degree, as well as type, of definition depended on the angle the wind made with the thermal front and associated currents. Winds blowing parallel to the fronts produced shear lines in the SAR and SLAR imagery. Winds blowing orthogonal to the front produced broad patterns whose changes mark the location of the thermal fronts. This latter definition however, delineation was more gradual than the sharp thermal gradients marking the fronts seen in satellite infrared imagery. The possible causes of these effects are detailed in this report. Author (GRA)

N84-18728# Environmental Research Inst. of Michigan, Ann Arbor. Applications Div.
SIMULATION OF THEMATIC MAPPER DATA FOR REMOTE BATHYMETRY Final Technical Report, 20 Jul. 1982 - 20 Apr. 1983
F. J. TANIS, J. S. OTT, and T. WESSLING Oct. 1983 67 p
(Contract N00014-82-C-2311)
(AD-A136377; ERIM-163100-7-F) Avail: NTIS HC A04/MF A01 CSCL 08J

A preliminary algorithm has been developed for the extraction of water depths from Thematic Mapper (TM) scanner data. Algorithm development was based on 1978 aircraft scanner (ERIM M-8) data processed to simulate TM data, and on data available from the 1980 Photobathymetric Calibration Survey. The Defense Mapping Agency (DMA) constructed a series of overlays to the ERIM data set showing locations of ship soundings. These overlays were used as a basis to extract corresponding TM simulated signals from the aircraft data set. Water depth prediction algorithms were developed based upon relationships between the simulated TM data and the measured water depths. Results will aid the development of bathymetric processing procedures for Thematic Mapper data. Author (GRA)

N84-18799# Meteorological Satellite Center, Tokyo (Japan).
ANALYSIS OF SEA ICE IN THE SEA OF OKHOTSK USING LANDSAT-MSS DATA (COMPARISON WITH GMS DATA)
T. KIMURA *In its* Meteorological Satellite Center Tech. Note, No. 8, 1983 p 41-59 Sep. 1983 refs In JAPANESE; ENGLISH summary
Avail: NTIS HC A06/MF A01

The spatial resolution of LANDSAT-MSS is about thirty times finer than that of GMS VISSR (visible) at the middle of the sea of Okhotsk. Therefore it is possible to survey the condition of sea ice there in greater detail using that observation. Seasonal variation of sea ice as seen by LANDSAT-MSS in the sea of Okhotsk and in the Bay of Terpeniya is shown in this report. It is confirmed that the drifting speed of pack-ice is related to its size. The relation between the mode and standard deviation of the brightness level frequency distribution from LANDSAT-MSS data is examined for various types of sea ice area and a comparison is made with those from GMS VISSR (visible) observation. In this research the data from the "band 7" of LANDSAT-MSS are used mainly, as the band is considered the most suitable to the observation of sea ice condition. Author

N84-18823# Miami Univ., Fla. School of Marine and Atmospheric Science.
SUBSYNOPTIC VARIATIONS IN SEASAT WINDS
M. A. ESTOQUE and J. FERNANDEZ-PARTAGAS Sep. 1983 45 p refs
(Contract NA79SA-C-00737)
(PB84-131697; UM-RSMAS-83016; NOAA-83121201) Avail: NTIS HC A03/MF A01 CSCL 04B

The objectives of the present study are the following: To determine the magnitudes of subsynoptic variations of high resolution SEASAT wind observations over two tropical regions (Caribbean Sea and Gulf of Mexico); to determine whether the averaging of high-resolution SEASAT observations is necessary prior to their use in synoptic analyses. GRA

N84-18824# Miami Univ., Fla. School of Marine and Atmospheric Science.
ANALYSIS OF SEASAT WIND OBSERVATIONS IN THE GULF OF MEXICO AND THE CARIBBEAN SEA
J. FERNANDEZ-PARTAGAS and M. A. ESTOQUE Sep. 1983 78 p
(Contract NA79SA-C-00737)
(PB84-131309; UM-RSMAS-83015; NOAA-83121202) Avail: NTIS HC A05/MF A01 CSCL 04B

In the summer of 1978 an oceanographic satellite (SEASAT) was launched for the purpose of measuring various sea surface variables. One of these variables is the radar backscatter from the sea surface roughness. With the aid of an algorithm one can use the backscatter to solve for the surface wind vector. Unfortunately, the algorithm gives a set of up to four wind solutions corresponding to each geographical point. One of the solutions represents the true wind while the others are fictitious winds or aliases. The customary procedure for selecting the true wind solution is by comparing the set of multiple wind solutions with independent wind observations in the vicinity. The object of the present investigation is to test the feasibility of the wind analysis procedure. GRA

N84-19954*# Ocean Weather, Inc., Cos Cob, Conn.
POTENTIAL IMPACT OF REMOTE SENSING DATA ON SEA-STATE ANALYSIS AND PREDICTION Final Report, 1 Mar. 1982 - 31 Dec. 1983
V. J. CARDONE Dec. 1983 105 p refs ERTS
(Contract NAS5-26890)
(E84-10083; NASA-CR-175209; NAS 1.26:175209) Avail: NTIS HC A06/MF A01 CSCL 08C

The severe North Atlantic storm which damaged the ocean liner Queen Elizabeth 2 (QE2) was studied to assess the impact of remotely sensed marine surface wind data obtained by SEASAT-A, on sea state specifications and forecasts. Alternate representations of the surface wind field in the QE2 storm were produced from the SEASAT enhanced data base, and from operational analyses based upon conventional data. The wind fields were used to drive a high resolution spectral ocean surface wave prediction model. Results show that sea state analyses would have been vastly improved during the period of storm formation and explosive development had remote sensing wind data been available in real time. A modest improvement in operational 12 to 24 hour wave forecasts would have followed automatically from the improved initial state specification made possible by the remote sensing data in both numerical and sea state prediction models. Significantly improved 24 to 48 hour wave forecasts require in addition to remote sensing data, refinement in the numerical and physical aspects of weather prediction models. A.R.H.

N84-19994# Royal Australian Navy Research Lab., Edgecliff.
COMPARISONS OF NAVAL AIR STATION, NOWRA OCEANOGRAPHIC ANALYSES WITH INDEPENDENTLY OBTAINED SHIP AND SATELLITE DATA
P. J. MULHEARN Sep. 1983 43 p
(AD-A136462; RANRL-TM(EXT)-4/83) Avail: NTIS HC A03/MF A01 CSCL 08J

Comparisons are made between weekly oceanographic analyses prepared by the Naval Air Station, NOWRA, and independently obtained data from ship cruises and high resolution infra-red satellite imagery. Analyses prepared by Nowra were for sea-surface temperature, temperature at a depth of 250 m, and surface mixed-layer depth. Good agreement was found for the location of warm-core rings, through Nowra's use of satellite-tracked buoys. However the position of the Tasman Front was poorly determined in their analyses, because of the lack of adequate data. Methods of improving analyses and future prospects are discussed. Author (GRA)

N84-20002# Research Inst. of National Defence, Linkoeping (Sweden). Dept. 3.
FUTURE SEA MAPPING TECHNIQUE: TRAVEL REPORT. ACTIVITIES IN SEA MAPPING TECHNIQUE, LASER TECHNIQUE AND ACOUSTICS AT SOME INSTITUTES IN NORTHERN EUROPE
T. CLAESSON Dec. 1983 27 p refs In SWEDISH; ENGLISH summary
(FOA-C-30346-E1; ISSN-0347-3708) Avail: NTIS HC A03/MF A01; Research Institute of National Defence, Stockholm KR50

Sea mapping techniques, and nautical chart production automation are discussed. Laser bathymetry, parallel depth measurements with several ships, interferometric side scan sonar, digital models for underwater, ground, and ultrasonic applications are reviewed. Position estimation using satellites is outlined. Author (ESA)

N84-20010# Scripps Institution of Oceanography, La Jolla, Calif.
SWIRLS AND PLUMES OR APPLICATION OF STATISTICAL METHODS TO SATELLITE-DERIVED SEA SURFACE TEMPERATURES Ph.D. Thesis
K. A. KELLY Aug. 1983 235 p refs
(Contract N00014-80-C-0440)
(AD-A135462; SIO-REF-83-15; TR-18) Avail: NTIS HC A11/MF A01 CSCL 08J

The acquisition of a satellite receiving station combined with an intensive experiment (Coastal Ocean Dynamics Experiment) created an opportunity to analyze a series of infrared images of the California Current. Along with image analysis, measurements on the shelf and slope from current meters, hydrography, surface drifters, Doppler acoustic log, wind recorders, and tide gauges were monitored. The goals of the analysis were to develop a method for removing unusable data (clouds) and systematic errors, to extract a quantitative description of sea surface temperature (SST) patterns off northern California, to compare satellite-derived temperature with in situ measurements, to investigate the relationship between SST, wind and topography, and to estimate surface velocities from a series of images. M.A.C.

N84-20082# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF THE SEASONAL VARIATION OF THE TROPICAL OCEAN FRONT BETWEEN THE BRAZIL CURRENT AND THE MALVINAS CURRENT, USING OCEANOGRAPHIC AND SMS-2 SATELLITE DATA M.S. Thesis [ESTUDO DAS VARIACOES SAZONAIS DA FRENTE OCEANICA SUBTROPICAL ENTRE A CORRENTE DO BRASIL E A CORRENTE DAS MALVINAS, UTILIZANDO DADOS OCEANOGRAFICOS E DO SATELITE SMS-2]
S. S. DEGODOI Jun. 1983 324 p refs In PORTUGUESE; ENGLISH summary
(INPE-2780-TDL/137) Avail: NTIS HC A14/MF A01

A study of seasonal variations of the Subtropical Oceanic Front (Subtropical Convergence) between the Brazil Current and Malvinas (Falkland) Current, located in the study area between 25 deg S and 45 deg S and 045 deg W and 065 deg W, is realized by utilizing oceanographic and SMS-2 data. The images automatic interpretation was realized by utilizing the IMAGE-100 System. During the period from January 1980 to March 1981, it was observed that the seasonal variations in the longitudinal direction of this front displacement were most prominent between autumn and spring. An analysis of the statistical behavior of the SMS-2 data (10,5 - 12,6 micron spectral window) was made utilizing a Gaussian model. Some statistical examples comparing the distributions of the blackbody temperature field with cloud and cloud free conditions are presented. A quantitative evaluation of the agreement between the experimental statistics distributions and Gaussian distribution data is provided. The values of the thermal gradient of the sea surface in the region of the Subtropical Convergence are estimated. The sea surface temperatures observed by remote sensors and oceanographic data are compared. The information obtained from remote sensors and compared with oceanographic data show that remote sensing is a powerful research tool when applied to the detection and monitoring of the Subtropical Oceanic Front. Author

N84-20903 California Univ., San Diego.
SATELLITE OBSERVATIONS OF FRONTS AND FRONTAL MEANDERS IN THE CENTRAL NORTH PACIFIC OCEAN Ph.D. Thesis
M. L. VANWOERT 1983 129 p
Avail: Univ. Microfilms Order No. DA8400013

This thesis combines satellite-derived estimates of sea-surface temperature and in situ data collected as part of the FRONTS 80 field program to describe mid-ocean fronts and frontal meanders in the Central North Pacific Ocean. Detailed comparisons were made between the satellite data and the in situ fields of temperature, salinity and density. Close agreement was found between the patterns derived from the satellite data and the in situ data to roughly 1000 m, thus indicating that the feature observed by the satellite was not a surface phenomenon but rather the surface manifestation of a deep dynamically active feature. With a knowledge that wintertime features in the Central North Pacific Ocean represent deep, dynamically active structures, a search for other meanders was undertaken. The results of the search indicated that many coherent mesoscale meanders exist with wavelengths of approx. 250 km and amplitudes of 100-400 km. It was also noticed that the features amplified with time. To quantify this development the evolution time scale for two features was estimated. Dissert. Abstr.

N84-21018# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OCEANIC MESOSCALE VARIABILITY AND GENERAL CIRCULATION FROM SATELLITE ALTIMETRY: A STATUS REPORT
L. L. FU *In* Hawaii Inst. Geophys. The Role of Eddies in the Gen. Ocean Circulation p 65-86 1983 refs
(AD-P002653) Avail: NTIS HC A16/MF A01 CSCL 08C

Progress on the applications of satellite altimetry from SEASAT and Geos-3 to the study of oceanic mesoscale variability and general circulation is reviewed. The major conclusion for the applications to mesoscale variability is that an optimally designed altimetric mission with a lifetime of several years will improve our knowledge of the global mesoscale variability to an extent unattainable by any other practical means. The proposed Topex mission will allow one to view the global oceanic variability in such a wide range of periods and wavelengths: from 20 days to 3 to 5 years; from 50 to 10,000 km. However, the goal of determining the general circulation cannot be achieved by a single altimetric mission, because a highly accurate geoid needs to be determined independently. The scenario of the combination of Topex with Gravsat, a gravity mission that will give accurate geoid information, will allow the global general circulation to be determined at scales as small as 100 km. Areas of research needing to be performed with existing altimeter data are also discussed. Author

N84-21029# Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE EDDY FIELD OF THE CENTRAL NORTH ATLANTIC
W. KRAUS *In* Hawaii Inst. Geophys. The Role of Eddies in the Gen. Ocean Circulation p 275-282 1983 refs
(AD-P002664) Avail: NTIS HC A16/MF A01 CSCL 08C

Sixty-eight satellite tracked buoys were released in the western and central North Atlantic during 1981 and 1982. Mean velocity values and the variance about the mean were calculated for 20 selected areas. The mean velocities confirm the large scale gyre circulation. The velocity variance decreases toward the east and south. East of the Mid-Atlantic Ridge the eddy kinetic energy reaches values of about 200 sq cm/s at 500 N, but only 50 sq cm/s at 30 N. Author

N84-21955*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE-DERIVED SEA SURFACE TEMPERATURE: WORKSHOP 1
E. G. NJOKU 1 May 1983 156 p refs Workshop held in Pasadena, Calif., 27-28 Jan. 1983
(Contract NAS7-918)
(NASA-CR-173450; JPL-PUB-83-34; NAS 1.26:173450) Avail: NTIS HC A08/MF A01 CSCL 05B

Satellite measurements of sea surface temperature are now possible using a variety of sensors. The present accuracies of these methods are in the range of 0.5 to 2.0 C. This makes them potentially useful for synoptic studies of ocean currents and for global monitoring of climatological anomalies. To improve confidence in the satellite data, objective evaluations of sensor accuracies are necessary, and the conditions under which these accuracies degrade need to be understood. The Scanning Multichannel Microwave Radiometer (SMMR) on the Nimbus-7 satellite was studied. Sea surface temperatures, derived from November 1979 SMMR data, were compared globally against ship

measurements and climatology, using facilities of the JPL Pilot Ocean Data System. Methods for improved data analysis and plans for additional workshops to incorporate data from other sensors were discussed.

N84-21956*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE-DERIVED SEA SURFACE TEMPERATURE: INTRODUCTION
E. G. NJOKU *In its* Satellite-Derived Sea Surface Temp. 8 p 1 May 1983
Avail: NTIS HC A08/MF A01 CSCL 05B

Satellites now play an increasing role in systematic monitoring of the global oceans. Measurements of sea surface temperature (SST) are of primary importance in understanding heat storage and transport within the ocean and cross the ocean-atmosphere boundary. In some regions, local changes in SST of only 1 to 2 C have major effects on global climate and weather patterns. The satellite measurements provide a data base complementary to the (sometimes) accurate but sparsely-distributed point measurements available from ships and buoys. The demands placed on satellite sensors are stringent. Accuracies of better than 1 C are required and are often desired to a few tenths of a degree. Furthermore, measurement accuracies must be stable spatially and temporally in order for satellite data to be used with confidence in models of air-sea interaction and climate. There now exists a need to evaluate objectively the performance of the latest generation of sensors under a sufficient variety of environmental conditions to indicate present accuracies, deficiencies, and potential for improvement. Author

N84-21957*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ANALYSIS TECHNIQUES
D. CHELTON *In its* Satellite-Derived Sea Surface Temp. 6 p 1 May 1983
Avail: NTIS HC A08/MF A01 CSCL 05B

Analysis techniques for the sea surface temperature (SST) intercomparison were discussed. Systematic differences between various measurement techniques were identified and examined. This in turn might reveal areas for needed improvement in the SST retrieval algorithms or, at the very least, a clearer understanding of the limitations of each sensor. B.G.

N84-21958*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCESSING SYSTEM
J. E. HILLAND *In its* Satellite-Derived Sea Surface Temp. 8 p 1 May 1983
Avail: NTIS HC A08/MF A01 CSCL 05B

To implement the analysis techniques and to provide end-to-end processing, a system was designed with the following capabilities: receive and catalog data from many sources; organize the data on mass storage for rapid access; edit for reasonableness; create new data sets by sorting on parameter, averaging and merging; provide statistical analysis and display tools; and distribute data on demand. Consideration was given to developing a flexible system that could meet immediate workshop needs and respond to future requirements. System architecture and data set details implemented are discussed. Author

N84-21959*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IN SITU DATA
S. PAZAN *In its* Satellite-Derived Sea Surface Temp. 16 p 1 May 1983
Avail: NTIS HC A08/MF A01 CSCL 05B

The evidence indicates that November 1979 was a very climatological month, certainly in the Atlantic. This must make us particularly wary of deviations from climatology anywhere in the globe during this period. The McLain and Pazan SST analyses are identical to within a degree. The Pazan ship data need to be edited against climatology in order to remove bad ship data. Author

N84-21960*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE DATA
E. G. NJOKU *In its* Satellite-Derived Sea Surface Temp. 9 p 1 May 1983
Avail: NTIS HC A08/MF A01 CSCL 05B

Three satellite SST data sets were analyzed, all derived from the Scanning Multichannel Microwave Radiometer (SMMR) on the Nimbus-7 satellite. The SMMR is a ten-channel instrument flown also on the SEASAT satellite (now defunct) and was designed to measure SST in addition to other oceanographic and meteorological parameters. The three SMMR data sets were referred to as SMMR-I, -II, and -III. SMMR-I and -II were produced by T. Wilheit and A. Milman, SMMR-II being an updated and refined version of SMMR-I. A description of the algorithms used is provided. SMMR-III was provided by C. Prabhakara and was obtained by a different retrieval approach from the others. For consistency with the file code conventions and to avoid confusion, SMMRs I, II, and III were renamed SMMR-A, SMMR-D, and SMMR-C, respectively. Author

N84-21961*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
COMPARISON OF SATELLITE AND IN SITU DATA
R. L. BERNSTEIN *In its* Satellite-Derived Sea Surface Temp. 11 p 1 May 1983
Avail: NTIS HC A08/MF A01 CSCL 05B

A variety of data sets were available and analyzed. The data sets discussed here are: (1) SMMR-A: The Nimbus Project data release; (2) SMMR-D: The revised SMMR version produced by Wilheit and Milman; (3) SMMR-C: The SMMR version produced by Prabhakara; (4) Fleet Numerical Oceanography Center (PNOC): The individual ship reports; and (5) Reynolds Climatology. Data from SMMR and PNOC ships were compared in three different ways: (1) The difference between individual ship and SMMR observations which were close in space and time. (2) The difference between the 20 degree lat-lon one month averages for SMMR and ship, respectively. (3) The difference between the 20 degree averages and climatology, for both SMMR and ship. Author

N84-21962*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONCLUSIONS AND RECOMMENDATIONS
In its Satellite-Derived Sea Surface Temp. 8 p 1 May 1983
Avail: NTIS HC A08/MF A01 CSCL 05B

From the analyses performed thus far, it is clear that the ship data must be treated with great care in any satellite comparisons because of their high noise level. At the very least, the ship data should be screened to eliminate observations deviating unreasonably from climatology. In fact, a two pass screening is better, with the second pass screening out data deviating unreasonably from the first pass mapping attempt. Even with screening, the noise level is comparable with that of the satellite data and, particularly in spot comparisons, should not be used to evaluate the accuracy of the satellite data. Consideration also should be given to more sophisticated mapping procedures than simple binning averaging. Procedures that attempt local least squares fitting to individual observations would give better results because they would then be less sensitive to the spatial distribution of the data. Author

N84-21963*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SEA SURFACE TEMPERATURES FROM THE NIMBUS-7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER
A. S. MILMAN (Systems and Applied Science Corp., Hyattsville, Md.) and T. T. WILHEIT *In* JPL Satellite-Derived Sea Surface Temp. 20 p 1 May 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 08J

The algorithm was developed to determine sea surface temperature (SST) from the Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) data. The SST algorithm has evolved over the last several years. The final version that will be applied to the 1979 SMMR data (more tuning may be needed for later data) is described. Four different stages in the development are reported: Versions I to IV; each version has evolved out of its predecessor either because newly processed data became available or because significant problems were uncovered in earlier versions. Author

N84-21964*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STATISTICAL METHOD TO SENSE SEA SURFACE TEMPERATURE FROM THE NIMBUS-7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER
C. PRABHAKARA and I. WANG *In* JPL Satellite-Derived Sea Surface Temp. 8 p 1 May 1983
Avail: NTIS HC A08/MF A01 CSCL 08J

Among the five channels in the Scanning Multichannel Microwave Radiometer (SMMR), the brightness temperature measured at 6.6 GHz vertical polarization is least affected by the atmospheric water vapor and liquid water in clouds or rain. Furthermore, as the undisturbed sea surface emissivity at 6.6 GHz is nearly constant over the temperature range 275 to 300 K, this channel has the best sensitivity to sea surface temperature (SST). The 6.6 GHz channel on SMMR is specifically chosen for these reasons to measure SST. Author

N84-21965*# National Oceanic and Atmospheric Administration, Suitland, Md.
NOAA SATELLITE-DERIVED OPERATIONAL SEA SURFACE TEMPERATURE PRODUCTS
E. P. MCCLAIN *In* JPL Satellite-Derived Sea Surface Temp. 17 p 1 May 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 08J

The National Oceanic and Atmospheric Administration (NOAA) began processing global measurements of emitted radiation in the 10.5 to 12.5 micron atmospheric window for purposes of deriving weekly composite and mean monthly sea surface temperature fields in the early 1970s. Atmospheric attenuation corrections, begun with empirical means, were accomplished chiefly with the aid of coarser resolution measurements from atmospheric sounders aboard the same polar orbiting spacecraft. Cloud filtering depended heavily upon the use of histogram techniques applied to 11 x 11 arrays of 8 km resolution Scanning Radiometer Infrared (SRIR) data. Details of the SRIR processing for SST are found in a NOAA Technical Memorandum. Author

N84-21966*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MEASUREMENT OF SEA SURFACE TEMPERATURE FROM HIRS2/MSU
J. SUSSKIND *In* JPL Satellite-Derived Sea Surface Temp. 11 p 1 May 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 08J

The High-Resolution Infrared Sounder (HIRS), a 20-channel infrared sounder, and the Microwave Sounding Unit (MSU), a 4-channel microwave sounder, were first launched on the TIROS-N Satellite in November 1978 as an upgraded operational temperature sounding system. Essentially identical instruments have flown on NOAA-6 and NOAA-7 and are scheduled to fly on future operational satellites through the eighties. While HIRS2 and MSU were designed primarily for the purpose of measuring atmospheric temperature profiles, the observed radiances are also sensitive to other meteorological parameters such as sea surface temperature, ground temperature, cloud height and cloud amount, ice extent over ocean, snow cover over land, etc. A physically based processing system for analysis of HIRS2/MSU data was developed to determine the above atmospheric and surface parameters, which when substituted in the radiative transfer equation, match the satellite observations to a given noise level. All parameters are retrieved in a mutually interacting fashion. Author

N84-21967*# Wisconsin Univ., Madison.
USE OF VAS MULTISPECTRAL DATA FOR SEA SURFACE TEMPERATURE DETERMINATION
J. BATES *In* JPL Satellite-Derived Sea Surface Temp. 7 p 1 May 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 08J

The Visible Infrared Spin Scan Radiometer Atmospheric Sounder (VAS) is a radiometer possessing eight visible channel detectors and six thermal detectors that sense infrared radiation in 12 spectral bands. Housed in the GOES satellite, VAS spins in a west to east direction at 100 rpm and achieves spatial coverage at resolutions of 1 km in the visible and 7 or 14 km in the infrared by stepping a scan mirror in a north to south direction. Designed for multipurpose applications, the VAS can be operated in two different modes: (1) a multi-spectral imaging (MSI) mode, and (2) a dwell sounding (DS) mode. The MSI mode of operation is used for sea surface temperature (SST) determination. Currently, a full-disk MSI image for SST determination is received every hour, 18 hours a day during weekdays. This MSI mode of operation for SST consists of data obtained from wavelengths centered at 3.9 microns (channel 12), 11.6 microns (channel 8), and 12.6 microns (channel 7) as well as visible data. Author

N84-21971# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.
MEASUREMENT OF OCEAN SURFACE WINDS BY SEASAT SYNTHETIC APERTURE RADAR
J. D. LYDEN, D. R. LYZENGA, R. A. SHUCHMAN, and W. L. JONES Jul. 1983 105 p
(Contract N00014-81-C-0692)
(AD-A138392; ERIM-155900-15-T) Avail: NTIS HC A06/MF A01 CSCL 20N

This report investigates the feasibility of using SEASAT Synthetic Aperture Radar (SAR) data for measuring ocean surface winds. An empirical model relating the received power of the L-band SAR to ocean surface wind conditions was evaluated. Results from this investigation indicate that past SEASAT SAR wind studies could be biased due to the nature of the measurement techniques employed. In these past studies, densitometer measurements of output imagery were related to wind speed and direction. Because of a shifting of the Doppler spectrum location with latitude due to the Earth's rotation and spacecraft attitude change, these measurements are valid only over short azimuthal distances. A theoretical correction was calculated and applied to the SEASAT data, resulting in improved correlations with the surface wind speed. Additionally, a simplified measurement technique which did not involve explicit corrections for this Doppler shifting was developed. The results of this study are consistent with those of previous investigations, but yield additional insight into the angular dependence of the SAR backscatter and the accuracy of the technique. GRA

N84-21974# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
FEASIBILITY STUDY OF ADVANCED OPTICAL TECHNIQUES FOR OCEAN COLOR MEASUREMENT Final Report
R. CZICHY, J. DOENECKE, H. HEINZE, M. HOFMANN, H. HUFNAGEL, G. KLEIN, B. KUNKEL, H. LAUCHT, W. SCHATTMANN, M. CUTTER (SIRA Inst. Ltd.) et al. Paris ESA Jul. 1983 297 p refs Prepared in cooperation with SIRA Inst. Ltd. and University College, Dublin
(Contract ESA-5235/82/F-CG(SC))
(MBB-R3700/292; ESA-CR(P)-1822) Avail: NTIS HC A13/MF A01

An electronic scanning ocean color measurement instrument concept was developed. Radiometric characteristics of 10 spectral channels, and optical, channel separation, and focal plane assembly concepts were studied. The preferred concept is fully modular with refractive lens systems per channel. Radiometry, image quality, mechanical and thermal adjustment precision, and calibration were investigated. Conceptual design of the optics; control and data processing electronics, and spacecraft interface specification are outlined. Author (ESA)

N84-21975# Kiel Univ. (West Germany). Abt. Theoretische Ozeanographie.
DETERMINATION OF SEA SURFACE TEMPERATURES FROM HIGH RESOLUTION INFRARED SATELLITE MEASUREMENTS Thesis [BESTIMMUNG DER MEERESOBERFLAECHENTEMPERATUR MITTELS HOCHAUFLOESENDER INFAROT-SATELLITENMESSUNGEN]
T. VIEHOFF 1983 134 p refs In GERMAN; ENGLISH summary
(REPT-115; ISSN-0341-8561) Avail: NTIS HC A07/MF A01

Determination of sea surface temperatures by the polar orbit satellite NOAA 7 is reported. Advanced very high resolution radiometry (AVHRR) was employed. Geographic location of data points and distinction between ocean surface and cloud signals were emphasized. Split-window technique was used to correct atmospheric attenuation. Insufficient knowledge of orbit and tilt parameters made necessary a manual correction of the computed geographic locations to obtain an accuracy of 2.5 km. A comparison between radiometrically measured temperatures and ground truth measurements was made during two orbits. The mean difference is within the margins of error. The thermal patterns at the sea surface correspond. Significant temperature differences only exist due to temporal difference between the two measurements.
Author (ESA)

N84-22116*# National Aeronautics and Space Administration, Washington, D. C.
SATELLITE DATA RELAY AND PLATFORM LOCATING IN OCEANOGRAPHY. REPORT OF THE IN SITU OCEAN SCIENCE WORKING GROUP
R. CHASE (Woods Hole Oceanographic Inst.), C. COTE (NASA Goddard Space Flight Center), R. E. DAVIS (Scripps Inst. of Oceanography), J. DUGAN (Naval Research Lab.), D. D. FRAME (NAVAIRSCOM), D. HALPERN (NOAA/Pacific Marine Environmental Lab.), E. KERUT, R. KIRK (NASA Goddard Space Flight Center), L. MCGOLDRICK (NASA, Washington, D.C.), and J. MCWILLIAMS (National Center for Atmospheric Research) Nov. 1983 56 p refs
(Contract NAS5-26714)
(NASA-TM-85443; NAS 1.15:85443) Avail: NTIS HC A04/MF A01 CSCL 04B

The present and future use of satellites to locate offshore platforms and relay data from in situ sensors to shore was examined. A system of the ARGOS type will satisfy the increasing demand for oceanographic information through data relay and platform location. The improved ship navigation provided by the Global Positioning System (GPS) will allow direct observation of currents from underway ships. Ocean systems are described and demand estimates on satellite systems are determined. The capabilities of the ARGOS system is assessed, including anticipated demand in the next decade. M.A.C.

06

HYDROLOGY AND WATER MANAGEMENT

Includes snow cover and water runoff in rivers and glaciers, saline intrusion, drainage analysis, geomorphology of river basins, land uses, and estuarine studies.

A84-19405* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE UTILIZATION OF NIMBUS-7 SMMR MEASUREMENTS TO DELINEATE RAINFALL OVER LAND
E. RODGERS (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, MD) and H. SIDDALINGAIAH (OAO Corp., Greenbelt, MD) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 22, Oct. 1983, p. 1753-1763. refs

Approaches for developing an improved passive microwave technique to delineate rain from wet land surfaces are considered, and an investigation is conducted with the objective to study the application of these ideas with empirical data. The investigation includes a statistical analysis of Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) 37.0, 18.0, and 10.7 GHz data. The possibility was assessed to make use of the 18.0 and 10.7 GHz channels in order to reduce the ambiguities found in the 37.0 GHz radiometer data for differentiating rainfall areas from wet land surfaces. It was found, however, that none of the SMMR channels could differentiate rain from wet or dry land when surface temperatures were less than 15 C. It appears that an improved rainfall-over-land detection technique could be developed by two different methods, utilizing both satellite infrared and multifrequency dual polarized passive microwave data. G.R.

A84-21584
THE USE OF AERIAL AND SPACEBORNE PHOTOGRAPHS TO STUDY LAKES OF THE SOUTHERN PLAINS OF WESTERN SIBERIA [ISPOL'ZOVANIE AEROKOSMICHESKIKH S'EMOK DLIA IZUCHENIIA OZER IUZHNYKH RAVNIN ZAPADNOI SIBIRI]
D. A. SINELNIKOV IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 47-49. In Russian.

A84-21592
PROBLEMS IN THE UTILIZATION OF SPACE DATA FOR HYDROLOGICAL STUDIES IN MOUNTAIN REGIONS [VOPROSY ISPOL'ZOVANIIA KOSMICHESKOI INFORMATSII PRI GIDROLOGICHESKIKH ISSLEDOVANIIAKH V GORNYKH RAIONAKH]
N. V. VOSTRIAKOVA IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 116-119. In Russian. refs

A84-21605
THEORETICAL-METHODOLOGICAL ASPECTS OF THE INTERPRETATION OF SPACEBORNE PHOTOGRAPHS ON THE EXAMPLE OF A MORPHOLOGICAL ANALYSIS OF ANCIENT RUNOFF DELLS OF THE OB'-IRTYSH INTERFLUVE [TEORETIKO-METODICHESKIE ASPEKTY DESHIFRIROVANIIA KOSMICHESKIKH SNIMKOV NA PRIMERE ANALIZA MORFOLOGII DREVNIKH LOZHBIN STOKA OB'-IRTYSHSKOGO MEZHDURECH'IA]
D. A. SINELNIKOV IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 42-49. In Russian. refs

A84-22453
DETERMINING THE CONCENTRATION OF THE MINERAL SUSPENSION IN NATURAL BODIES OF WATER ON THE BASIS OF THE SPECTRUM OF OUTGOING RADIATION [OPREDELENIE KONTSENTRATSII MINERAL'NOI VZVESI V PRIRODNOM VODOEME PO SPEKTRU VYKHODIASHCHEGO IZLUCHENIIA]
IU. A. SHEVCHENKO and L. A. SHLIAKHOVA (Gidrokhimicheskii Institut, Rostov-on-Don, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 22-27. In Russian. refs

Theoretical calculations and experimental findings are used to establish the possibility of mapping bodies of water surfaces on the basis of their coefficients of spectral brightness and then determining the weight concentration of suspended matter. Long-term a priori information on the water bodies is required, but the number of reference parameters that must be obtained during surveys from aircraft or ground stations is a minimum. C.R.

A84-23242
DETERMINATION OF SNOWPACK PROPERTIES FROM SATELLITE PASSIVE MICROWAVE MEASUREMENTS
H.-H. K. BURKE, C. J. BOWLEY, and J. C. BARNES (Environment Research and Technology, Inc., Concord, MA) Remote Sensing of Environment (ISSN 0034-4257), vol. 15, Feb. 1984, p. 1-20. refs
(Contract NOAA-NA-80SAC00763)

It is pointed out that snow cover has been mapped from satellites since the mid-1960s primarily using data from visible-channel radiometers. The present investigation is concerned with a research effort to investigate the use of satellite microwave data to determine snowpack properties. Data from three different sensors were acquired, taking into account ESMR-5 data from the Nimbus-5 satellite, ESMR-6 data from Nimbus-6, and SMMR data from Nimbus-7. It could be demonstrated that microwave sensors, particularly those operating around 37 GHz can help in the determination of certain snow properties, including the snow boundary and the depth of dry snow. G.R.

A84-26837
SNOW-MELT RUN-OFF STUDIES USING REMOTE SENSING DATA
A. S. RAMAMOORTHI (National Remote Sensing Agency, Hydrology Div., Hyderabad, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Sept. 1983, p. 279-286. refs

With the advent of satellite-based remote sensing technology, it has become possible to survey extensive areas of snow and collect snow data from inaccessible and hazardous high-altitude areas. This has led to the development of snow-melt run-off simulation and forecasting models using snow covered area data derived from Landsat and NOAA. The information required for the effective management of snow-melt run-off is reviewed, and the models currently in use in the United States and India are discussed. V.L.

A84-27386
SNOW MAPPING WITH ACTIVE MICROWAVE SENSORS
C. MAETZLER and E. SCHANDA (Bern, Universitaet, Berne, Switzerland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 409-422. Research supported by the Eidgenoessiches Institut fuer Schnee- und Lawinenforschung, European Space Agency, Commission of the European Communities, and Swiss Federal Office of Topography. refs

Hydrological interest in mapping snow concentrates on the phase of snow depletion when at least part of the snow cover is wet. In this situation, snow has a very low backscatter coefficient, smaller than almost any land surface at X-band. Together with the independence of cloud cover and time, this unique signature of snow enables frequent and regular mapping of snow even in rugged terrain. First results from a synthetic aperture radar experiment made during the melting season even under unfavorable conditions - clearly indicate this potential. The backscatter data used in this work are based on four seasons of scatterometer measurements made on the alpine test site Weissfluhjoch, Davos, and on a comparison with additional backscatter data from groups in Europe and the U.S.A. Author

A84-29725
WATER QUALITY MONITORING USING AN AIRBORNE SPECTRORADIOMETER
H. L. MCKIM, C. J. MERRY (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH), and R. W. LAYMAN (Dartmouth College, Hanover, NH) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, March 1984, p. 353-360. Army-sponsored research. refs

A84-29918* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
JAKOBSHAVNS GLACIER DRAINAGE BASIN - A BALANCE ASSESSMENT
R. A. BINDSCHADLER (NASA, Goddard Space Flight Center, Laboratory for Atmospheric Sciences, Greenbelt, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 89, March 20, 1984, p. 2066-2072. NSF-NASA-sponsored research. refs

Maximum and minimum estimates are made of the drainage basin feeding the Jakobshavns Glacier by using surface elevation maps derived from Seasat altimetry. Benson's (1962) net balance measurements are used to calculate the balance flow within the basin. Comparisons of the balance flux at the terminus with estimates of actual flux suggest the basin is in overall equilibrium or slightly thickening. This agrees with measurements along the nearby EGIG traverse. Balance velocities accelerate rapidly within 100 km of the coast. Farther upstream, balance velocities are consistent with both measured velocities along the EGIG traverse and calculated deformation velocities. It is estimated that Jakobshavns Glacier discharges between 4.8 and 7.6 percent of the annual net balance over Greenland and drains between 3.7 and 5.8 percent of the ice sheet area. Author

A84-30414
THE DURABILITY OF THIN-WALLED ENGINE PARTS UNDER NONSTATIONARY STRESSES UNDER CONDITIONS OF CREEP [DOLGOVECHNOST' TONKOSTENNYKH DETALEI DVIGATELEI PRI NESTATSIONARNYKH NAPRIAZHENIIAKH V USLOVIIAKH POLZUCHESTI]
A. F. GUROV, V. D. TOKAREV, and V. A. KOMKOV Aviatsionnaia Tekhnika (ISSN 0579-2975), no. 4, 1983, p. 31-35. In Russian.

Attention is given to the problem of prolonging the useful life of engine parts operating at high temperatures and subjected to nonstationary forces. Relations are obtained for the nonlinear accumulation of damage and the service life of thin-walled parts under various conditions of monotonically increasing stress. C.R.

N84-16621*# California Univ., Santa Barbara. Dept. of Geography.
LANDSAT-D INVESTIGATIONS IN SNOW HYDROLOGY Quarterly Progress Report, 1 Oct. - 31 Dec. 1983
J. DOZIER 31 Dec. 1983 2 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(Contract NAS5-27463)
(E84-10074; NASA-CR-173224; NAS 1.26:173224) Avail: NTIS HC A02/MF A01 CSCL 08B

The atmospheric radiative transfer calculation program (ATARD) and its supporting programs (setting up atmospheric profile, making Mie tables and an exponential-sum-fitting table) were completed. More sophisticated treatment of aerosol scattering (including angular phase function or asymmetric factor) and multichannel analysis of results from ATRAD are being developed. Some progress was made on a Monte Carlo program for examining two dimensional effects, specifically a surface boundary condition that varies across a scene. The MONTE program combines ATRAD and the Monte Carlo method together to produce an atmospheric point spread function. Currently the procedure passes monochromatic tests and the results are reasonable. A.R.H.

N84-16628*# Hydex Corp., Fairfax, Va.
REMOTE SENSING AND HYDROLOGIC MODELS
E. L. PECK, R. S. MCQUIVEY, T. N. KEEFER, E. R. JOHNSON, and J. L. EREKSON Mar. 1982 179 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract PROJ. AGRISTARS)
(E84-10082; NASA-CR-173232; CP-G204249; NAS 1.26:173232)
Avail: NTIS HC A09/MF A01 CSCL 08H

Hydrology moels are reviewed in order to provide information for evaluating the use of remote sensing capabilities. Strategies for using remotely sensed data in hydrology moels are also discussed.

N84-16629*# Hydex Corp., Fairfax, Va.
REVIEW OF HYDROLOGIC MODELS FOR EVALUATING USE OF REMOTE SENSING CAPABILITIES Interim Progress Report
E. L. PECK, R. MCQUIVEY, T. KEEFER, E. R. JOHNSON, and J. L. EREKSON *In its* Remote Sensing and Hydrol. Models 93 p Mar. 1982 refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS
(Contract NAS5-26446; PROJ. AGRISTARS)
Avail: NTIS HC A09/MF A01 CSCL 08H

Hydrologic models most commonly used by federal agencies for hydrologic forecasting are reviewed. Six catchment models and one snow accumulation and ablation model are reviewed. Information on the structure, parameters, states, and required inputs is presented in schematic diagrams and in tables. The primary and secondary roles of parameters and state variables with respect to their function in the models are identified. The information will be used to evaluate the usefulness of remote sensing capabilities in the operational use of hydrologic models. Author

N84-16630*# Hydex Corp., Fairfax, Va.
STRATEGIES FOR USING REMOTELY SENSED DATA IN HYDROLOGIC MODELS Final Report
E. L. PECK, T. N. KEEFER, and E. R. JOHNSON *In its* Remote Sensing and Hydrol. Models 84 p Mar. 1982 refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development
(Contract NAS5-26446; PROJ. AGRISTARS)
Avail: NTIS HC A09/MF A01 CSCL 08H

Present and planned remote sensing capabilities were evaluated. The usefulness of six remote sensing capabilities (soil moisture), land cover, impervious area, areal extent of snow cover, areal extent of frozen ground, and water equivalent of the snow cover) with seven hydrologic models (API, CREAMS, NWSRFS, STORM, STANFORD, SSARR, and NWSRFS Snowmelt) were reviewed. The results indicate remote sensing information has only limited value for use with the hydrologic models in their present form. Modifications to the models which would enhance their usefulness are discussed. M.G.

N84-16635# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ASSESSMENTS BY SATELLITE OF METEOROLOGICAL DATA FOR WATER RESOURCES
A. D. MOURA Nov. 1983 13 p refs Presented at the 8th UN/FAO Training Course on Appl. of Satellite Remote Sensing to Water Resources, Rome, 19 Sep. - 7 Oct. 1983
(INPE-2949-PRE/432) Avail: NTIS HC A02/MF A01

Meteorological satellites, ground receiving stations and the necessity of having digital data for quantitative use of the information, including algorithms for estimating rainfall of convective origin are described. Author

N84-17660# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
SNOW AND ICE MONITORING BY MICROWAVE TECHNIQUES
H. ROTT *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 75-86 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

Methods and applications of microwave sensors for snow and land ice monitoring are presented. Visible and infrared satellite sensors, and microwave radiometry and radar methods are discussed. Physical properties of different snow types are described. Examples of surface, aircraft, and satellite measurements are given for emission and backscattering from dry snow, wet snow, and polar firn. Analyses of SAR-580 data of an Alpine test site, glaciological studies with SEASAT SAR and altimeter, and methods for global snow mapping with Nimbus-7 SMMR are presented. The results are very promising for operational applications in hydrology and glaciology. Author (ESA)

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A84-20103
THE PROBLEM OF RADAR-IMAGE RESOLUTION (SEASAT/LANDSAT COMPOSITE MIXTURE) [LE PROBLEME DE LA RESOLUTION D'UNE IMAGE RADAR /MIXAGE COMPOSITE SEASAT-LANDSAT/]
M. GUY, C. LALLEMAND, and G. LEGENDRE (Institut Francais du Petrole, Rueil-Malmaison, Val-d'Oise, France) Photo Interpretation (ISSN 0031-8523), vol. 21, Sept.-Oct. 1982, 9 p. In French, English, and Spanish.

Seasat, Landsat, and composite images of a coastal region near Royan, Charente-Maritime, France, are presented and compared in terms of optical and practically useable resolution. The image characteristics, correlation matrix, and eigenvectors are listed in tables. The images are interpreted for coastal shape, hydrographic information, and land use. The radar image is shown to add much valuable information on the shapes of fields, rivers, the rocky coast, and other areal objects, but also to distort or hide differences in ground cover (such as forest types) detectable in the lower-'resolution' Landsat data, or even to create artifacts (such as false 'villages' formed by any dihedrally reflective objects larger than 20-30 cm). Thus careful analysis on the part of the image interpreter is required to exploit the advantages of radar images while minimizing the disadvantages. T.K.

A84-20104
THE OPTIMAL PRESENTATION OF SATELLITE IMAGES FOR THEIR INTERPRETATION [LA PRESENTATION OPTIMALE DES IMAGES DE SATELLITES EN VUE DE LEUR INTERPRETATION]
M. GUY (Groupement pour le Developpement de la Teledetection Aerospatiale, Toulouse, France) and M. TRAIZET (Centre National d'Etudes Spatiales, Paris, France) Photo Interpretation (ISSN 0031-8523), vol. 21, Sept.-Oct. 1982, 7 p. In French, English, and Spanish.

Skylab and Landsat (channel 7) images of the coastal zone and town of Sete, France, are presented, a map is provided for comparison, and the relationship of scale, resolution, and field is discussed as it affects visual image interpretation. The Skylab photographic image is presented at scales 1:200,000 and 1:50,000 (for a detail); the Landsat image is shown in its original form, after geometrical correction and 4 x 4 Shannon filtering, and in a double-oversampled form with a 40-m pixel. It is found that oversapling with a step length about half the sensor sampling step is best able to make patterns visible but may produce artifacts.

For visual interpretation, a field no larger than 25 cm square and pixels no larger than 0.1-0.2 mm are desirable. The optimal presentation scales corresponding to these requirements are given in a table for Landsat (MSS and TM) and SPOT (color and panchromatic) sensors. T.K.

A84-20402
ON THE RELATION BETWEEN HCMM SATELLITE DATA AND TEMPERATURES FROM STANDARD METEOROLOGICAL SITES IN COMPLEX TERRAIN
G. F. BYRNE, J. D. KALMA (Commonwealth Scientific and Industrial Research Organization, Div. of Water and Land Resources, Canberra, Australia), and N. A. STRETEN (Australian Numerical Meteorology Research Centre, Melbourne, Australia) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Jan.-Feb. 1984, p. 65-77. refs

Data from the Heat Capacity Mapping Mission Experiment Satellite (HCMM) are used to plot lines of constant temperature at 1 deg intervals for the city of Melbourne and surrounding country. Using four individual scenes, the relationship between uncalibrated, i.e. relative, surface temperature and screen daily minimum air temperature at some 26 standard meteorological stations in the greater Melbourne region was studied. It was found that the relation between the two data sources is poor for the sites taken separately but that means of daily minimum temperatures for appropriately grouped meteorological sites show a consistent linear relationship with night-time HCMM data. The HCMM data also show significant variation in surface temperatures within short distances from meteorological sites and it is concluded that surface temperatures in such an area vary on a spatial scale that is large compared with the area sampled by a standard meteorological site but small compared with an HCMM pixel. The implications are that a number of sites are needed to characterize a region independently of site-specific effects (i.e. that appropriately grouped sites can under some circumstances be used for calibrating satellite thermal data) and that thermal imagery could provide criteria for the selection of new standard meteorological sites. Author

A84-21576
PHOTOINTERPRETATION [DESHIFRIROVANIE SNIMKOOV]
V. I. AKOVETSKII Moscow, Izdatel'stvo Nedra, 1983, 376 p. In Russian. refs

General problems in the interpretation of aerial and spaceborne photographs are examined along with some theoretical and practical aspects of small-scale interpretation. The interpretation of features of terrain objects is discussed in a consideration of remote sensing methods and the information content of aerial photographs. Such factors as observer response, correlations between terrain objects, interpretation based on standards, optical characteristics of the earth's surface, and brightness characteristics of landscapes are studied. The technology of topographic interpretation is outlined and the collection and utilization of cartographically significant materials are discussed. Interpretation of nonphotographic images, including radar, infrared, television, and laser, are also given attention. Topographic and thematic interpretation of small-scale images and the selection of optimum parameters are discussed, and the problem of full and partial automation of interpretation and recognition is considered. J.N.

A84-21614
STANDARDIZED TECHNIQUE FOR THE BATCH INTERPRETATION OF SPACEBORNE PHOTOGRAPHS WITH MULTIPLE MONITORING OF CONVERGENCE ON THE EXAMPLE OF SIBERIAN DATA [STANDARTIZOVANNAIA METODIKA SERIINOGO DESHIFRIROVANIIA KOSMOSNIMKOV S MNOGOKRATNYM KONTROLEM SKHODIMOSTI PO MATERIALAM SIBIRI]
A. M. BOROVIKOV, V. E. KOVALEVSKII, and A. A. PRUSEVICH IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 100-113. In Russian.

A84-21615
HARDWARE AND SOFTWARE AT A REGIONAL CENTER FOR THE AUTOMATED PROCESSING OF AERIAL AND SPACE IMAGES [APPARATNO-PROGRAMMNOE OBESPECHENIE REGIONAL'NOGO TSENTRA AVTOMATIZIROVANNOI OBRABOTKI AEROKOSMICHESKIKH IZOBRAZHENII]
A. S. ALEKSEEV, V. N. DEMENTEV, P. A. KALANTAEV, B. K. KOZHEVNIKOV, N. V. KULKOV, V. P. PIATKIN, IU. P. PROKHORENKO, R. M. SALAVATOV, and S. L. SHEVELEV IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 115-125. In Russian. refs

A84-21616
PROBLEM-ORIENTED COMPLEX FOR THE PROCESSING OF AERIAL AND SPACEBORNE DATA [PROBLEMNO-ORIENTIROVANNYI KOMPLEKS OBRABOTKI AEROKOSMICHESKOI INFORMATSII]
IU. E. NESTERIKHIN, R. D. BAGLAI, and V. S. KIRICHUK IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 125-129. In Russian.

A multifunctional complex for the large-volume automated processing of images for the purpose of thematic mapping is being developed at the Space Data Processing Center (TsOKI). This paper reviews the system design principles and hardware and software aspects of the complex. The algorithms developed make it possible to generate a package of applications programs. B.J.

A84-21617
METHOD FOR REVEALING SEMIHIDDEN OBJECTS ON SPACE IMAGES [METOD VYIAVLENIIA POLUSKRYTYKH OB'EKTOV NA KOSMICHESKIKH IZOBRAZHENIIAKH]
V. A. ZABELIN, G. V. MIAKIN, and V. M. CHUKHLEBOV IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 129-132. In Russian.

A transformation method is proposed which makes it possible to enhance the visual perception of terrain features and surface objects hidden by semitransparent noise. The proposed method of the transformation of two-dimensional video images was used to process data from the Meteor satellite, resulting in the elimination of the masking effect of semitransparent clouds and atmospheric haze. It is noted that the transformation used makes it possible to vary the optical range of the image, leading to a clarification of surface features. B.J.

A84-21620
ORGANIZATION OF THE INTERACTIVE MODE IN THE THEMATIC PROCESSING OF AERIAL AND SPACE IMAGES [OB ORGANIZATSII DIALOGOVOGO REZHIMA V TEMATICHESKOI OBRABOTKE AEROKOSMICHESKIKH IZOBRAZHENII]
B. M. PUSHNOI IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 155-165. In Russian.

The characteristics of operator work in an interactive system for the processing of remote-sensing data are examined. Consideration is given to requirements on the software and structure of peripheral units oriented toward the solution of nonformal image-analysis problems. B.J.

A84-22454
PHASE DISTORTIONS IN THE ATMOSPHERE OF THE BRIGHTNESS PROFILES OF SURFACE OBJECTS [O FAZOVYKH ISKAZHENIIAKH PROFILEI IARKOSTI NAZEMNYKH OB'EKTOV V ATMOSPHERE]
I. V. MISHIN (Vsesoiuznyi Nauchno-Issledovatel'skii Informatsionnyi Tsentr, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 28, 29. In Russian. refs

A84-22465
REPRESENTING DATA FROM REMOTE SENSING USING A REFERENCE OBJECT [PREDSTAVLENIE DANNYKH DISTANTSIONNOGO ZONDIROVANIIA S ISPOL'ZOVANIEM OB'EKTA-ETALONA]
V. V. GOGOKHIIA (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 102-106. In Russian.

It is pointed out that in many cases the mass of data can be broken down into families formed through realizations in a comparatively narrow interval near a certain mean realization, which can be related to a reference object. This is referred to here as reference realization. The treatment presented is confined to one-dimensional realizations. A differential equation is obtained whose solutions are functions describing the possible realizations. An estimate is made of the increase in accuracy afforded by the reference dependence. It is shown that the method is well suited to representing a large number of close realizations and that it will be useful in organizing data banks of natural resources. C.R.

A84-22466
A METHOD OF PERFORMING PARALLEL COMPUTATIONS OF THE GEOMETRIC PARAMETERS OF CONTOUR IMAGES [METOD PARALLEL'NYKH VYCHISLENII GEOMETRICHESKIKH PARAMETROV OB'EKTOV KONTURNYKH IZOBRAZHENII]
M. M. FEIGIN (Institut Soiuzgiprovodkhoz, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 107-114. In Russian.

The method consists in an automatic measurement of the geometric parameters of contour images obtained from interpretations of the data gathered in surveys from the air. It makes use of parallel computations during the process of line scanning. An algorithm and its program are devised which make it possible, in a single treatment of the image, to distinguish the bounded regions and to calculate their geometric characteristics. Estimates made of the parameters being measured are analyzed, and techniques are proposed for obtaining unbiased estimates. C.R.

A84-23341* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
UTILIZATION OF SPACEBORNE SAR DATA FOR MAPPING
J. C. CURLANDER (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-22, March 1984, p. 106-112. refs
(Contract NAS7-100)

Recent developments in automated processing of digital SEASAT SAR imagery have made feasible the generation of large-scale high-resolution maps. Standard preprocessing of raw data into digital images results in geometrically distorted imagery. Computer algorithms have been developed for unsupervised pixel location, geometric rectification, and mosaicking of multiple-image frames without ground control points. These algorithms utilize knowledge of the spacecraft trajectory data, the imaging geometry, and the coherent properties of the sensor to generate the required processing parameters. This paper discusses the advantages as well as the inherent limitations of this technique, analyzes the associated errors, and presents results using SEASAT SAR imagery. Also discussed are the results of the recent shuttle imaging radar (SIR-A) experiment as well as a follow-on experiment (SIR-B) planned for 1984. Author

A84-23614* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SIMPLE DESCRIPTOR FOR CONTEXTUAL CLASSIFICATION OF HYPERDIMENSIONAL REMOTELY SENSED SPECTRAL DATA
W. C. CHIOU (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) Applied Optics (ISSN 0003-6935), vol. 23, Feb. 1, 1984, p. 465-468. NASA-supported research. refs

An extended CIE transformation was employed to deal with data reduction problems of hyperdimensional spectral data for NASA airborne and Shuttle imaging spectrometers. A simple descriptor was found to be very effective in analyzing spectral data covers from 0.4 to 2.4 microns. Results reveal contextual properties of minerals, vegetation, and crops. It provides a means to monitor seasonal growth variations for crops. It can also serve as pseudocolor indexing for imaging spectrometer imagery extended beyond the visible range. Author

A84-23752
CURRENT STATUS AND PROSPECTS OF THE FURTHER DEVELOPMENT OF METHODS AND EQUIPMENT FOR PHOTOINTERPRETATION [SOVREMENNOE SOSTOIANIE PERSPEKTIVY RAZVITIIA METODOV I SREDSTV DESHIFRIROVANIIA IZOBRAZHENII]
V. I. AKOVETSKII Geodeziia i Aerofotos'emka (ISSN 0536-101X), no. 5, 1983, p. 61-69. In Russian. refs

Techniques for the interpretation of aerial and space images are examined, with attention given to the resolution improvement of aerial photographs, enhancement of image contrast, and devices used for interpretation. The correlation, spectral decomposition, and perceptron methods of photointerpretation are compared. Particular consideration is given to a system for the processing of aerial photographs, comprising a coherent spectral analyzer, a coherent correlator, and an optical system of spatial filtering. B.J.

A84-23753
APPLICATION OF COHERENT OPTOELECTRONIC SYSTEMS AS PART OF COMPLEXES FOR THE PROCESSING OF AIR AND SPACE REMOTE-SENSING DATA [PRIMENENIE KOGERENTNYKH OPTIKO-ELEKTRONNYKH SISTEM V SOSTAVE KOMPLEKSOV OBRABOTKI AEROKOSMICHESKOI INFORMATSII]
A. S. DUBOVIK and N. N. MASHNIKOV Geodeziia i Aerofotos'emka (ISSN 0536-101X), no. 5, 1983, p. 73-77. In Russian.

A84-23754
APPLICATION OF REGULARIZATION AND SMOOTHING METHODS TO TRANSFORM SPACE PHOTO IMAGES TO THE CARTOGRAPHIC PROJECTION [PRIMENENIE METODOV REGULIARIZATSII I SGLAZHIVANIIA DLIA PREOBRAZOVANIIA IZOBRAZHENII KOSMICHESKIKH SNIMKOV V KARTOGRAFICHESKUIU PROEKTSIIU]
L. M. BUGAEVSKII and A. M. PORTNOV Geodeziia i Aerofotos'emka (ISSN 0536-101X), no. 5, 1983, p. 115-121. In Russian. refs

A84-24096
THE PRODUCTION AND USE OF CARTOGRAPHICALLY ENHANCED COLOUR COMPOSITES
L. SCHUBERT (Deutsche Akademie der Wissenschaften, Institut fuer Geographie und Geooekologie, Leipzig, East Germany) Jena Review (ISSN 0448-9497), vol. 28, no. 4, 1983, p. 180, 181, 200. refs

Color composites overlayed with topographic or thematic map lines provide up-to-date and inexpensive cartographical information, which can replace or supplement the 1:10,000 topographic map. Color composites are made from MKF-6 photographs taken at channel 4 (640-680 nm) and channel 6 (790-890 nm): the former for object demarcation and the latter for vegetation-area differentiation. If needed, scales of the MKF-6 photographs and

the topographic or thematic map are adjusted. Rectification may be required, though registration of paths, roads, and field boundaries between the TK 10' map and unrectified MKF-6 photographs is satisfactory. Applications for overlayed color composites include agricultural crop mapping, urban and rural development planning, and site assessment. C.M.

A84-24322
PHOTOGRAMMETRIC DATA ACQUISITION USING AN INTERACTIVE COMPUTER GRAPHICS SYSTEM
M. T. EREZ (Survey of Israel, Tel Aviv, Israel) and E. DORRER (Muenchen, Hochschule der Bundeswehr, Neubiberg, West Germany) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, Feb. 1984, p. 183-188. Research sponsored by the Deutsche Forschungsgemeinschaft. refs

Acquistion of digital photogrammetric data is discussed. The system used entails interactive digitizing, verified on-line either by a digital plotting table, or by a direct view storage tube. The relevant performance of both of these devices is evaluated. The hardware and software of an experimental set-up based on a Tektronix 4054 graphics system is described in detail, with special emphasis on the user's software developed at the Bundeswehr University in Munich. An explanation is given on the application of visual signals, prompts, texts, and audio signals to maintain interactivity with the operator. Finally, taking into account technological advancement, the trend for future developments is indicated. Author

A84-24323* Nebraska Univ., Lincoln.
AN AUTOMATED LAND-USE MAPPING COMPARISON OF THE BAYESIAN MAXIMUM LIKELIHOOD AND LINEAR DISCRIMINANT ANALYSIS ALGORITHMS
C. H. TOM (ConTel Information Systems, Inc., Government Systems Div., Littleton, CO) and L. D. MILLER (Nebraska, University, Lincoln, NE) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 50, Feb. 1984, p. 193-207. Research supported by the Colorado State University and NASA. refs

The Bayesian maximum likelihood parametric classifier has been tested against the data-based formulation designated 'linear discrimination analysis', using the 'GLIKE' decision and 'CLASSIFY' classification algorithms in the Landsat Mapping System. Identical supervised training sets, USGS land use/land cover classes, and various combinations of Landsat image and ancilliary geodata variables, were used to compare the algorithms' thematic mapping accuracy on a single-date summer subscene, with a cellularized USGS land use map of the same time frame furnishing the ground truth reference. CLASSIFY, which accepts a priori class probabilities, is found to be more accurate than GLIKE, which assumes equal class occurrences, for all three mapping variable sets and both levels of detail. These results may be generalized to direct accuracy, time, cost, and flexibility advantages of linear discriminant analysis over Bayesian methods. O.C.

A84-24675
PHOTOGRAMMETRY [FOTOGRAMMETRIIA]
V. M. SERDIUKOV Moscow, Izdatel'stvo Vysshaia Shkola, 1983, 352 p. In Russian. refs

The mathematical basis of photogrammetry and a geometric analysis of aerial photography are presented in a study of the theory and practice of phototopography. Phototriangulation techniques in the compilation of photomaps and combined photography are discussed and the theoretical bases of stereophotogrammetry are presented. Also considered are the differentiated and universal methods of stereotopography and their associated instrumentation and processing techniques. Photogrammetric applications in ground surveying, geodesy, road construction, and architecture, and in the deformation analysis of engineering structures are given. J.N.

A84-25141
AN APPROACH TO THE DESIGN OF A DIGITAL RELIEF MODEL [OB ODNOM PODKHODE K POSTROENIIU TSIFROVOI MODELI REL'EFA]
I. G. ZHURKIN (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR) and V. S. KORKIN Geodeziia i Aerofotos'emka (ISSN 0536-101X), no. 4, 1983, p. 66-71. In Russian.

A method is proposed for modeling a relief surface on the basis of spline approximation by orthonormal Chebyshev polynomials. The design of the digital relief model involves the construction of a grid of contours, followed by the construction of an approximating surface in each square grid of the cell, under the condition of continuity at the boundaries. The solution is reduced to the determination of an extremum of the Lagrange function. This approach makes it possible to considerably reduce the order of the system of linear equations, and the proposed digital model has a simple algorithm and is intended for use in systems of analytical photogrammetry. B.J.

A84-25142
CERTAIN ASPECTS OF THE INTERPRETATION OF SPACE PHOTOGRAPHS OF THE TERRITORY OF THE REPUBLIC OF MALI [NEKOTORYE ASPEKTY DESHIFRIROVANIIA KOSMICHESKIKH SNIMKOV TERRITORII RESPUBLIKI MALI]
A. KULIBALI Geodeziia i Aerofotos'emka (ISSN 0536-101X), no. 4, 1983, p. 81-86. In Russian.

A84-25143
FEATURES CHARACTERIZING THE INTERPRETATION OF MULTISPECTRAL SPACE PHOTOGRAPHS OF THE CENTRAL DELTA OF THE TERRITORY OF THE REPUBLIC OF MALI [OSOBENNOSTI DESHIFRIROVANIIA KOSMICHESKIKH MNOGOZONAL'NYKH SNIMKOV TSENTRAL'NOI DEL'TY TERRITORII RESPUBLIKI MALI]
A. BAGAIOKO Geodeziia i Aerofotos'emka (ISSN 0536-101X), no. 4, 1983, p. 86-93. In Russian.

A84-26841
BASIC RESEARCH PROBLEMS IN REMOTE SENSING
B. L. DEEKSHATULU and R. KRISHNAN (National Remote Sensing Agency, Hyderabad, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Dec. 1983, p. 337-354. refs

The sources of geometric errors and methods to correct them with special reference to satellite-derived multi-spectral data are described. An overview of an atmospheric model which can correct for atmospheric distortions is given, followed by discipline-oriented problems. Finally, some of the future remote sensing satellites which can cater to the problems referred to above are examined. Author

A84-27202
REAL-TIME GROUND PROCESSING OF LAND OBSERVING SATELLITE IMAGERY
L. I. SHERRY and G. B. SHAHAN (E-Systems, Inc., Garland Div., Dallas, TX) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 66-72.

An approach has been developed for real-time processing of land observing satellite imagery transmitted downlink at rates of 300 megabits per second or higher. This approach eliminates the necessity for large-scale storage of unprocessed data, and affords the capability for near-real-time display of the collected and processed image data. A test bed for softcopy display of digital imagery, developed in house by E-Systems, has been used to demonstrate the concept and the capability of achieving the required processing speeds. Author

A84-27380
SOME EXPERIMENTS WITH SPATIAL FEATURE EXTRACTION METHODS IN MULTISPECTRAL CLASSIFICATION
L. V. DUTRA and N. D. A. MASCARENHAS (Instituto de Pesquisas Espaciais, Sao Josedos Campos, Sao Paulo, Brazil) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 303-313. refs

Linear and nonlinear local filtering methods developed to increase image spatial features in multispectral classification are examined. Since all generated features cannot be used, feature selection methods are also developed. Classification is performed by a statistical supervised method based on the maximum likelihood criterion under the Gaussian assumption. The spectral feature extraction phase was carried out in April 1978 by the Landsat-3 satellite, over the area of Ribeirao Preto, Brazil. The same area was photographed at a 1:20,000 scale with color IR film in June 1978. Results demonstrate an improvement in average performance, a reduction in average confusion, but a general increase in average rejection, particularly on the borders between different fields. An increase in intrinsic dimensionality of the data is attributed to the use of spatial information. C.M.

A84-27381* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INFLUENCE OF AUTOCORRELATION IN SIGNATURE EXTRACTION - AN EXAMPLE FROM A GEOBOTANICAL INVESTIGATION OF COTTER BASIN, MONTANA
M. L. LABOVITZ and E. J. MASUOKA (NASA, Goddard Space Flight Center, Geophysics Branch, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 315-332. refs

The presence of positive serial correlation (autocorrelation) in remotely sensed data results in an underestimate of the variance-covariance matrix when calculated using contiguous pixels. This underestimate produces an inflation in F statistics. For a set of Thematic Mapper Simulator data (TMS), used to test the ability to discriminate a known geobotanical anomaly from its background, the inflation in F statistics related to serial correlation is between 7 and 70 times. This means that significance tests of means of the spectal bands initially appear to suggest that the anomalous site is very different in spectral reflectance and emittance from its background sites. However, this difference often disappears and is always dramatically reduced when compared to frequency distributions of test statistics produced by the comparison of simulated training sets possessing equal means, but which are composed of autocorrelated observations. Author

A84-27382* Arizona Univ., Tucson.
TOPICS IN THE TWO-DIMENSIONAL SAMPLING AND RECONSTRUCTION OF IMAGES
R. SCHOWENGERDT, S. GRAY (Arizona, University, Tucson, AZ), and S. K. PARK (NASA, Langley Research Center, Langley, VA) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 333-347. refs
(Contract AF-AFOSR-81-0170)

Mathematical analysis of image sampling and interpolative reconstruction is summarized and extended to two dimensions for application to data acquired from satellite sensors such as the Thematic mapper and SPOT. It is shown that sample-scene phase influences the reconstruction of sampled images, adds a considerable blur to the average system point spread function, and decreases the average system modulation transfer function. It is also determined that the parametric bicubic interpolator with alpha = -0.5 is more radiometrically accurate than the conventional bicubic interpolator with alpha = -1, and this at no additional cost. Finally, the parametric bicubic interpolator is found to be suitable for adaptive implementation by relating the alpha parameter to the local frequency content of an image. C.M.

A84-27543
AURORAL X-RAY IMAGES FROM DMSP-F6
P. F. MIZERA, D. J. GORNEY, and J. L. ROEDER (Aerospace Corp., Space Sciences Laboratory, Los Angeles, CA) Geophysical Research Letters (ISSN 0094-8276), vol. 11, March 1984, p. 255-258. refs
(Contract F04701-83-C-0084)

X-ray images of auroral arcs for consecutive north and south polar crossings of the DMSP-F6 satellite are presented. On January 18, 1983, the north polar region was in the earth's shadow and the south polar region was in complete sunlight. The X-ray images of both polar cap regions show features of the dawn and dusk auroral oval that are quite similar. However a strong polar cap structure appears only in the north pole image. Near simultaneous measurements of precipitating electrons obtained by instruments aboard the NOAA-6 and NOAA-7 satellites crossing the south pole, show no indication of polar auroral structures. These examples illustrate the utility of X-ray imaging in both sunlight and in darkness for studying auroral boundaries and morphology. Author

A84-27734#
AN EVALUATION OF DATA ENHANCEMENT TECHNIQUES FOR A GEOBOTANICAL SITE: SOLDIER'S DELIGHT, MARYLAND - PHASE I
K. LULLA, R. HOWE, and P. MAUSEL (Indiana State University, Terre Haute, IN) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 97-107. refs

Vegetation characteristics of a known geobotanical test site at Soldier's Delight, Maryland were evaluated using eight different enhanced Landsat data bands as Phase I of a three phase study. The spectral separability between vegetation classes of geobotanical interest was analyzed statistically. Intensive visual interpretation was conducted using enhanced and original data, in single and multi-band formats, displayed in image form on a CRT or grayscale alphanumeric map. Results of analysis indicate that enhanced data provide a better potential for site-specific geobotanical analysis than original data. It was determined that multispectral combinations of bands such as red, IR, red/IR ratio, and soil index ratio provide a better delineation of vegetation density/cover classes of geobotanical interest than do any single band or any two/three band combination. The soil index ratio proved to be especially valuable in multispectral analysis of the anomaly. Six of the eight enhanced bands, when interpreted individually, proved to be better for analysis than any one of the original four bands of Landsat data. Author

A84-27735*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AN EXPLOITATION OF COREGISTERED SIR-A, SEASAT AND LANDSAT IMAGES
P. REBILLARD (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) and T. P. NGUYEN (IBM France, S. A., Paris, France) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 109-117. refs
(Contract NAS7-100)

Multispectral registration and classification of SIR-A, Seasat SAR, and Landsat MSS data is presented over two playas located in the northeastern Algerian Sahara. A supervised classification was made over six classes: salt, palm trees, dunes, limestones, gypsum and sand. The best classification is obtained by using all of the data. The images using radar only misclassify trees and salt, limestone and dunes, gypsum and dunes. Landsat only gives a good map but lacks the roughness information contained in the radar data. The Landsat/SIR-A combination gives a better classification than the Landsat/Seasat combination. Density number histograms computed within several classes on the Seasat

and SIR-A data show the misclassification is mainly due to the Seasat data. C.D.

A84-27760#
IMPROVED SPATIAL AND ALTIMETRIC INFORMATION FROM SPOT COMPOSITE IMAGERY
R. SIMARD (Canada Centre for Remote Sensing, Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 433-444. refs

The SPOT earth observation satellite to be launched by the French Space Agency in 1984 will be operating in two modes: the panchromatic mode with a 10 m resolution on the ground and the multispectral mode consisting of 3 spectral bands at 20 m. The higher panchromatic resolution could be used effectively to increase the spatial resolution of the multispectral data as has been proposed for composite images from different sensors (e.g., Seasat-SAR/Landsat-MSS). But for SPOT, the spectral information in the two modes is closely related, and the concept of composite images presents some immediate implications. By applying an appropriate 'spatial modulation' on the first two multispectral bands, and by over-sampling the infrared band, the panchromatic-multispectral composite images could increase the spatial resolution of SPOT data with no alteration of the original radiometric information defined on the 20 m resolution. This work presents SPOT simulated panchromatic-multispectral composite images over the Gun Lake test site in British Columbia. Simulations were generated for nadir and off-nadir look angles, making possible the production of stereoscopic pairs and digital elevation models (DEM). Comparisons with Landsat data also have been done and have shown very promising results. Author

A84-27787*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.
A NEW METHOD FOR MAPPING MULTIDIMENSIONAL DATA TO LOWER DIMENSIONS
K. C. GOWDA (NASA, Goddard Institute for Space Studies, New York, NY) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 765-774. refs

A multispectral mapping method is proposed which is based on the new concept of BEND (Bidimensional Effective Normalised Difference). The method, which involves taking one sample point at a time and finding the interrelationships between its features, is found very economical from the point of view of storage and processing time. It has good dimensionality reduction and clustering properties, and is highly suitable for computer analysis of large amounts of data. The transformed values obtained by this procedure are suitable for either a planar 2-space mapping of geological sample points or for making grayscale and color images of geo-terrains. A few examples are given to justify the efficacy of the proposed procedure. Author

A84-27790*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADIOMETRIC CALIBRATION OF SEASAT SAR IMAGERY
C. CROFT (Sohio Petroleum Co., Dallas, TX), D. N. HELD, and B. L. HUNEYCUTT (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 817-825. refs

A goal of future synthetic aperture radar (SAR) system design is to yield the radiometrically accurate imagery necessary for use in classification problems. To accomplish this, a reliable calibration technique must be developed. Many such techniques have been proposed (e.g., Stiles and Holtzman, 1982); however, until now, none have been tested on spaceborne SAR digital data. In this paper, a method of significantly increasing the reproducibility of several independent Seasat SAR data sets of a test site using an automated correction procedure is described. Author

A84-28165
COMPARATIVE STUDY OF SIR-A AND LANDSAT IMAGES OF THE WESTERN TERMINATION OF THE GREAT WESTERN ERG (ALGERIA) [ETUDE COMPARATIVE DES IMAGES SIR-A ET LANDSAT SUR LA TERMINAISON OUEST DU GRAND ERG OCCIDENTAL /ALGERIE/]
A. MARIE (Institut Francais du Petrole, Rueil-Malmaison, Hauts-de-Seine, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 92, 1983-1984, p. 13-21. In French.

A84-28504* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTEGRATION OF IMAGERY AND CARTOGRAPHIC DATA THROUGH A COMMON MAP BASE
J. CLARK (California Institute of Technology, Jet Propulsion Laboratory, Image Processing Applications and Development Section, Pasadena, CA) IN: Applications of digital image processing IV; Proceedings of the Meeting, San Diego, CA, August 24-27, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 163-168. refs
(Contract NAS7-100)

Several disparate data types are integrated by using control points as the basis for spatially registering the data to a map base. The data are reprojected to match the coordinates of the reference UTM (Universal Transverse Mercator) map projection, as expressed in lines and samples. Control point selection is the most critical aspect of integrating the Thematic Mapper Simulator MSS imagery with the cartographic data. It is noted that control points chosen from the imagery are subject to error from mislocated points, either points that did not correlate well to the reference map or minor pixel offsets because of interactive cursorring errors. Errors are also introduced in map control points when points are improperly located and digitized, leading to inaccurate latitude and longitude coordinates. Nonsystematic aircraft platform variations, such as yawl, pitch, and roll, affect the spatial fidelity of the imagery in comparison with the quadrangles. Features in adjacent flight paths do not always correspond properly owing to the systematic panorama effect and alteration of flightline direction, as well as platform variations. C.R.

A84-28570
USE OF SATELLITE IMAGERY IN WEATHER FORECASTING OVER WESTERN UNITED STATES
G. E. RASCH (NOAA, National Weather Service, Salt Lake City, UT) IN: Advanced remote sensing; Proceedings of the Meeting, San Diego, CA, August 26, 27, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 13-20. refs

A84-28696
TECHNOLOGICAL APPROACH TO THE AUTOMATION OF THE *THEMATIC PROCESSING OF REMOTE-SENSING DATA* [TEKHNOLOGICHESKII PODKHOD K AVTOMATIZATSII TEMATICHESKOI OBRABOTKI MATERIALOV S'EMKI]
E. D. BODANSKII, L. A. KUZENKOV, and R. I. ELMAN (Vsesoiuznoe Aerofotolesoustroitel'noe Ob'edinenie Lesproekt, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 92-100. In Russian. refs

The automation of the thematic processing of remote-sensing images of earth resources has been carried out with consideration of specific technology requirements. Two structures for a complex of technical facilities are compared and evaluated in terms of productivity and other parameters. As a validation, the proposed approach was applied to the determination of forest valuation indices and forest management mapping. B.J.

A84-28697
CHOICE OF A CARTOGRAPHIC PROJECTION FOR THE DATA BANK OF A SPACEBORNE SYSTEM FOR THE REMOTE SENSING OF EARTH RESOURCES [VYBOR KARTOGRAFICHESKOI PROEKTSII DLIA BANKA DANNYKH KOSMICHESKOI SISTEMY IZUCHENIIA PRIRODNYKH RESURSOV]
V. I. KHIZHNICHENKO (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1984, p. 101-109. In Russian. refs

A84-28851* Johns Hopkins Univ., Laurel, Md.
THE APL IMAGE PROCESSING LABORATORY
J. O. JENKINS, J. P. RANDOLPH, D. G. TILLEY, and C. A. WATERS (Johns Hopkins University, Laurel, MD) Johns Hopkins APL Technical Digest (ISSN 0270-5214), vol. 5, Jan.-Mar. 1984, p. 59-78. Research supported by U.S. Department of Transportation, Navy, DOD, NOAA, and NASA. refs

The present and proposed capabilities of the Central Image Processing Laboratory, which provides a powerful resource for the advancement of programs in missile technology, space science, oceanography, and biomedical image analysis, are discussed. The use of image digitizing, digital image processing, and digital image output permits a variety of functional capabilities, including: enhancement, pseudocolor, convolution, computer output microfilm, presentation graphics, animations, transforms, geometric corrections, and feature extractions. The hardware and software of the Image Processing Laboratory, consisting of digitizing and processing equipment, software packages, and display equipment, is described. Attention is given to applications for imaging systems, map geometric correction, raster movie display of Seasat ocean data, Seasat and Skylab scenes of Nantucket Island, Space Shuttle imaging radar, differential radiography, and a computerized tomographic scan of the brain. J.N.

A84-29250
THE NIMBUS-7 ERB SUB-TARGET RADIANCE TAPE (STRT) DATA BASE FOR RADIATION BUDGET STUDIES
L. L. STOWE (NOAA, National Environmental Satellite, Data and Information Service, Washington, DC) American Meteorological Society, Bulletin (ISSN 0003-0007), vol. 64, Dec. 1983, p. 1366. refs

A brief summary of the contents of the Sub-Target Radiance Tape (STRT) data base, which provides detailed information describing the earth surface topography and vegetation, snow and ice cover, and the radiance of long- and short-wave radiation at the top of the atmosphere, twice daily, is presented. The radiance data are derived from Nimbus-7 earth radiation budget narrow field-of-view scanning channel measurements. The period covered by the data base extends from November 16, 1978 to May 19, 1980, providing 272 days of data. J.N.

A84-29294
EVALUATION OF INTERFEROMETRIC DATA BY OPTO-DIGITAL COMPUTING
H. GLUENDER and J. HOFER-ALFEIS (Muenchen, Technische Universitaet, Munich, West Germany) IN: Electro-Optics/Laser International '82 UK; Proceedings of the Conference, Brighton, England, March 23-25, 1982 . London, Butterworths, 1982, p. 297-306. refs

An opto-digital interferogram evaluation system has been developed for nondestructive testing applications. The hybrid interferogram evaluation system allows a reduction of about 2 Mbit of input data (the space-bandwidth product of the processor) to 10 Kbit of digitally stored data from which the final decision is computed. The processing time is of the order of the time necessary for the registration of a double-exposure hologram on a thermoplastic film. The interferograms are characterized by the local radial and angular frequency, which guarantees a minimum loss of relevant information. The time-varying filtering process employed in the system is described in detail. V.L.

A84-29361
OPTICAL-DIGITAL PROCESSING OF DIRECTIONAL TERRAIN TEXTURES INVARIANT UNDER TRANSLATION, ROTATION, AND CHANGE OF SCALE
J. DUVERNOY (Franche-Comte, Universite, Besancon, France) Applied Optics (ISSN 0003-6935), vol. 23, March 15, 1984, p. 828-837. refs

Measurements are made of isoenergy directional signatures in two-dimensional Fourier spectra of aerial photographs. Three classes of textures, associated with fields, woods, and urban regions, are considered. Invariant signatures are defined by means of an automated application of the technique of Fourier descriptors for plane closed curves to contour lines selected in the spectra of the photographs. The dimensionality of these descriptors is then reduced through a partial expansion of an orthonormal polynomial basis. A determination is made of their statistical significance by means of nonsupervised classification methods. An obique basis of signatures matched to the three classes of textures is proposed which does not change under translation, rotation, or change of scale. By means of the Gram-Schmidt procedure, the identification rate is optimized by a further orthogonalization of this basis. A comparison is then made of the results of terrain classifications using the direct signatures and the two proposed bases. C.R.

A84-29735#
ULTRAVIOLET IMAGING FROM SPACE OF THE AURORA UNDER FULL SUNLIGHT
C.-I. MENG (Johns Hopkins University, Laurel, MD) and R. E. HUFFMAN (USAF, Geophysics Laboratory, Bedford, MA) Geophysical Research Letters (ISSN 0094-8276), vol. 11, April 1984, p. 315-318. refs

This report presents the first successful global-scale auroral images in full daylight. The vacuum ultraviolet (VUV) imager on board the recently launched HILAT satellite has demonstrated that clear images of the global auroral display over the local summer polar region under full sunlight conditions can be obtained, indicating that the earth's albedo and dayglow background are not formidable obstacles to the global auroral imaging at the VUV wavelengths (135.6 + or 1.5 nm and 149.3 + or - 1.5 nm). Some of the images of dayglow and auroras in daylight are presented and discussed. Author

N84-16399*# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.
SAR CALIBRATION: A TECHNOLOGY REVIEW
R. W. LARSON, D. T. POLITIS, and R. A. SHUCHMAN *In* JPL Spaceborne Imaging Radar Symp. p 48-49 1 Jul. 1983
(Contract NAS9-16135; NAS9-16467)
Avail: NTIS HC A08/MF A01 CSCL 17I

Various potential applications of amplitude-calibrated SAR systems are briefly described, along with an estimate of calibration performance requirements. A review of the basic SAR calibration problem is given. For background purposes and to establish consistent definition of terms, various conventional SAR performance parameters are reviewed along with three additional parameters which are directly related to calibrated SAR systems. Techniques for calibrating a SAR are described. Included in the results presented are: calibration philosophy and procedures; review of the calibration signal generator technology development with results describing both the development of instrumentation and internal calibration measurements for two SAR systems; summary of analysis and measurements required to determine optimum retroreflector design and configuration for use as a reference for the absolute calibration of a SAR system; and summary of techniques for in-flight measurements of SAR antenna response. Author

N84-16403*# Kansas Univ., Lawrence. Remote Sensing Lab.
MAPPING AND MONITORING RENEWABLE RESOURCES WITH SPACE SAR
F. T. ULABY, B. BRISCO, M. C. DOBSON, and S. MOEZZI *In* JPL Spaceborne Imaging Radar Symp. p 76-78 1 Jul. 1983
Avail: NTIS HC A08/MF A01 CSCL 08B

The SEASAT-A SAR and SIR-A imagery was examined to evaluate the quality and type of information that can be extracted and used to monitor renewable resources on Earth. Two tasks were carried out: (1) a land cover classification study which utilized two sets of imagery acquired by the SEASAT-A SAR, one set by SIR-A, and one LANDSAT set (4 bands); and (2) a change detection to examine differences between pairs of SEASAT-A SAR images and relates them to hydrologic and/or agronomic variations in the scene. E.A.K.

N84-16615*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF SPECTRAL/RADIOMETRIC CHARACTERISTICS OF THE THEMATIC MAPPER FOR LAND USE APPLICATIONS Quarterly Status and Technical Progress Report, 21 Sep. - 20 Dec. 1983
W. A. MALILA, Principal Investigator and M. D. METZLER Jan. 1984 17 p ERTS
(Contract NAS5-27346)
(E84-10058; NASA-CR-173218; NAS 1.26:173218; ERIM-164000-8-P; QSTPR-5) Avail: NTIS HC A02/MF A01 CSCL 08B

The previous characterization of scan-related low-frequency noise was confirmed and extended through analysis of reflective-band data from another nighttime acquisition. Amplitude and phase relationships of the level shifts were determined for each detector in each of free full frames. Analysis of scan-direction-related signal droop effects in nighttime data from the reflective bands was begun with encouraging initial observations. Also, an effort to characterize high-frequency noise in the reflective bands through Fourier analysis of nighttime data was initiated. Recommendations are made relative to the choice of radiometric calibration constants in the thematic mapper image processing system for the routine processing of TM data. Non-linear (piece-wise linear) calibration curves are recommended. A.R.H.

N84-16618*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CNPQ/INPE LANDSAT SYSTEM Report of Activities, 1 Oct. 1982 - 30 Sep. 1983
N. D. J. PARADA, Principal Investigator and J. L. D. B. AGUIRRE Nov. 1983 27 p Presented at the LANDSAT Ground Station Operations Working Group and the Data Distribution Working Group, Nov. 1983 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS
(E84-10071; NASA-CR-173221; NAS 1.26:173221; INPE-2952-PRE/434) Avail: NTIS HC A03/MF A01 CSCL 08B

The status of the Brazilian LANDSAT facilities and the results achieved are discussed. The receiving and recording systems, processing laboratories and products, and data distribution are addressed. M.G.

N84-16622*# EROS Data Center, Sioux Falls, S. Dak.
LANDSAT 4 INVESTIGATION OF THEMATIC MAPPER AND MULTISPECTRAL SCANNER APPLICATIONS Quarterly Report
D. T. LAUER, Principal Investigator 30 Dec. 1983 3 p ERTS
(Contract NASA ORDER S-10757-C)
(E84-10075; NASA-CR-173225; NAS 1.26:173225) Avail: NTIS HC A02/MF A01 CSCL 05B

Six different band combinations of TM data were selected for evaluation by four experienced photointerpreters who were asked to rank the band combinations according to the ease with which the category of image feature designated for each set of combinations could be distinguished. There were four sets of combinations selected for each category of image feature. Scenes of Oklahoma City, Oklahoma and of the Sacramento Valley, California area were enlarged to 1:250,000 and 2 cm circular chips were cut from each print. A nonparametric rank order test was carried out on the data to determine if the interpreters found no difference among the band combinations in ranking for the designated categories. Kendall's coefficient of concordance (W) was calculated and the significance of the W value was determined by a chi-square test. A table summarizes the results of the evaluation and shows the rank order of band combinations indicated as valid by rejection of the null hypothesis. A.R.H.

N84-16623*# Arizona Univ., Tucson.
INVESTIGATION OF SEVERAL ASPECTS OF LANDSAT-4 DATA QUALITY Quarterly Progress Report
R. C. WRIGLEY, Principal Investigator 20 Dec. 1983 7 p ERTS
(E84-10076; NASA-CR-173226; NAS 1.26:173226) Avail: NTIS HC A02/MF A01 CSCL 08B

Preliminary analysis of band-to-band registration in a TM scene of San Francisco, California by flickering different band pairs on the display showed no major problems. The power spectra of individual lines in each band on the A-tape of a Washington, D.C. scene, which represented data from individual detectors, was calculated. The power spectra for each detector were averaged and the peak-to-peak amplitudes were calculated as a function of frequency. Estimated system modulation transfer functions were calculated for bands 3 and 4 for a 128 x 128 pixel area of the San Francisco Bay containing the San Matteo Bridge. The shape and width of the modulation transfer functions appear reasonable, but further study is required to establish confidence in the results which yield an effective-instantaneous field of view of 33.6 meters and 40.8 meters in bands 3 and 4, respectively. A.R.H.

N84-17195*# Old Dominion Univ., Norfolk, Va. Dept. of Electrical Engineering.
INVESTIGATION OF DESIGN CONSIDERATIONS FOR A COMPLEX DEMODULATION FILTER Final Report, 6 Jun. - 6 Sep. 1979
J. W. STOUGHTON Jan. 1984 14 p refs
(Contract NAS1-15648)
(NASA-CR-173295; NAS 1.26:173295) Avail: NTIS HC A02/MF A01 CSCL 22A

The digital design of an adaptive digital filter to be employed in the processing of microwave remote sensor data was developed. In particular, a complex demodulation approach was developed to provide narrow band power estimation for a proposed Doppler scatterometer system. This scatterometer was considered for application in the proposed National Oceanographic survey satellite, on an improvement of SEASAT features. A generalized analysis of complex diagrams for the digital architecture component of the proposed system. S.L.

N84-17435*# Texas Univ., Austin. Applied Research Labs.
APQ-102 IMAGING RADAR DIGITAL IMAGE QUALITY STUDY Final Report, 1 Nov. 1981 - 31 Oct. 1982
C. R. GRIFFIN and J. M. ESTES 11 Nov. 1982 102 p refs
(Contract NAS9-16497)
(NASA-CR-171738; NAS 1.26:171738; ARL-TR-82-68) Avail: NTIS HC A06/MF A01 CSCL 17I

A modified APQ-102 sidelooking radar collected synthetic aperture radar (SAR) data which was digitized and recorded on wideband magnetic tape. These tapes were then ground processed into computer compatible tapes (CCT's). The CCT's may then be processed into high resolution radar images by software on the CYBER computer. S.L.

N84-17669# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.

APPROACHES TO RADAR IMAGE INTERPRETATION

A. J. SIEBER *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 159-166 Sep. 1983 refs

Avail: NTIS HC A09/MF A01

The electromagnetic interaction mechanism of a radar beam with its target, described by the backscattering coefficient, is outlined. Image data correction by polynomial interpolation and moving average procedures is recalled. Global image analysis, speckle characteristics, and the relation between wavelength and target length in thematic interpretation are discussed. Speckle reduction by incoherent averaging and adaptive filtering is treated. Author (ESA)

N84-19957*# Research and Data Systems, Inc., Lanham, Md.

AN ANALYSIS OF NEW TECHNIQES FOR RADIOMETRIC CORRECTION OF LANDSAT-4 THEMATIC MAPPER IMAGES

J. KOGUT, E. LARDUINAT, and M. FITZGERALD 20 Oct. 1983 29 p ERTS

(Contract NAS5-27371)

(E84-10086; NASA-CR-175179; NAS 1.26:175179) Avail: NTIS HC A03/MF A01 CSCL 08B

The utility of methods for generating TM RLUTS which can improve the quality of the resultant images was investigated. The TM-CCT-ADDS tape was changed to account for a different collection window for the calibration data. Several scenes of Terrebonne Bay, Louisiana and the Grand Bahamas were analyzed to evaluate the radiometric corrections operationally applied to the image data and to investigate several techniques for reducing striping in the images. Printer plots for the TM shutter data were produced and detector statistics were compiled and plotted. These statistics included various combinations of the average shutter counts for each scan before and after DC restore for forward and reverse scans. Results show that striping is caused by the detectors becoming saturated when they view a bright cloud and depress the DC restore level. A.R.H.

N84-19965*# State Univ. of New York, Albany.

DEMONSTRATION OF ANGULAR ANISOTROPY IN THE OUTPUT OF THEMATIC MAPPER Quarterly Status Technical Progress Report

M. J. DUGGIN, Principal Investigator, J. LINDSAY, D. J. PIWINSKI, and L. B. SCHOCH 11 Feb. 1984 135 p ERTS

(Contract NAS5-27595)

(E84-10095; NASA-CR-175387; NAS 1.26:175387) Avail: NTIS HC A07/MF A01 CSCL 08B

There is a dependence of TM output (proportional to scene radiance in a manner which will be discussed) upon season, upon cover type and upon view angle. The existence of a significant systematic variation across uniform scenes in p-type (radiometrically and geometrically pre-processed) data is demonstrated. Present pre-processing does remove the effects and the problem must be addressed because the effects are large. While this is in no way attributable to any shortcomings in the thematic mapper, it is an effect which is sufficiently important to warrant more study, with a view to developing suitable pre-processing correction algorithms. A.R.H.

N84-19966*# Canada Centre for Remote Sensing, Ottawa (Ontario).

CCRS PROPOSAL FOR EVALUATING LANDSAT-4 MSS AND TM DATA Progress Report, 3 Sep. 1983 - 2 Jan. 1984

W. M. STROME, J. CIHLAR, D. G. GOODENOUGH, F. E. GUERTIN, Principal Investigators, B. GUINDON, J. MURPHY, J. M. BUTLIN, P. DUFF, A. FITZGERALD, G. GRIEVE et al. 26 Jan. 1984 35 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E84-10096; NASA-CR-175388; NAS 1.26:175388; PR-2) Avail: NTIS HC A03/MF A01 CSCL 05B

The measurement of registration errors in LANDSAT MSS data is discussed as well as the development of a revised algorithm for the radiometric calibration of TM data and the production of a geocoded TM image.

N84-19967*# Canada Centre for Remote Sensing, Ottawa (Ontario).

REVISED RADIOMETRIC CALIBRATION TECHNIQUE FOR LANDSAT-4 THEMATIC MAPPER DATA BY THE CANADA CENTRE FOR REMOTE SENSING

J. MURPHY, T. BUTLIN, P. DUFF, and A. FITZGERALD (Ball (Roy) Associates) *In its* Proposal for Evaluating LANDSAT-4 MSS and TM Data 4 p 26 Jan. 1984 ERTS

Avail: NTIS HC A03/MF A01 CSCL 08B

Observations of raw image data, raw radiometric calibration data, and background measurements extracted from the raw data streams on high density tape reveal major shortcomings in a technique proposed by the Canadian Center for Remote Sensing in 1982 for the radiometric correction of TM data. Results are presented which correlate measurements of the DC background with variations in both image data background and calibration samples. The effect on both raw data and data corrected using the earlier proposed technique is explained and the correction required for these factors as a function of individual scan line number for each detector is described. How the revised technique can be incorporated into an operational environment is demonstrated. A.R.H.

N84-19968*# Canada Centre for Remote Sensing, Ottawa (Ontario).

REVISED RADIOMETRIC CALIBRATION TECHNIQUE FOR LANDSAT-4 THEMATIC MAPPER DATA

J. MURPHY, T. BUTLIN, P. DUFF, and A. FITZGERALD (Ball (Roy) Associates) *In its* Proposal for Evaluating LANDSAT-4 MSS and TM Data 22 p 26 Jan. 1984 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

Avail: NTIS HC A03/MF A01 CSCL 05B

Depending on detector number, there are random fluctuations in the background level for spectral band 1 of magnitudes ranging from 2 to 3.5 digital numbers (DN). Similar variability is observed in all the other reflective bands, but with smaller magnitude in the range 0.5 to 2.5 DN. Observations of background reference levels show that line dependent variations in raw TM image data and in the associated calibration data can be measured and corrected within an operational environment by applying simple offset corrections on a line-by-line basis. The radiometric calibration procedure defined by the Canadian Center for Remote Sensing was revised accordingly in order to prevent striping in the output product. A.R.H.

N84-19969*# Canada Centre for Remote Sensing, Ottawa (Ontario).

LANDSAT-4 MSS INTERBAND REGISTRATION

G. GRIEVE and R. SIMARD *In its* Proposal for Evaluating LANDSAT-4 MSS and TM Data 2 p 26 Jan. 1984 refs ERTS

Avail: NTIS HC A03/MF A01 CSCL 05B

Interband registration on raw LANDSAT-4 MSS data was measured in the four MSS bands of the Mistassini, Quebec scene (path-row 16-24, June 21, 1983). Statistical comparison between

line-pixel locations of uniformly distributed ground control points in the four different bands permitted quantitative measures of the offset over the entire scene. The statistical distribution of the offset measures permitted evaluation of the standard error on the mean values, giving confidence on their precision. Results obtained using a manual ground control point done on a digital image correction system and those obtained using digital band-to-band correlation adapted from a digital stereographic correlation algorithm are tabulated. The pixel misrepresentation values obtained are compared with published NASA figures. A.R.H.

N84-19970*# Canada Centre for Remote Sensing, Ottawa (Ontario).
LANDSAT-MSS MULTITEMPORAL REGISTRATION
G. GRIEVE and R. SIMARD *In its* Proposal for Evaluating LANDSAT-4 MSS and TM Data 2 p 26 Jan. 1984 ERTS
Avail: NTIS HC A03/MF A01 CSCL 05B

The multitemporal registration of LANDSAT-4 MSS products was tested for two different geocoded subscenes acquired in 1982 and 1983. The scenes were then compared with LANDSAT-2 MSS geocoded data from 1981. Statistical comparison between line-pixel locations of uniformly distributed ground control points in the three geocoded products permitted quantitative measure of the offset over the sub-scene. Values of line and pixel misregistration obtained using the manual ground control points and digital correlation are tabulated and discussed. A.R.H.

N84-19971# LANDSAT Technical Working Group.
PROCEEDINGS OF THE FOURTH MEETING OF THE LANDSAT TECHNICAL WORKING GROUP (LTWG). ATTACHMENTS
1983 349 p refs Meeting held in Frascati, Italy, 19-21 Apr. 1983
(LIB-PRO-0012) Avail: NTIS HC A15/MF A01

The performance of LANDSAT remote sensing and data transmission systems is assessed and methods are discussed for radiometric and geometric correction. Standard formats for data products and options for LANDSAT 4 TM data distribution to ground stations are considered.

N84-19975# Canada Centre for Remote Sensing, Ottawa (Ontario).
RADIOMETRIC CALIBRATION AND GEOCODED PRECISION PROCESSING OF LANDSAT-4 MSS PRODUCTS
J. MURPHY, D. BENNETT, and F. GUERTIN *In* LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 31 p 1983
Avail: NTIS HC A15/MF A01

The stability of the calwedge is being monitored by CCRS for two major purposes. Firstly, it is advisable to select as reference detectors for absolute calibration purposes the detector within each band which is most reliable in terms of both long term stability and constancy within one scene. Secondly, any long term drift in the absolute calibration of the MSS sensor should be monitored for quality assessment purposes. Author

N84-19976# National Space Development Agency, Tokyo (Japan).
OPERATIONAL STATUS OF THE LANDSAT-5 GROUND STATION
In LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 3 p 1983
Avail: NTIS HC A15/MF A01

The status of receiving and recording LANDSAT 4 S-band MSS data is examined as well X-band test reception. Problems solved involve modulation mode and frequency change of received USB telemetry and auto-tracking loss due to USB received AGC level change. The LANDSAT 4 data processing system is summarized and the implementation of the standard format for MSS CCT's is reported. Changes were made to the MSS data processing system for longitude/latitude tickmark coordination, and improvement of radiometric correction. A.R.H.

N84-19977# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CURRENT STATUS OF TH BRAZILIAN LANDSAT FACILITIES Progress Report, 1 Oct. 1982 - 31 Mar. 1983
M. N. BARBOSA and J. B. ESCADA, JR. *In* LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 21 p 1983
Avail: NTIS HC A15/MF A01

The current status of Brazilian facilities for LANDSAT data is discussed including the Cuiaba tracking and receiving station; electronic and photographic processing laboratories, and the data distribution centers. Subsystems for receiving, recording, and processing LANDSAT 4 data are described as well as the preliminary TM products produced. A.R.H.

N84-19978# National Space Development Agency, Tokyo (Japan).
DESCRIPTION AND STATUS REPORT ON TM PROCESSING SYSTEM
In LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 6 p 1983
Avail: NTIS HC A15/MF A01

The TM processing system consists of two independent computer subsystems; TM-IDPS (Image Data Processing Subsystem) and TM-PGS (product generation subsystem). The TM-IDPS feeds TM data reproduced from the high density digital recorder and performs, radiometric and geometric corrections. Processed data are output into CCT's. The TM-PGS is for exposing TM image upon a 240 mm film and for copying CCT's. The hardware structure, system performance, and products are discussed. A schedule is given for the development of systems for recording, receiving and processing data, for products generation, and for photographics for both the TM and the MSS. A.R.H.

N84-19979*# National Aeronautics and Space Administration, Washington, D. C.
NASA TM PROCESSING SYSTEM DESCRIPTION AND STATUS
W. WATT *In* LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 32 p 1983
Avail: NTIS HC A15/MF A01 CSCL 17B

An overview of the processing system for LANDSAT 4 imagery is given. Charts show system requirements; the LANDSAT 4 ground segment with its elements, configurations, and data flow; image generation requirements; and the major functions, interfaces, and hardware of the image generation facility and the image processing systems for the TM and MSS. The laser beam film recorder and the high density digital recorder are covered as well as the data available at EDC. A.R.H.

N84-19980# EROS Data Center, Sioux Falls, S. Dak.
TM DATA AVAILABLE AT EDC, AND EDC TM DATA HANDLING AND PROCESSING PLAN
In LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 39 p 1983
Avail: NTIS HC A15/MF A01

Pixel values of LANDSAT 4 MSS detectors are plotted and other graphs show the MSS spectral response and TM calibration data by pixel position. Tables show postlaunch radiometric calibration of TM data, and spectral radiance values. The plan for processing and handling TM data is presented including basic workflow, section responsibilities, impacts, and assumptions at EDC. Anticipated software requirements are included. A.R.H.

N84-19981# National Oceanic and Atmospheric Administration, Washington, D. C.
NOAA POSITION FOR TM DATA DISTRIBUTION
E. CONLAN *In* LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 23 p 1983
Avail: NTIS HC A15/MF A01

The layout of the 14 track raw TM data ground station tape is illustrated and specifications for recording are given. Topics covered

include: demultiplexing; track assignment; randomizing; bit inversions and byte parity; digital coding; and high density digital recording frame format. The randomization code and internal controls are show in tables. A.R.H.

N84-19982# Canada Centre for Remote Sensing, Ottawa (Ontario).
CCRS OPTION FOR TM DATA DISTRIBUTION
J. MURPHY *In* LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 4 p 1983
Avail: NTIS HC A15/MF A01

The proposed HDR Control System should provide the means to distribute LANDSAT-4 thematic mapper data in downlink serial format on high density tape. While the data is not availale directly from the satellite via X-band transmission, TDRSS will provide the alternative means to obtain it. However, TDRSS data is not available directly to foreign stations, and the proposed system will allow the data to be distributed on each foreign station's high density medium. Data input to the system can be from either of two sources: by high speed dedicated line from NASA, in which case the system will be on NASA's premises; or temporarily on NASA's high density medium, in which case the system will be at CCRS for ease and economy of operation. The latter is likely to be the mode of operation for the first 8 months, until TDRSS is proven and a facility can be made ready for the system to be installed at NASA, Goddard. Author

N84-19983# European Space Agency, Frascati (Italy).
GEOMETRIC PERFORMANCE: LINE TO LINE DISPLACEMENT ANALYSIS
L. FUSCO and W. MEHL *In* LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 32 p 1983 refs
Avail: NTIS HC A15/MF A01

An early acquired TM data frame (track 23, frame 35 of 22 August 1982) was used to assess the geometric performance of the LANDSAT-4 thematic mapper instrument. The developed method consists in determining the displacements of adjacent lines by locating the maximum of the correlation profile between the two lines. Then the line to line displacement is used to characterize the TM instrument in respect to: scan to scan jitter and image skew, scan profile non-linearity, along scan jitter, detector to detector displacement, and band to band displacement. To verify the quality of the reported performance parameters, some extracted geometric parameters were used to correct the original raw data. Comparison between P-tape data and results of reprocessed data shows no significant differences in an area of 1024 x 1024 pixels. A.R.H.

N84-19984# LANDSAT Technical Working Group.
SUMMARY OF LANDSAT TECHNICAL WORKING GROUP (LTWG) MEETINGS
In its Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 24 p 1983
Avail: NTIS HC A15/MF A01

Principal activities of the meetings are summarized and LANDSAT 4 technical information exchange is discussed from the viewpoints of background, cause, current status, and future plans. Current applications of the superstructure format standard and promulgation of the tape standard are discussed. Participants at the three previous LANDSAT Technical Working Group Meetings are listed along with the organizations they represent. A.R.H.

N84-19986*# Wisconsin Univ., Madison. Space Science and Engineering Center.
THE SPECIAL EFFORT PROCESSING OF FGGE DATA Final Report
2 Mar. 1983 4 p refs
(Contract NAS5-26540)
(NASA-CR-175214; NAS 1.26:175214) Avail: NTIS HC A02/MF A01 CSCL 05B

The basic FGGE level IIb data set was enhanced. It focused on removing deficiencies in the objective methods of quality assurance, removing efficiencies in certain types of operationally produced satellite soundings, and removing deficiencies in certain types of operationally produced cloud tracked winds. The Special Effort was a joint NASA-NOAA-University of Wisconsin effort. The University of Wisconsin installed an interactive McIDAS capability on the Amdahl computer at the Goddard Laboratory of Atmospheric Sciences (GLAS) with one interactive video terminal at Goddard and the other at the World Weather Building. With this interactive capability a joint processing effort was undertaken to reprocess certain FGGE data sets. NOAA produced a specially edited data set for the special observing periods (SOPs) of FGGE. NASA produced an enhanced satellite sounding data set for the SOPs while the University of Wisconsin produced an enhanced cloud tracked wind set from the Japanese geostationary satellite images. Author

N84-20064# Schweizerische Meteorologische Zentralanstalt, Zurich.
PROSPECTIVE USE OF A MOBILE RADIATION SYSTEM TO VALIDATE TECHNIQUES OF RADIATION ESTIMATIONS FROM SATELLITE RECORDS
A. HEIMO, J. RUCHTI (Eidgenoessische Technische Hocschule), and A. ZELENKA *In* Cologne Univ. Satellite Meas. of Radiation Budget Parameters p 143-152 Oct. 1983 refs
Avail: NTIS HC A08/MF A01

A mobile radiation measurement system was used for spectral measurements of direct and diffuse radiation. Daily and hourly sums of horizontal global radiation were calculated. A model for correlating satellite measurements with terrestrial radiation measurements was developed. Results show that the estimation is feasible, but the model should be refined. Author (ESA)

N84-20065# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
MAPPING OF GLOBAL RADIATION FROM METEOSAT IMAGE DATA
W. MOESER *In its* Satellite Meas. of Radiation Budget Parameters p 153-159 Oct. 1983 refs
Avail: NTIS HC A08/MF A01

An operational method to determine the field of global radiation at the surface from Meteosat imagery was developed. Daily sums of global radiation measured by 19 pyranometers were compared with the results derived from Meteosat data of the same period. The RMS difference for daily sums (using up to 6 satellite images per day) reaches 0.56 kWh/sqm, which is 7% of the corresponding daily sum under clear sky conditions. Maps of global radiation were derived for Europe, the Mediterranean Sea and North Africa. Author (ESA)

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A84-20097
METHOD OF DETERMINING THE SPECTRAL POLARIZATION CHARACTERISTICS OF INSTRUMENTS DESIGNED FOR REMOTE NATURAL-RESOURCE STUDIES
B. I. BELIAEV, V. A. ZAITSEVA, V. E. PLIUTA, and A. F. IANOVSKII (Optiko-Mekhanicheskaia Promyshlennost', vol. 50, Apr. 1983, p. 10-12) Soviet Journal of Optical Technology (ISSN 0038-5514), vol. 50, April 1983, p. 212-214. Translation. refs

A method for calibrating spectral equipment which takes account of the polarization characteristics of the instrument and the polarization state of the radiation arriving at the entrance pupil of the spectrometer is described. The representation of the polarization state of the incident radiation is achieved by determining the transfer coefficient, and the extended source method is used for the calibration. The determination of the spectral sensitivity of the instrument is also shown. Results are presented and calibration errors are estimated for series MSS-2 spectrometers. C.D.

A84-20407
AN EVALUATION OF DIGITIZED APT DATA FROM THE TIROS-N/NOAA-A,-J SERIES OF METEOROLOGICAL SATELLITES
B. WANNAMAKER (*NATO, Saclant ASW Research Centre, La* Spezia, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Jan.-Feb. 1984, p. 133-144. refs

There have been a number of improvements with respect to the quality of the imagery data from meteorological spacecraft. The new instrument on the Tiros-N/NOAA-A,-J series represents one of these improvements. Another imporvement is related to the APT (Automated Picture Transmission) formatted data. The APT data included initially only visible, photographic data. However, thermal infrared data were added in 1972. On the Tiros-N satellite the APT data become a digitally processed product of the main high-resolution sensor. The quality of digitized APT data is discussed, and the data are evaluated with respect to their ability to return precise geophysical parameters at known geographical positions. It is shown that the quality is sufficient for many mesoscale measurements. G.R.

A84-20409
REMOVAL OF ATMOSPHERIC EFFECTS ON A PIXEL BY PIXEL BASIS FROM THE THERMAL INFRARED DATA FROM INSTRUMENTS ON SATELLITES - THE ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR)
S. M. SINGH (Dundee, University, Dundee, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Jan.-Feb. 1984, p. 161-183. Research supported by the Science and Engineering Research Council. refs

The problem of obtaining the actual sea-surface temperatures (SSTs) on the basis of the data provided by the Advanced Very High Resolution Radiometer (AVHRR) is considered. It is found that no matter which of a number of approaches for removal of the atmospheric effects is selected, there are always some difficulties involved. The present investigation is concerned with yet another method of atmospheric correction. Simple algorithms for evaluating brightness temperatures and for applying nonlinearity and emissivity corrections to the thermal infrared data from the AVHRR on the Tiros-N/NOAA satellite series are presented, and an atmospheric correction method on a pixel by pixel basis is described. G.R.

A84-20817
ANALYSIS OF THE CHARACTERISTICS OF A SIDELOOKING INTERFEROMETER [ANALIZ KHARAKTERISTIK INTERFEROMETRA BOKOVOGO OBZORA]
B. A. DUBINSKII and S.O. KUZMIN (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) (Vsesoiuznaia Shkola-Seminar po Aperturnomu Sintezu i Metodam Radiointerferometrii v Radioastronomii, 1st, Gorki, USSR, Sept. 1982) Radiofizika (ISSN 0021-3462), vol. 26, no. 11, 1983, p. 1480-1483. In Russian.

The radio-astronomical technique for the resolution of sources by means of a fixed-baseline interferometer can be used for radio-contrast studies of the earth's surface and that of other planets. This paper describes the aperture-synthesis technique utilizing an airborne fixed-baseline sidelooking interferometer. An expression is derived for the synthesized pattern, the resolving power, and the sensitivity. B.J.

A84-21593
RESULTS AND PROSPECTS OF REMOTE-SENSING STUDIES OF EARTH RESOURCES [ITOGI I PERSPEKTIVY RAZVITIIA ISSLEDOVANII PRIRODNYKH RESURSOV S POMOSHCH'IU AEROKOSMICHESKIKH SREDSTV]
A. S. ISAEV and F. I. PLESHIKOV IN: Spaceborne investigations of the natural complexes of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 120-126. In Russian.

A84-22463
FEATURES OF THE PROCESSING OF RADAR DATA DESCRIBING THE EARTH'S SURFACE ON BOARD AEROSPACE VEHICLES [OSOBENNOSTI OBRABOTKI RADIOLOKATSIONNOI INFORMATSII O ZEMNOI POVERKHNOSTI S AEROKOSMICHESKIKH NOSITELEI]
A. I. KALMYKOV, A. P. PICHUGIN, IU. A. SINITSYN, A. B. FETISOV, and V. N. TSYMBAL (Akademiia Nauk Ukrainskoi SSR, Institut Radiofiziki i Elektroniki, Kharkov, Ukrainian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Nov.-Dec. 1983, p. 91-96. In Russian. refs

To lessen the quantity of data and to ensure real-time transmission of the data from the aerospace vehicle to the user, preliminary processing must be carried out on board the vehicle. The effectiveness of this processing can be assessed by determining the influence of instrument parameters and parameters describing the processing techniques. It is shown here that these parameters can increase the quality of the information obtained. Consideration is given to the effect that the radar's resolving ability has on signal contrast for signals reflected from inhomogeneities on a background of homogeneous surface. C.R.

A84-22753* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INFERENCE OF CLOUD TEMPERATURE AND THICKNESS BY MICROWAVE RADIOMETRY FROM SPACE
P. C. PANDEY, E. G. NJOKU, and J. W. WATERS (California Institute of Technology, Jet Propulsion Laboratory, Earth and Space Sciences Div., Pasadena, CA) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 22, Nov. 1983, p. 1894-1898. refs
(Contract NAS7-100)

The Scanning Multichannel Microwave Radiometer (SMMR) on the Seasat and Nimbus-7 satellites measured microwave radiation at 6.6, 10.69, 18.0, 21.0 and 37.0 GHz with both horizontal and vertical polarizations. Numerical simulations have been performed to explore the potential of using the 18.0, 21.0 and 37.0 GHz SMMR channels with simultaneous infrared measurements of cloud top height for retrieving cloud temperature differential and thickness over the ocean. The results suggest it is possible to infer cloud vertical thickness to approximately 0.4 km rms accuracy and cloud temperature differential to approximately 3 C rms. These accuracies are approximately half the a priori variances. Author

A84-23243
APPLICATION OF LANDAT MSS, NOAA/TIROS AVHRR, AND NIMBUS CZCS TO STUDY THE LA PLATA RIVER AND ITS INTERACTION WITH THE OCEAN
D. A. GAGLIARDINI, H. KARSZENBAUM (Centro Argentino de Estudios de Radiocommunicaciones y Compatibilidad Electromagnetica, Buenos Aires, Argentina), R. LEGECKIS (NOAA, National Environmental Satellite Service, Washington, DC), and V. KLEMAS (Delaware, University, Newark, DE) Remote Sensing of Environment (ISSN 0034-4257), vol. 15, Feb. 1984, p. 21-36. Research supported by the Tinker Foundation of New York. refs

A84-23246* Research Triangle Inst., Research Triangle Park, N.C.
A COMPARISON OF SURFACE TEMPERATURE DERIVED FROM HCMM INFRARED MEASUREMENTS WITH FIELD DATA
F. M. VUKOVICH (Research Triangle Institute, Research Triangle Park, NC) Remote Sensing of Environment (ISSN 0034-4257), vol. 15, Feb. 1984, p. 63-76. refs
(Contract NAS5-26442)

The satellite for the Heat Capacity Mapping Mission (HCMM) was launched on April 26, 1978. The HCMM had the objective to collect data in support of studies concerned with the feasibility of using infrared temperature data to compute the thermal inertia from the earth's surface. The HCMM radiometer had a channel for reflected radiation in the 0.5 to 1.1 micron waveband, and a channel for the infrared radiation in the 10.5 to 12.5 micron band. However, difficulties developed in connection with changes in the characteristics of the radiometer. The present investigation is concerned with a comparison of HCMM infrared temperatures with in situ data from the Mississippi River in the St. Louis, Missouri, area and with sea-surface temperatures collected in the Nantucket Shoals and Gulf of Mexico regions. It was found that, on the average, the difference between satellite in situ data was -4.6 C. G.R.

A84-23684
SPECTROMETRY OF CLOUDS FROM BOARD OF THE METEOR-PRIRODA SATELLITE
K. P. BAKALOVA (B'lgarska Akademiia na Naukite, Geofizichen Institut, Sofia, Bulgaria) Bolgarskaia Akademiia Nauk, Doklady (ISSN 0366-8681), vol. 36, no. 11, 1983, p. 1399-1402.

Data from different satellite measurements of the sunlight scattered from clouds are compared, including light from the setting sun. The data processing method is described, showing the results for a daily orbit and two evening ones. Data on absorption in the atmosphere are given. The brightness levels measured in daytime are about 4-5 times higher than those of the evening orbits. The results of the measurements normalized to a single mean spectral brightness are shown; the results of evening recordings agree completely within the examined spectral range, while the daytime results show some typical differences. Observed changes in the intensity of the water vapor absorption lines can be used to estimate variations in atmospheric water vapor content. C.D.

A84-24092
REMOTE SENSING OF THE EARTH WITH NEW EQUIPMENT SYSTEM
K. SZANGOLIES Jena Review (ISSN 0448-9497), vol. 28, no. 4, 1983, p. 160-164.

Cartographical equipment and the optical-photographic MKF-6 multispectral camera (used in Soviet space experiments) are discussed. The optical-photographic camera system has resolving power, information content, and geometric accuracy advantages over optoelectronic scanners, which are more useful in meteorology than cartography. Techniques for evaluating aerial photographs are listed; map production, revision and accuracy are treated. A digital metric image processing system designed for automated interpretation of all types of photogrammetric photographs is described; its applications include medicine, microscopy, and astronomy. A detailed specifications table covering the equipment is included. C.M.

A84-24093
THE MSK-4 MULTISPECTRAL CAMERA, A NEW HIGH-PERFORMANCE PHOTOGRAPHIC SYSTEM
G. NICOLAI Jena Review (ISSN 0448-9497), vol. 28, no. 4, 1983, p. 165-167.

The design, operation and applications of the MSK-4 multispectral camera system are analyzed. The MSK-4 allows the digital processing of aircraft exploration data from four optical spectrum ranges; spectral, photometric, and photogrammetric data are among the data types obtainable with high geometric resolution. The main components of the camera are four high-performance 125 mm f/4 Pinatar lenses, shutters with drive mechanism, image motion compensator, and a system for additional data imaging. Mechanisms to prevent photograph blurring during flight include camera tilting and smooth speed adjustment between 10 and 40 mrad/s. Applications include foodstuff production, resource exploration, environmental control, and cartography. C.M.

A84-24126
LARGE-SCALE FIELD-ALIGNED CURRENTS AND OTHER GEOPHYSICAL PHENOMENA [KRUPNOMASSHTABNYE PRODOL'NYE TOKI I DRUGIE GEOFIZICHESKIE IAVLENIIA]
IA. I. FELDSHTEIN, R. G. AFONINA, B. A. BELOV, and A. E. LEVITIN Ionosfernye Issledovaniia, no. 37, 1983, p. 5-29. In Russian. refs

Measurements of large-scale field-aligned currents over the ionosphere at high latitudes made by satellite with three-component magnetometers are reported, and models summarizing these measurements are then presented. The models give the spatiotemporal distribution of field-aligned currents as a function of conditions in interplanetary space. Consideration is then given to the relationships between incoming and outgoing field-aligned currents, on the one hand, and various geophysical phenomena, on the other. The latter include the polar aurora (diffuse and discrete forms), fluxes of charged particles of various energy (protons and electrons), plasma convection in the magnetosphere, the change in ionization density in the ionosphere, and the eastern and western electrojets at ionospheric heights. C.R.

A84-24411* Michigan Univ., Ann Arbor.
DOPPLER LINE PROFILE ANALYSIS FOR A MULTICHANNEL FABRY-PEROT INTERFEROMETER
T. L. KILLEEN and P. B. HAYS (Michigan, University, Ann Arbor, MI) Applied Optics (ISSN 0003-6935), vol. 23, Feb. 15, 1984, p. 612-620. refs
(Contract NAS5-24296)

A new method of instrument calibration and data analysis is presented for single-etalon interferometric measurements of winds, temperatures, and emission line intensities. The technique has been developed for the multichannel Fabry-Perot interferometer on the Dynamics Explorer spacecraft. A numerical representation of the instrumental transfer function is used based on a truncated Fourier series with empirically determined coefficients. The numerical form is compared with the conventional analytic form. The Fourier coefficients describing the instrument function are generated at the wavelength of a stable He-Ne laser and are translated to other wavelengths using an interpolation technique for both phase and power. A quasi-linear least-squares fitting process involving matrices provides for a rapid and accurate data reduction. Author

A84-24917
SPACEBORNE IMAGING RADARS, PRESENT AND FUTURE
B. N. KOOPMANS (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 3, 1983, p. 223-231. refs

The evolution of spaceborne imaging radar is described, from the first Seasat (1978) to present-day SIR-A. SIR-A (1981), with a 43 deg incidence angle, provides a much better configuration than Seasat for land surveying. Comparative studies show that SIR-A imagery is better able to show terrain morphologic features, as well as lineament patterns and faults. The influence of surface roughness on the radar backscatter makes terrain differentiation

possible. Its penetration capacity of loose sand cover in hyperarid areas, however, has provided the most exciting results in the SIR-A program. SIR-B, SIR-C and programs of various other space agencies are also described. Author

A84-25166
MICROSTRIP ANTENNA FOR A MULTICHANNEL RADIOMETER [MIKROPOLOSKOVAIA ANTENNA DLIA MNOGOKANAL'NOGO RADIOMETRA]
S. T. KNIAZEV, E. I. NEFEDOV, and B. A. PANCHENKO Radioelektronika (ISSN 0021-3470), vol. 27, Feb. 1984, p. 86, 87. In Russian.

The paper examines the design and basic characteristics of an airborne microstrip-antenna radiometric hygrometer operating at wavelengths of 2, 18, and 30 cm. The main parameters of experimental radiation patterns of the antenna arrays at the central and boundary frequencies are tabulated. For the 30-cm array the SWR does not exceed 1.6 in the operating-frequency band; for the 18-cm array the SWR is 1.3. Losses in the microstrip antenna are evaluated. B.J.

A84-25407
EXAMPLES OF THE APPLICATION OF RADAR TO SATELLITE REMOTE SENSING [BEISPIELE FUER DEN EINSATZ VON RADAR IN DER SATELLITEN-FERNERKUNDUNG]
A. SIEBER (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Hochfrequenztechnik, Oberpfaffenhofen, West Germany) (Hermann-Oberth-Gesellschaft, Symposium on Earth Observation and Remote Sensing by Satellites, Hanover, West Germany, May 21, 1982) Acta Astronautica (ISSN 0094-5765), vol. 11, Jan. 1984, p. 15-31. In German. refs

Examples of the application of radar to the Seasat and SIR-A space missions and to the CV-580 aircraft campaign are presented. The remote sensing of bodies of water and of soil moisture is addressed, and the application of radar to agriculture is discussed. The ability of radar waves to penetrate tropical rainforest and to assist in the search for offshore oil is considered. Applications to oceanography, monitoring of ice, and urban planning are discussed. C.D.

A84-25412
SATELLITE-SCATTEROMETER FOR WIND MEASUREMENTS [SATELLITEN-SCATTEROMETER ZUR WINDMESSUNG]
P. HANS (Dornier System GmbH, Friedrichshafen, West Germany) (Hermann-Oberth-Gesellschaft, Symposium on Earth Observation and Remote Sensing by Satellites, Hanover, West Germany, May 21, 1982) Acta Astronautica (ISSN 0094-5765), vol. 11, Jan. 1984, p. 81-89. In German.

The geophysical basis of the measurement principle of the wind scatterometer aboard the planned European Remote Sensing Satellite ERS-1 is explained. The calculation method for determining wind direction and velocity from scatterometer data is briefly addressed. Sensor system concepts are discussed and a calculative example of an actual wind field over the Atlantic is presented. C.D.

A84-26826
MICROWAVE SENSORS (PRESENT AND FUTURE)
O. P. N. CALLA (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, June 1983, p. 109-119.

Passive and active microwave sensors are described, and the physics of their operation is explained. Active sensors like side-looking radar, scatterometer, and altimeter are covered. Block diagrams of a side-looking radar and a radiometric receiver are provided. The Indian satellites Bhaskara-I and Bhaskara-II which carried radiometers operating at 19 and 22 GHz, and 19, 22, and 31 GHz, are discussed, as well as NASA's plans for in-space assembly of an antenna with a resolution capability of approximately 1 to 2 km. Future trends include constructing sensors with multifrequency and cross-polarisation capabilities, onboard signal processing and direct data transmission, and in the near future, an X-band SAR system to be carried onboard the Shuttle. Finally, potential applications which include agricultural, geological, and water resource topics are presented. C.M.

A84-26827
OPTICAL INFRARED REMOTE SENSORS
G. JOSEPH (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) and A. S. MANJUNATH (National Remote Sensing Agency, Hyderabad, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, June 1983, p. 121-133. refs

Various kinds of remote sensors, active and passive, covering a significant part of the electromagnetic spectrum from ultraviolet to microwave regions have been developed for observation of earth for the purpose of resource survey. Several of the widely used remote sensors (in the visible and infrared region) beginning from photographic cameras to the modern-day linear imaging self-scanning sensors have been described with reference to the state-of-the-art, critical parameters, performance limitations etc. User requirements with regard to various system parameters of the remote sensors have been analysed. Some future trends in the development of remote sensors for spaceborne applications have been touched upon. Author

A84-26835
PASSIVE MICROWAVE REMOTE SENSING OF THE ATMOSPHERE AND OCEAN
T. A. HARIHARAN and P. C. PANDEY (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Sept. 1983, p. 233-254. refs

The microwave remote sensing experiments conducted during the last decade using airborne and spaceborne sensors are now evolving as operational spacecraft observation systems. Microwave sounding unit (MSU) onboard TIROS-N regularly provides global atmospheric temperature profile required for numerical weather prediction. The monitoring of composition profile and geophysical parameters from space platform is now a reality and holds a great promise for future meteorological and oceanographic research. This review paper summarizes the recent advances and future opportunities in passive microwave radiometry. Indian microwave remote sensing program and achievements to date are also described. Author

A84-27192
ADVANCED SIGNAL PROCESSING FOR PASSIVE INFRARED REMOTE SENSING
D. P. PANDA (Honeywell Systems and Research Center, Minneapolis, MN) and M. J. FLANAGAN (Honeywell, Inc., St. Petersburg, FL) *IN: Infrared sensor technology; Proceedings of* the Conference, Arlington, VA, May 4, 5, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 116-121.

Passive remote sensing addresses the problem of remotely monitoring, i.e., detecting the presence of, specific chemicals by the analysis of the radiative infrared signature of the material in the line-of-sight (LOS). Development of processing techniques for detecting the presence of the target chemical with a low enough false alarm rate in real time is the essence of the signal processing requirement for remote sensing. The aspects of data simulation and signal processing to achieve the passive remote monitoring objective are discussed. Application to environmental pollution monitoring is suggested. Author

A84-27195* National Aeronautics and Space Administration, Washington, D. C.
ADVANCED MULTISPECTRAL REMOTE SENSING TECHNOLOGY AND APPLICATIONS; PROCEEDINGS OF THE CONFERENCE, ARLINGTON, VA, MAY 6, 7, 1982
K. J. ANDO, ED. (NASA, Earth and Planetary Exploration Div., Washington, DC) Conference sponsored by SPIE - The International Society for Optical Engineering. Bellingham, WA, SPIE - The International Society for Optical Engineering (SPIE Proceedings. Volume 345), 1982, 200 p.

Sensor system concepts are discussed, taking into account a multispectral linear array instrument design, an improved earth resources sensing instrument, design tradeoffs for a multispectral linear array instrument, imaging spectrometer technologies for advanced earth remote sensing, and the design concept for an optimized earth radiation budget sensor. Topics related to supporting optics and signal processing methodologies are explored, giving attention to two mirror objective design for multispectral remote sensing, the measurement of optical modulation functions in sparsely sampled mosaic focal plane arrays, multispectral linear array focal plane signal processing, signal processing for the NASA multispectral linear array, the concept for a multiple resolution pushbroom sensor, and the evolution of the octal radiometer. Techniques and applications for multispectral data are considered along with aspects of focal plane technology. G.R.

A84-27197
IMPROVED EARTH RESOURCES SENSING INSTRUMENT
G. T. KEENE (Eastman Kodak Co., Rochester, NY) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 11-22. refs

Keene (1981) has described a concept for an advanced earth resources sensing system. In this concept, f/2.5 Schwarzschild optics was employed to image the ground onto a multilinear array of photodetectors in which each line of detectors was overcoated with a different color filter. Radiation to the two-band shortwave infrared array was directed by means of a beam splitter, while a separate optical system was used to illuminate the thermal infrared array. Attention is given to details regarding the optics, aspects of thermal control, calibration, and performance characteristics. G.R.

A84-27199* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IMAGING SPECTROMETER TECHNOLOGIES FOR ADVANCED EARTH REMOTE SENSING
J. B. WELLMAN, J. B. BRECKINRIDGE, P. KUPFERMAN, R. P. SALAZAR, and K. B. SIGURDSON (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 32-39. NASA-supported research. refs

A major requirement of multispectral imaging systems for advanced earth remote sensing is the provision for greater spectral resolution and more versatile spectral band selection. The imaging spectrometer instrument concept provides this versatility by the combination of pushbroom imaging and spectrally dispersing optics using area array detectors in the focal plane. The shuttle imaging spectrometer concept achieves 10- and 20-meter ground instantaneous fields of view with 20-nanometer spectral resolution from earth orbit. Onboard processing allows the selection of spectral bands during flight; this, in turn, permits the sensor parameters to be tailored to the experiment objectives. Advances in optical design, infrared detector arrays, and focal plane cooling indicate the feasibility of the instrument concept and support the practicability of a validation flight experiment for the shuttle in the late 1980s. Previously announced in STAR as N83-28542 M.G.

A84-27200* TRW Defense and Space Systems Group, Redondo Beach, Calif.
DESIGN CONCEPT FOR AN OPTIMIZED EARTH RADIATION BUDGET SENSOR
S. L. CARMAN, M. Z. HANSEN (TRW Defense and Space Systems Group, Redondo Beach, CA), A. ARKING, and J. W. HOFFMAN (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 40-49.
(Contract NAS5-25620)

The Earth Radiation Budget Program has the objective to measure and model the terrestrial radiation budget and obtain a better understanding of the climate and its changes. A multisensor, multisatellite system with high and midinclination orbits will be needed for implementing this program. Various approaches for conducting sensing operations have been evaluated. The present investigation considers a method of sampling with a unique multidirectional array mosaic sensor to fulfill the requirements of earth radiation budget measurements. Previous and present generation earth radiation budget (ERB) satellite instruments are discussed, and attention is given to instrument design tradeoffs and the baseline instrument concept. G.R.

A84-27201* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OBSERVATIONAL PARAMETERS FOR REMOTE SENSING IN THE NEXT DECADE
G. VANE, F. C. BILLINGSLEY, and J. A. DUNNE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 52-65. refs

The spectral and spatial requirements for remote sensing in the next decade are presented. The requirements presented were obtained through extensive literature research and discussions with leading members of the various remote sensing research communities. In the 0.35-2.5 micron region of the spectrum, numerous bands will be needed at bandwidths as narrow as 10-20 nanometers. There is also growing interest in the thermal infrared (8-14 microns). Spatial resolution (instantaneous field of view) of 5 to 10 meters will be of great benefit to many fields of remote sensing. Author

A84-27205* Honeywell Electro-Optics Operations, Wilmington, Mass.
TWO MIRROR OBJECTIVE DESIGN FOR MULTISPECTRAL REMOTE SENSING
P. P. CLARK (Honeywell Space Systems Center, Wilmington, MA) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 112-118. refs
(Contract NAS5-26588)

A two mirror flat field anastigmatic telescope was designed for multispectral sensing. The design was adapted to prism-type beamsplitting arrangements without loss of multispectral image quality by the addition of one refractive element. In addition to being relatively simple and mechanically insensitive, the design is immune to focus shift caused by index of refraction variation with temperature. Author

A84-27206* Santa Barbara Research Center, Goleta, Calif.
MEASUREMENT OF OPTICAL MODULATION FUNCTIONS IN SPARSELY SAMPLED MOSAIC FOCAL PLANE ARRAYS
J. B. YOUNG and P. E. THURLOW (Santa Barbara Research Center, Electro-Optical Instrumentation Div., Goleta, CA) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 119-122.
(Contract NAS5-24200)

It is pointed out that the measurement of optical modulation functions for detectors in focal plane arrays may be somewhat more difficult under 'full-up' systems conditions as compared to ideal laboratory conditions. An idealized optical modulation test arrangement is considered along with a full-up scanned system involving an earth mapper in polar orbit. In testing the system in full-up condition, a problem arises with respect to the acquisition of knife edge response data. In order to overcome this problem, a preferred method is developed for obtaining KER data on a single scan. A special 'phased edge' reticle is developed for use in the test set-up. Attention is given to aspects of knife edge reconstruction. G.R.

A84-27208
SIGNAL PROCESSING FOR THE NASA MULTISPECTRAL LINEAR ARRAY
M. MCCALLIG, F. CORBETT, and Z. ORBACH (Honeywell, Inc., Lexington, MA) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 129-136.

The Multispectral Linear Array Sensor is being developed by NASA as a next generation remote sensor. The development is presently in a competitive design phase. This paper describes the on-board signal processing electronics for the Honeywell design. The signal processing includes focal plane electronics for push broom arrays in six spectral bands, on-board radiometric calibration, digitization, bandwidth compression, and formatting for transmission over a high bandwidth data link. The signal processing must adapt to different detector dwell times and bandwidth compression ratios for three different orbital altitudes. A high degree of fault detection and redundant circuitry is incorporated into the design to meet the high reliability requirements of a space sensor. Author

A84-27209* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CONCEPT FOR A MULTIPLE RESOLUTION PUSHBROOM SENSOR
F. C. BILLINGSLEY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 137-142.
(Contract NAS7-100)

A general purpose pushbroom sensor will have parameters determined by the needs of the majority of potential users. These parameters may not satisfy the needs of certain users: Agriculture requires a very short return visit interval; cartography requires a very small pixel size; land use and geology would be satisfied with moderate resolution and seasonal return times. The aggregate solution of these needs would produce a sensor with extremely high data rates. A sensor concept is proposed which may meet the combined needs without the extreme data rate. Previously announced in STAR as N82-28735 Author

A84-27210
EVOLUTION OF THE OCTAL RADIOMETER
R. E. BUCKLEY (Barnes Engineering Co., Stamford, CT) and B. F. ROBINSON (Purdue University, West Lafayette, IN) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 143-146.

The history of efforts related to the conduction of measurements of the radiant characteristics of the environment is discussed, taking into account measurements in 1955, satellite borne infrared sensors, and a contract for the production of the Model 12-1000 Multi-Mode Radiometer or MMR. The MMR is an 8-channel radiometer using silicon, lead sulfide, and lithium tantalate detectors to cover the required spectral regions. The complete instrument is contained in a housing, and weighs less than 13.2 pounds. The MMR was designed for a variety of applications including aircraft, helicopter, truck, and hand-held measurements. Attention is given to an instrument description, laboratory and field tests, and the field operation of the MMR. G.R.

A84-27211* Westinghouse Electric Corp., Baltimore, Md.
MULTISPECTRAL LINEAR ARRAY FOCAL PLANE
J. A. HALL, F. C. BLAHA, and R. C. MCKEE (Westinghouse Electric Corp., Baltimore, MD) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 148-154.
(Contract NAS5-26589; NAS5-25622)

A description is provided of a sensor chip array for a unified multispectral focal plane for the Multispectral Linear Array (MLA) instrument. The involved concept of sensing multispectral earth resources imagery through the use of spectral filters deposited directly on a single row of silicon charge-coupled device (CCD) chips has been considered for a number of years. A simplified focal plane was designed after a number of experiments. Technology considerations regarding the design of the multispectral focal plane are discussed. Experimental data are presented which show that the arising problems have been or can be solved. G.R.

A84-27212* Westinghouse Electric Corp., Baltimore, Md.
MULTISPECTRAL LINEAR ARRAY (MLA) FOCAL PLANE MECHANICAL AND THERMAL DESIGN
A. S. MITCHELL and E. F. KAMINSKI (Westinghouse Electric Corp., Aerospace Div., Baltimore, MD) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 155-160.
(Contract NAS5-2689)

The mechanical and thermal design of an integrated focal plane subsystem of a Multispectral Linear Array (MLA) instrument is discussed in terms of focal-plane alignment, thermoelastic performance, and thermal requirements. The modular construction and thermal control of the focal plane array are discussed. Author

A84-27213
HIGH DENSITY SCHOTTKY BARRIER INFRARED CHARGE-COUPLED DEVICE (IRCCD) SENSORS FOR SHORT WAVELENGTH INFRARED (SWIR) APPLICATIONS AT INTERMEDIATE TEMPERATURE
H. ELABD, T. S. VILLANI (RCA Laboratories, Princeton, NJ), and J. R. TOWER (RCA Advanced Technology Laboratories, Camden, NJ) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 161-171. USAF-supported research. refs

The current level of Schottky barrier infrared technology makes it attractive for an employment in next generation space-borne sensors. The technology is suitable for earth sensing applications

in which moderate quantum efficiency and intermediate operating temperatures are needed. The main advantage of the technology is related to the possibility of a utilization of standard integrated circuit (IC) processing techniques and commercial IC grade silicon. It is, therefore, feasible to construct high yield Schottky barrier area and line arrays with high density designs and large numbers of blemish-free elements. Attention is given to Schottky barrier sensor technology, detector and focal plane array (FPA) responsivities, SWIR-FPA read-out structure, electrical characteristics, test imagery, Multispectral Linear Array (MLA) application, and MLA sensor design. G.R.

A84-27214* Fairchild Weston Systems, Inc., Syosset, N.Y.
VISIBLE CHARGE-COUPLED DEVICE (CCD) FOCAL PLANE DESIGN CONSIDERATIONS FOR MULTISPECTRAL APPLICATIONS
H. SADOWSKI (Fairchild Weston Systems, Inc., Syosset, NY) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 172-184. refs
(Contract NAS5-26588)

The typical Multispectral Linear Array (MLA) Instrument mission would be to gather high-resolution, radiometrically accurate earth resources data in several spectral bands over a prolonged period of time. These bands would include the visible (VIS), near infrared (NIR) and short wavelength infrared. Silicon charge-coupled imaging devices (CCDs) can be assembled into contiguous pixel focal planes which will cover the VIS/NIR region and operate reliably for several years in a space environment. A typical MLA focal plane would have approximately 12,000 pixels, with a pixel-to-pixel registration requirement on the order of + or - 0.1 pixel. The technology to assemble such focal planes has been developed and is described. The problem of polarization sensitivity associated with certain types of focal plane assemblies is addressed. Radiation effects on CCDs are also discussed, and a practical solution to the problem through the use of shielding is described. Author

A84-27215* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
INTEGRATING 128 ELEMENT INSB ARRAY - RECENT RESULTS
G. BAILEY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 185-191. NASA-supported research.

There has been a continuing evolution toward larger arrays of infrared detectors, and the technology base derived from the Galileo Near Infrared Mapping Spectrometer (NIMS) has been expanded to linear arrays including from 128 to 512 elements. This advance is based on the commercial availability of high-quality InSb photodiodes and 128/256 element FET switch MUX's (multiplexing elements). The present investigation is concerned with an experimental 128-element linear imager using InSb detectors and silicon MUX for readout. Attention is given to detector array electrical characteristics, the detector readout architecture, noise, and special effects. G.R.

A84-27267
FIELD MEASUREMENT AND CALIBRATION USING ELECTRO-OPTICAL EQUIPMENT: ISSUES AND REQUIREMENTS; PROCEEDINGS OF THE CONFERENCE, SAN DIEGO, CA, AUGUST 24, 25, 1982
H. REGISTER, ED. (USAF, Eglin AFB, FL) and F. M. ZWEIBAUM, ED. Conference sponsored by SPIE - The International Society for Optical Engineering. Bellingham, WA, SPIE - The International Society for Optical Engineering (SPIE Proceedings. Volume 356), 1983, 174 p.

Subjects related to the measurement of the characteristics of the ambient atmosphere are considered, taking into account problems associated with atmospheric visibility measurement techniques, low resolution atmospheric measurements and data applications, the influence of atmospheric uncertainties on predicting infrared atmospheric attenuation and radiance, and a compact, pulsed laser Doppler anemometer for airborne and wind-tunnel applications. Other topics explored are related to the determination of the parameters of the battlefield environment, instrumentation and requirements for the measurement of transmission and radiance in the field, and field research in remote sensing. Attention is given to an applications overview of battlefield oscurant parameters measured in the U.S. Army tests, a field system for the measurement of atmospheric propagation and radiant signatures, and a mobile tracking imaging radiometer. G.R.

A84-27392* Reading Univ. (England).
OBJECTIVE ASSESSMENT OF ADVANCED VERY HIGH RESOLUTION RADIOMETER DATA FOR LAND COVER MAPPING
J. R. G. TOWNSHEND (Reading, University, Reading, England) and C. J. TUCKER (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 497-504. refs

The validity of using data from the Advanced Very High Resolution Radiometer (AVHRR) of the satellites NOAA-6 and NOAA-7 for land cover mapping is assessed by making comparisons with much higher resolution LANDSAT multi-spectral scanner (MSS) data. Near synchronous data for both systems are analysed for test sites in the Imperial Valley, California, the Nile Delta, and southern Italy. The results strongly indicate that despite the very coarse resolution of the AVHRR data compared with conventional MSS data they are sufficiently strongly correlated to suggest that the former have significant potential for land cover mapping, especially at small scales and for large areas. Hence the outstanding benefits of AVHRR data, namely their high temporal frequency, relative cheapness and low data volumes for image processing, may readily be taken advantage of for such tasks. Author

A84-27604
ON THE RESOLUTION OF DICKE-TYPE RADIOMETERS
F. THOMSEN (Royal Danish Air Force, Air Materiel Command, Vaerlose, Denmark) IEEE Transactions on Microwave Theory and Techniques (ISSN 0018-9480), vol. MTT-32, Feb. 1984, p. 145-150. refs

Microwave radiometers for remote sensing of the earth from a satellite are now in service. These are developed from astronomical radiometers designed for detection of interstellar radio sources. The radiometers measure the brightness temperature by comparing the received energy with an internal noise source at a well-defined radiation temperature. In the astronomical radiometers, it is traditional to use the same amount of time measuring the unknown source and the reference source. This principle has been inherited from the earth-based radiometers. As the earth brightness temperature varies very much due to the movement of the satellite, it is possible to enhance the resolution by using more time to measure the earth brightness temperature and less time measuring the stable reference source. The possible gain in resolution is limited by the gain fluctuation of the receiver. Author

A84-27746*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SIR-B RADAR ON THE SHUTTLE
J. B. CIMINO and C. ELACHI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: International Symposium on Remote Sensing of Environment, Second Thematic Conference: Remote Sensing for Exploration Geology, Fort Worth, TX, December 6-10, 1982, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1983, p. 263-278. refs
(Contract NAS7-100)

The Shuttle Imaging Radar-B (SIR-B) will be the third in a series of spaceborne SAR experiments which began with the 1978 launch of Seasat and continued with the 1981 launch of Seasat and continued with the 1981 launch of SIR-A. Like Seasat and SIR-A, SIR-B will operate at L-band and be horizontally polarized. However, SIR-B will allow digitally processed imagery to be acquired at selectable look angles between 15 and 60 deg, thereby permitting for the first time quantitative and analytical studies of the geometric variables associated with a radar image. These geometric variables include look angle and look direction which have never been studied with previous fixed parameter radar systems. Author

A84-28298
PROCESSING AND ANALYSIS OF DIGITAL IMAGES FROM ORBITAL AND AIRBORNE REMOTE SENSORS [TRAITEMENT ET ANALYSE DES IMAGES DIGITALES FOURNIES PAR DIVERS TELEDETECTEURS ORBITAUX ET AEROPORTES]
D. G. GOODENOUGH, P. M. TEILLET, and B. GUINDON (Canada Centre for Remote Sensing, Ottawa, Canada) Photo Interpretation (ISSN 0031-8523), vol. 21, Nov.-Dec. 1982, p. 4.6.1 - 4.6.17. In French, English, and Spanish. refs

MSS and SAR data were collected from a forest region near Anderson River in British Columbia and an agricultural region near the town of Gran Falls, New Brunswick, Canada. The data were subsequently geometrically and radiometrically corrected. Average registration errors were reduced to approximately 10 m for the Gran Falls images and 20 m for the Anderson River images. Examples were presented of combined Landsat and airborne imagery, the latter resampled to 50 m resolution with a truncated sin (x)/x convolution. Using feature selection and classification of remotely sensed images, it was established that the airborne MSS with 11 channels was the best instrument (88 percent correct) for classifying forest types in mountainous areas. SAR data obtained with two different antenna orientations, steep and shallow, provided 69 percent accuracy. Locations where SAR data were affected by shadow and layover could be specified. C.M.

A84-28447
MILLIMETER WAVE RADIOMETRIC IMAGING
F. J. PORADISH and J. M. HABBE (Texas Instruments, Inc., Advanced Radar Systems, Dallas, TX) IN: Millimeter wave technology; Proceedings of the Meeting, Arlington, VA, May 6, 7, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 170-181. Research supported by Texas Instruments, Inc. refs

New developments and applications for radiometric imaging systems are discussed. The basic operating principles of radiometry are reviewed and results are presented from two different Ka band (36 GHz) radiometric test beds. Passive weather detection is presented with actual results from an airborne imaging radiometer. Thunderstorm and cloud formations have been detected at ranges in excess of 20 NM. Tactical ground mapping and target detection is also presented with results from a ground based high resolution imaging radiometer. Enhanced target detection using a low power bistatic illuminator is demonstrated. An inverse filter algorithm has been developed to attain better than real beam resolution in high contrast images. Raw and enhanced images are presented for comparison. Author

A84-28580* State Univ. of New York, Syracuse.
SCAN ANGLE DEPENDENCE OF RADIANCE RECORDED BY THE NOAA-AVHRR
M. J. DUGGIN, D. PIWINSKI (New York, State University, Syracuse, NY), V. WHITEHEAD (U.S. Department of Agriculture, Houston, TX), and G. RYLAND (Lockheed Engineering and Management Services Co., Inc., Houston, TX) IN: Advanced remote sensing; Proceedings of the Meeting, San Diego, CA, August 26, 27, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 98-103. refs
(Contract NAS9-16514)

NOAA-AVHRR data is being used to monitor global vegetation type and condition and to study various environmental factors in addition to performance of meteorological functions. The AVHRR instrument has + or - 54 deg as maximum scan angle limits and it is necessary to be aware of the effects of sun-target-sensor geometry at extreme scan angles to be able to properly interpret the satellite images. In order to interpret the images for vegetation type and condition analysis, it is necessary to calibrate back to the nadir view position. Both simulation studies and empirical investigations with digital scanner data have been performed in order to sufficiently understand the effects of scan angle and sun angle, as well as the effects of atmospheric scattering, to eventually perform adequate calibrations. Not surprisingly, the effects are large and studies are continuing to provide improved calibrations. Author

A84-28585
MODERN UTILIZATION OF INFRARED TECHNOLOGY VIII; PROCEEDINGS OF THE MEETING, SAN DIEGO, CA, AUGUST 26, 27, 1982
I. J. SPIRO, ED. (Aerospace Corp., Los Angeles, CA) Meeting sponsored by SPIE - The International Society for Optical Engineering. Bellingham, WA, SPIE - The International Society for Optical Engineering (SPIE Proceedings. Volume 366), 1983, 197 p.

Topics on the military and scientific applications of infrared technology are addressed. The subjects discussed include: data processing approach to jitter suppression, optical technique for increasing fill factor of mosaic arrays, automatic testing of IR components, design philosophy of the JPL IR detector test facility, measurement program for determining excitation cross section values of exhaust species, and atmospheric transmittance derived from radiance measurements. Also considered are: phenomenology of thermal IR background scenes, thermographic techniques for the nondestructive evaluation of graphite composite structures, IR imaging techniques for flaw detection in composite materials, IR sensor for remote temperature monitoring of solar thermal central receivers, Monte Carlo sets of synthetic IR background scenes, alternate approaches to cryogenic cooling, advanced low altitude IR earth sensors, detection range computation by convolution for IR detectors, atmospheric IR emission at 27,000-28,000 m altitude, development of a 10/cm 6.3 micron H2O band model, and transition flow effects on plume radiation. C.D.

A84-28599
ADVANCED LOW ALTITUDE INFRARED EARTH SENSORS
T. K. ALEX, Y. K. JAIN, K. KANAKARAJU, and J. A. KAMALAKAR (Indian Space Research Organization, Satellite Centre, Bangalore, India) IN: Modern utilization of infrared technology VIII; Proceedings of the Meeting, San Diego, CA, August 26, 27, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1984, p. 140-147.

Novel low altitude infrared earth sensors are described. A static horizon sensor utilizes the state of art technology in electronics to minimize the effect of radiance gradient by taking ratio of the radiometric signals by a hard wired or micro-processor based system. A scanning sensor is also being developed which scans radially at four edges on earth using a single scan assembly thus reducing errors caused by conventional techniques. Author

A84-28602
ATMOSPHERIC INFRARED EMISSION OBSERVED AT ALTITUDE OF 27,000 TO 28,000 M
H. SAKAI (Massachusetts, University, Amherst, MA) and G. VANASSE (USAF, Geophysics Laboratory, Bedford, MA) IN: Modern utilization of infrared technology VIII; Proceedings of the Meeting, San Diego, CA, August 26, 27, 1982 . Bellingham, WA, SPIE - The International Society for Optical Engineering, 1983, p. 165-172. refs
(Contract AF PROJECT 2310; AF TASK 2310G1)
(AD-A133472; AFGL-TR-83-0237)

The molecules in the lower part of atmosphere are in thermal equilibrium with the local surrounding. The infrared emission resulted by their thermal excitation can be studied to determine their temperature and concentration profile in the atmosphere. A cryogenically cooled Fourier spectrometer mounted on a balloon-borne platform has been used to study the infrared emission spectrum of the atmosphere for this purpose. The experiment, which took place on October 7, 1981, at Holloman AFB, produced analyzable data for more than two hours at an altitude of 27,000-28,000 m along the horizontal and vertical line of sight. The spectral data extended from 550/cm to 1000/cm covering the CO2 15 micron bands with a resolution of 0.2/cm. The data were found interesting on two accounts: (1) a continuum background feature was superimposed with the molecular emission feature; (2) the radiance level of the CO2 15 micron bands observed along the horizontal line of sight varied by a much greater degree than expected. Author

A84-29288
SOLID STATE IMAGE SENSORS
M. TROWBRIDGE (Fairchild Camera and Instrument /UK/, Ltd., Potters Bar, Herts., England) IN: Electro-Optics/Laser International '82 UK; Proceedings of the Conference, Brighton, England, March 23-25, 1982 . London, Butterworths, 1982, p. 102-111. refs

The principles underlying the operation of charge-coupled device (CCD) image sensors are reviewed, with particular emphasis on low light level (L3) imaging. The factors affecting the performance of CCD image sensors in demanding applications, such as L3, are then discussed, and it is shown how these limits to performance can be reduced or eliminated. A sensor design for L3 imaging is proposed, which has an amplifier with a noise equivalent signal level of approximately 20 electrons per pixel rms at a sample rate of 1 MHz. With on-chip exposure control, an effective dynamic rate of 6.4 x 10 to the 6th is shown to be possible. V.L.

A84-29292
NEW DEVELOPMENTS IN THE DESIGN AND APPLICATION OF ELECTRONIC SPECKLE PATTERN INTERFEROMETERS
R. JONES (Loughborough Consultants, Ltd.; Loughborough University of Technology, Loughborough, Leics., England) IN: Electro-Optics/Laser International '82 UK; Proceedings of the Conference, Brighton, England, March 23-25, 1982 . London, Butterworths, 1982, p. 272-284. refs

This paper provides a brief survey of recent developments in the design and application of Electronic Speckle Pattern Interferometers (ESPI's). Layouts of wide angle and high magnification systems for both single and dual wavelength applications are described. The digital processing of video signals and correlation fringe patterns is outlined and related to computerised fringe recognition techniques. The paper concludes with a short summary of new applications in weld testing, computerised vibration analysis (ESPAMS) and aspheric measurement. Author

A84-29651#
THE MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER MOMS PRELIMINARY RESULTS FROM THE STS-7 MISSION [DER MODULARE OPTOELEKTRONISCHE MULTISPEKTRAL SCANNER-MOMS ERSTE ERGEBNISSE DER MISSION AUF STS-7]
J. BODECHTEL (Muenchen, Universitaet, Munich, West Germany) Deutsche Gesellschaft fuer Luft- und Raumfahrt, Jahrestagung, Munich, West Germany, Oct. 17-19, 1983. 5 p. In German.
(DGLR PAPER 83-71)

MOMS, a modular optoelectronic multispectral scanner for installation on satellite platforms, was tested under outer space conditions in June 1983. The experimental performance of this scanner is described and its technical parameters are given. The technical and scientific applications of MOMS are summarized and future missions of which it is to be a part are mentioned. C.D.

N84-16390*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPACEBORNE IMAGING RADAR SYMPOSIUM
C. ELACHI 1 Jul. 1983 156 p refs Symp. held in Pasadena, Calif., 17-20 Jan. 1983
(Contract NAS7-100)
(NASA-CR-173186; JPL-PUB-83-11; NAS 1.26:173186) Avail: NTIS HC A08/MF A01 CSCL 17I

An overview of the present state of the art in the different scientific and technological fields related to spaceborne imaging radars was presented. The data acquired with the SEASAT SAR (1978) and Shuttle Imaging Radar, SIR-A (1981) clearly demonstrated the important emphasis in the 80's is going to be on in-depth research investigations conducted with the more flexible and sophisticated SIR series instruments and on long term monitoring of geophysical phenomena conducted from free-flying platforms such as ERS-1 and RADARSAT.

N84-16417*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPACEBORNE RADAR RESEARCH IN THE 1980'S
C. ELACHI *In its* Spaceborne Imaging Radar Symp. p 131-135 1 Jul. 1983 refs
Avail: NTIS HC A08/MF A01 CSCL 17I

The SEASAT SAR and Shuttle Imaging Radar SIR-A experiments demonstrated that spaceborne synthetic aperture radars provide synoptic images of land and ocean features. Radar images clearly show geologic structures, morphologic features, clear cutting, subsurface features (in very arid regions), agricultural and urban land use, ocean surface waves, current boundaries, internal waves, ice floes and numerous other ocean features which affect the surface roughness. E.A.K.

N84-16418*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
RADAR ACTIVITIES OF THE DFVLR INSTITUTE FOR RADIO FREQUENCY TECHNOLOGY
W. KEYDEL *In* JPL Spaceborne Imaging Radar Symp. p 136-139 1 Jul. 1983
Avail: NTIS HC A08/MF A01 CSCL 17I

Aerospace research and the respective applications microwave tasks with respect to remote sensing, position finding and communication are discussed. The radar activities are directed at point targets, area targets and volume targets; they center around signature research for earth and ocean remote sensing, target recognition, reconnaissance and camouflage and imaging and area observation radar techniques (SAR and SLAR). The radar activities cover a frequency range from 1 GHz up to 94 GHz. The radar program is oriented to four possible application levels: ground, air, shuttle orbits and satellite orbits. Ground based studies and measurements, airborne scatterometers and imaging radars, a space shuttle radar, the MRSE, and follow on experiments are considered. E.A.K.

N84-16626*# General Software Corp., Landover, Md.
LANDSAT-4 HORIZON SCANNER PERFORMANCE EVALUATION
S. BILANOW, L. C. CHEN, W. M. DAVIS, and J. P. STANLEY Jan. 1984 423 p refs ERTS
(Contract NAS5-17664)
(E84-10079; NASA-CR-173229; NAS 1.26:173229) Avail: NTIS HC A18/MF A01 CSCL 08B

Representative data spans covering a little more than a year since the LANDSAT-4 launch were analyzed to evaluate the flight performance of the satellite's horizon scanner. High frequency noise was filtered out by 128-point averaging. The effects of Earth oblateness and spacecraft altitude variations are modeled, and residual systematic errors are analyzed. A model for the predicted radiance effects is compared with the flight data and deficiencies in the radiance effects modeling are noted. Correction coefficients are provided for a finite Fourier series representation of the systematic errors in the data. Analysis of the seasonal dependence of the coefficients indicates the effects of some early mission problems with the reference attitudes which were computed by the onboard computer using star trackers and gyro data. The effects of sun and moon interference, unexplained anomalies in the data, and sensor noise characteristics and their power spectrum are described. The variability of full orbit data averages is shown. Plots of the sensor data for all the available data spans are included. A.R.H.

N84-16627*# General Software Corp., Landover, Md.
LANDSAT-4 HORIZON SCANNER FULL ORBIT DATA AVERAGES
J. P. STANLEY and S. BILANOW Nov. 1983 215 p refs ERTS
(Contract NAS5-27664)
(E84-10080; NASA-CR-173230; NAS 1.26:173230) Avail: NTIS HC A10/MF A01 CSCL 08B

Averages taken over full orbit data spans of the pitch and roll residual measurement errors of the two conical Earth sensors operating on the LANDSAT 4 spacecraft are described. The variability of these full orbit averages over representative data throughtout the year is analyzed to demonstrate the long term stability of the sensor measurements. The data analyzed consist of 23 segments of sensor measurements made at 2 to 4 week intervals. Each segment is roughly 24 hours in length. The variation of full orbit average as a function of orbit within a day as a function of day of year is examined. The dependence on day of year is based on association the start date of each segment with the mean full orbit average for the segment. The peak-to-peak and standard deviation values of the averages for each data segment are computed and their variation with day of year are also examined. A.R.H.

N84-17240# Bohan (Walter A.) Co., Park Ridge, Ill.
NAVY TACTICAL APPLICATIONS GUIDE. OPERATIONAL ENVIRONMENTAL SATELLITES. POLAR-ORBITING SATELLITES GEOSTATIONARY SATELLITES, SPACECRAFT, SENSORS, IMAGERY
R. W. FETT, W. A. BOHAN, J. J. BATES, and S. L. TIPTON Jun. 1983 93 p
(Contract N00228-82-C-6222; F59-553)
(AD-A135466; NEPRF-TR-83-02) Avail: NTIS HC A05/MF A01 CSCL 22B

This volume user oriented sections on current operational satellite systems that describe imagery acquisition and distribution, sensor systems, and spectral characteristics. In addition, sample imagery is included for each of the meteorological satellite systems. GRA

N84-17248*# Martin Marietta Aerospace, Denver, Colo.
TECHNOLOGY NEEDS OF ADVANCED EARTH OBSERVATION SPACECRAFT Final Report
J. J. HERBERT, J. R. POSTUCHOW, and W. A. SCHARTEL Washington NASA Jan. 1984 261 p
(Contract NAS1-16756)
(NASA-CR-3698; NAS 1.26:3698; MCR-81-630) Avail: NTIS HC A12/MF A01 CSCL 22B

Remote sensing missions were synthesized which could contribute significantly to the understanding of global environmental parameters. Instruments capable of sensing important land and sea parameters are combined with a large antenna designed to passively quantify surface emitted radiation at several wavelengths. A conceptual design for this large deployable antenna was developed. All subsystems required to make the antenna an autonomous spacecraft were conceptually designed. The entire package, including necessary orbit transfer propulsion, is folded to package within the Space Transportation System (STS) cargo bay. After separation, the antenna, its integral feed mast, radiometer receivers, power system, and other instruments are automatically deployed and transferred to the operational orbit. The design resulted in an antenna with a major antenna dimension of 120 meters, weighing 7650 kilograms, and operating at an altitude of 700 kilometers. Author

N84-17655# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Research Dept. for Communications Technology and Remote Sensing.
REMOTE SENSING EXPERIMENTS ON SPACELAB AND STS
F. SCHLUDE *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 37-46 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

The Shuttle Imaging Radar (SIR-A), Ocean Color Experiment (OCE), Modular Optoelectronic Multispectral Scanner (MOMS), Metric Camera (MC), and Microwave Remote Sensing Experiment (MRSE) are described. The SIR-A collected 10 million sq km of Earth surface data. The OCE measured water color to enable ocean analysis in terms of water composition and dynamics. The MOMS was used for thematic mapping, sea and vegetation monitoring, and coastal zone evaluation. The MC gives 20 to 30 m ground resolution photographs in standard aerial photography format. The MRSE comprises X-band radar operating as a dual frequency scatterometer, a SAR imaging radar, and as a passive microwave radiometer. Author (ESA)

N84-17667# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Research Dept. for Communications Technology and Remote Sensing.
WORKSHOP ON ACTIVE MICROWAVE SENSOR DESIGN
F. SCHLUDE *In* ESA Remote Sensing: New satellite Systems and Potential Appl. p 143-150 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

The design of a synthetic aperture radar for land observation and of a scatterometer for measuring global wind speed and wind direction are described. The fundamental equations governing radar operation are recalled. The thin point radar target model and the quasi continuous point target distribution are outlined. The wind scatterometer measuring principle, beam configuration, and the accuracy of measurements of sea surface radar backscattering are discussed. Author (ESA)

N84-20000# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
BASIC INVESTIGATION ON THE FEASIBILITY OF MULTISPECTRAL RADIATION INFORMATION FROM MICROWAVE RADIOMETRY MEASUREMENTS FOR EARTH-SCIENTIFIC OBJECTIVES OF REMOTE SENSING Ph.D. Thesis - Freiburg Univ., West Germany
R. H. DITTEL Mar. 1983 375 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-846)
(DFVLR-FB-83-27; ESA-TT-846) Avail: NTIS HC A16/MF A01; DFVLR, Cologne DM 95

Multispectral microwave radiometry applied to remote sensing is considered. The data properties were estimated by signal analysis and statistical analysis. The radiant intensity in the 11, 32, and 90 GHz bands is sufficient for a coarse classification of single objects. Detailed investigation requires an extended spectral band 90 GHz. Data reconstruction methods using a priori knowledge result in improved geometrical resolution by increase of the radiometric contrast. Modeling of object specific optical coefficients permits a comparison of scene contents detected under different environmental radiation conditions. Author (ESA)

N84-20001# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany). Bereich Raumfahrt Hess- und Regeltechnik.
MICROWAVE REMOTE SENSING EXPERIMENT FOR FIRST SPACELAB MISSION Final Report, Nov. 1982
P. HEINECKE, R. KREMER, M. BOISON, R. ULBRICHT, R. LOEWENS, and H. J. REUTHER Bonn Bundesministerium fuer Forschung und technologie Nov. 1983 157 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-83-022; ISSN-0170-1339) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 33

A microwave remote sensing experiment (MRSE) Spacelab payload for measuring vegetation parameters, geological structures, ocean waves, and state of ice and snow almost independent of solar position and weather conditions is presented. The MRSE comprises a synthetic aperture radar, a two-frequency scatterometer, and a passive radiometer. The operating frequency is in the X-band at 9.6 GHz. The power supply for the traveling wave tube within the high power amplifier is outlined.
Author (ESA)

N84-20044# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie
SATELLITE MEASUREMENTS OF RADIATION BUDGETS Final Report, Feb. 1983
Bonn Bundesministerium fuer Forschung und Technologie Oct. 1983 159 p refs Presented at 2nd Symp. on Meas. of the Radiation of the Earth, Cologne, 9-10 Dec. 1982 Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-83-025; ISSN-0170-1339) Avail: NTIS HC A08/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 32,50

Determination of the radiation budget parameters at the top of the atmosphere and on the ground; sampling problems, including sources; conical scan radiometers; measurement of optical data of aerosols in the atmosphere; the interactions of clouds and radiation; and comparison between radiation budget components derived from climate modeling and satellite measurements are discussed.

N84-20045# Cologne Univ. (West Germany).
SAMPLING PROBLEMS OF SATELLITE MEASUREMENTS OF RADIATION BUDGET PARAMETERS
E. RASCHKE *In its* Satellite Meas. of Radiation Budget Parameters p 14-19 Oct. 1983 refs
Avail: NTIS HC A08/MF A01

Sampling errors in satellite measurements of planetary emission and albedo to space are reviewed. Spectral and field of view (FOV) limitations, angular dependence of radiances from the same scene, and time and space coverage of radiation fields are discussed. Scanning radiometers with narrow FOV, and nonscanning radiometers with wide FOV are considered. Although errors can be investigated by numerical simulation, no overall strategy is available. Author (ESA)

N84-20050# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
A CONICAL SCAN RADIOMETER FOR AN AIRPLANE MISSION
T. PROSCH, D. HENNINGS, W. H. LIN, and E. RASCHKE *In its* Satellite Meas. of Radiation Budget Parameters p 44-52 Oct. 1983 refs
Avail: NTIS HC A08/MF A01

An aircraft-borne radiometer to complement satellite radiometer observations is proposed. Performance is studied using systems theory. The instrument provides in situ ground truth, optimizes satellite sampling properties, and analyzes radiation in a given area by temporal sampling. Subsystems include a Herschel telescope mounted on a spinning optical bench; a detector system composed of filters, pyroelectrical sensors in the focal plane, reference blackbodies and a chopper wheel; signal processing electronics to amplify filter and digitize sensor signals; control and housekeeping electronics; calibration system consisting of temperature stabilized blackbodies and light sources with related diffusors; and data gathering system with on-line data check capability. Author (ESA)

N84-20062# Cologne Univ. (West Germany). Inst. fuer Geophysik und Meteorologie.
ON THE DERIVATION OF CLOUD STRUCTURE PARAMETERS FROM AIRCRAFT MEASUREMENTS
J. SCHMETZ and F. J. DIEKMANN *In its* Satellite Meas. of Radiation Budget Parameters p 132-137 Oct. 1983
Avail: NTIS HC A08/MF A01

Cloud cover, cloud height and spatial distribution were derived from radiation measurements with aircraft. The consistency of the parameters derived from different radiation sensors was checked. Results show that the derived parameters can be used as ground truth for a cloud structure analysis from satellite. Author (ESA)

N84-20609 Texas Univ., Austin.
NON-GRAVITATIONAL FORCE MODELLING AND ALTIMETER MEASUREMENT MODELLING FOR SEASAT-A SATELLITE Ph.D. Thesis
P. A. M. ABUSALI 1983 236 p
Avail: Univ. Microfilms Order No. DA8329804

The SEASAT altimeter measurements have an accuracy of about 10 cm. In order to make best use of the altimeter measurements for oceanographic and other applications, the radial component of the satellite orbit must be known with an accuracy of about 10 cm. In the orbit computation, drag and solar radiation pressure are significant perturbations. Uncertainties in the reference which appear in these models along with errors in the atmospheric density model are primary error sources, limiting the orbit determination accuracy. In the case of SEATSAT, the effective areas vary considerably with time. In this research, models which account for the actual area variations are developed. To account for the atmospheric density model errors, a set of empirical density model parameters is defined and estimated in the data analysis process. These models are used to achieve laser range residual of 0.939 meter root mean square for a 16 day SEASAT orbit, a factor of about four improvement, over that obtained using the constant area models. Dissert. Abstr.

N84-20842*# Illinois Univ., Urbana. Radio Research Lab.
THEORETICAL AND EXPERIMENTAL ANALYSIS OF LASER ALTIMETERS FOR BAROMETRIC MEASUREMENTS OVER THE OCEAN
B. M. TSAI and C. S. GARDNER Mar. 1984 215 p refs
(Contract NSG-5049)
(NASA-CR-175443; NAS 1.26:175443; RRL-PUBL-527) Avail: NTIS HC A10/MF A01 CSCL 20E

The statistical characteristics and the waveforms of ocean-reflected laser pulses are studied. The received signal is found to be corrupted by shot noise and time-resolved speckle. The statistics of time-resolved speckle and its effects on the timing accuracy of the receiver are studied in the general context of laser altimetry. For estimating the differential propagation time, various receiver timing algorithms are proposed and their performances evaluated. The results indicate that, with the parameters of a realistic altimeter, a pressure measurement accuracy of a few millibars is feasible. The data obtained from the first airborne two-color laser altimeter experiment are processed and analyzed. The results are used to verify the pressure measurement concept. A.R.H.

N84-21466# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environment Lab.
OPERATIONAL USES FOR A SOLAR SOFT X-RAY IMAGING TELESCOPE
S. T. SUESS Jul. 1983 46 p refs
(PB84-137538; NOAA-TM-ERL-SEL-66; NOAA-83121902) Avail: NTIS HC A03/MF A01 CSCL 03B

Taken from space, above the Earth's atmosphere, X-ray images of the Sun reveal the structure of the corona and magnetic loops, flares and erupting filaments against a black solar disk. This information can be put to immediate use to improve present space environment monitoring and forecasting, and to provide entirely new products and services. An operational use exists, and details of this use are described here. Furthermore, the instruments necessary to make X-ray photographs have been flown on rockets and spacecraft many times so that no new technological development would be required to realize the benefits to the Space Environment Services Center. GRA

N84-22049*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESEARCH REVIEW, 1983
Jan. 1984 366 p refs
(NASA-TM-86053; NAS 1.15:86053) Avail: NTIS HC A16/MF A01 CSCL 04B

The Global Modeling and Simulation Branch (GMSB) of the Laboratory for Atmospheric Sciences (GLAS) is engaged in general circulation modeling studies related to global atmospheric and oceanographic research. The research activities discussed are organized into two disciplines: Global Weather/Observing Systems and Climate/Ocean-Air Interactions. The Global Weather activities are grouped in four areas: (1) Analysis and Forecast Studies, (2) Satellite Observing Systems, (3) Analysis and Model Development, (4) Atmospheric Dynamics and Diagnostic Studies. The GLAS Analysis/Forecast/Retrieval System was applied to both FGGE and post FGGE periods. The resulting analyses have already been used in a large number of theoretical studies of atmospheric dynamics, forecast impact studies and development of new or improved algorithms for the utilization of satellite data. Ocean studies have focused on the analysis of long-term global sea surface temperature data, for use in the study of the response of the atmosphere to sea surface temperature anomalies. Climate research has concentrated on the simulation of global cloudiness, and on the sensitivities of the climate to sea surface temperature and ground wetness anomalies.

09

GENERAL

Includes economic analysis.

A84-21622
APPLICATION OF AERIAL AND SPACEBORNE TECHNIQUES TO STUDY EARTH RESOURCES (BIBLIOGRAPHIC REVIEW) [PRIMENENIE AEROKOSMICHESKIKH METODOV DLIA IZUCHENIIA PRIRODNYKH RESURSOV ZEMLI /BIBLIOGRAFICHESKII OBZOR/]
A. A. MISTRIUKOV IN: Spaceborne methods for investigating the natural environment of Siberia and the Far East . Novosibirsk, Izdatel'stvo Nauka, 1983, p. 174-178. In Russian. refs

A brief description is given of a bibliographic index concerning the remote sensing of earth resources being prepared by IGiG SO AN USSR. The index will be divided into five broad categories: (1) general information on the use of remote sensing to study earth resources; (2) the application of remote-sensing data for geological and geographic investigations; (3) the investigation of biological resources; (4) thematic mapping; and (5) computer techniques of image data interpretation. B.J.

A84-21671
REMOTE SENSING MISSIONS FOR THE NEXT DECADE
W. A. KRIEGL (Dornier System GmbH, Friedrichshafen, West Germany) British Interplanetary Society, Journal (Space Technology) (ISSN 0007-084X), vol. 37, Feb. 1984, p. 75-80. refs

An overview of earth observation applications in atmospheric physics, ocean and polar ice physics, land studies, and solid earth physics is presented. Applications of various optical and microwave sensors and the main sensor platforms are outlined. The development of the all-weather ocean monitoring satellite, ERS-1, is considered. J.N.

A84-24630#
USE OF A SPACE STATION FOR SPACE APPLICATIONS
G. A. HARTER (TRW, Inc., Cleveland, OH) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 36-39.

The Space Applications Board conducted a one-week summer study on potential uses of a space station for civil or commercial applications. Six study panels identified future space application needs, and then assessed how well a space station might satisfy those needs. Some special requirements were identified to facilitate use of a space station for application purposes. Finally, the role of a manned presence was considered for each of the application areas. Author

A84-24631#
THE ROLE OF SPACE STATION IN EARTH SCIENCES
L. R. GREENWOOD (Fairchild Space Co., Germantown, MD) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 66-72. refs

Space-station or space-platform characteristics and technologies required or desirable for future research in upper-atmosphere studies, global atmospheric chemistry, meteorology, and climatology are examined, summarizing the findings of a summer (1982) study by the Earth's Environment Panel of the National Research Council Space Applications Board. Capabilities discussed include deployment of large numbers of sensors, high-inclination-orbit options, frequent recalibration and intercalibration with satellites, introduction of new or larger lidar and microwave observatories, and repair and maintenance of instruments and cooled detectors. Earth-science missions are found to require only intermittent manned presence for maintenance and calibration or for construction of large platforms for transfer to GEO. T.K.

A84-24634*# National Aeronautics and Space Administration, Washington, D. C.
SPACE STATION ARCHITECTURAL ISSUES AS VIEWED BY THE USER COMMUNITY - APPLICATIONS
W. P. RANEY (NASA, Washington, DC) IN: Space station: Policy, planning and utilization; Proceedings of the Symposium, Arlington, VA, July 18-20, 1983 . New York, American Institute of Aeronautics and Astronautics, 1983, p. 139-141.

Potential applications of the proposed space station are briefly examined. Areas considered include communications (bulk traffic, direct broadcast, and assembly of GEO platforms), earth sciences (repair and refurbishment of long-term spacecraft), and materials processing. The importance of developing a comfortable habitat is stressed. T.K.

A84-25406
EARTH OBSERVATION AND REMOTE SENSING BY SATELLITES; PROCEEDINGS OF THE SYMPOSIUM, HANOVER, WEST GERMANY, MAY 21, 1982
R. E. LO, ED. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer chemische Antriebe und Verfahrenstechnik, Hardthausen am Kocher, West Germany) Symposium sponsored by the Hermann-Oberth-Gesellschaft. Acta Astronautica (ISSN 0094-5765), vol. 11, Jan. 1984, 96 p. In English and German.

Various topics on earth observation and remote sensing by satellites are considered. The subjects addressed include: examples of the application of radar to remote sensing by satellite; ESA's earth observation satellite programs; requirements and concepts for earth observation missions; the market for remote sensing data; instrument developments for applications in remote sensing, photogrammetry, geophysics, and geodesy; the metric camera experiment on the first Spacelab flight; and a spaceborne scatterometer for wind field measurement. C.D.

A84-25409
EARTH OBSERVATION MISSIONS - REQUIREMENTS AND CONCEPTS [ERDBEOBACHTENDE MISSIONEN - ANFORDERUNGEN UND KONZEPTE]
W. GILG (Dornier System GmbH, Friedrichshafen, West Germany) (Hermann-Oberth-Gesellschaft, Symposium on Earth Observation and Remote Sensing by Satellites, Hanover, West Germany, May 21, 1982) Acta Astronautica (ISSN 0094-5765), vol. 11, Jan. 1984, p. 37-49. In German.

A review is presented of both past remote sensing missions and planned ones. The system elements of a remote sensing system are listed, and the systemic dependences, limits, and requirements pertinent to the planning of an earth observational mission are clarified. Examples of previously researched systems are considered, including the first European earth reconnaissance satellite ERS-1. C.D.

A84-25410
THE MARKET OF REMOTE SENSING DATA - A DEVELOPING BUSINESS
M. TRAIZET (Centre National d'Etudes Spatiales, Division Programmes d'Application, Paris, France) (Hermann-Oberth-Gesellschaft, Symposium on Earth Observation and Remote Sensing by Satellites, Hanover, West Germany, May 21, 1982) Acta Astronautica (ISSN 0094-5765), vol. 11, Jan. 1984, p. 51-60.

Commercial applications of the SPOT and Landsat satellite programs are discussed. The SPOT system's features useful in the commercial area include its high-resolution imaging, refined spectral bands, instrument cross-track pointability, and three different geometrical levels of products, including system-corrected geometry, fine geometric corrections for digital cartography, and image-to-image registration for change detection. The SPOT system acquisition capability is described and a SPOT market assessment is briefly presented. For Landsat, the historical background of its commercial application is summarized, international data distribution centers are listed, the geographical receiving station coverage is depicted, and the worldwide sales distribution is shown. C.D.

A84-26838
INTEGRATED RESOURCES SURVEY AND APPLICATIONS
L. R. A. NARAYAN (National Remote Sensing Agency, Secunderabad, India) and B. SAHAI (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Dec. 1983, p. 287-295. refs

Comprehensive, reliable and up-to-date information on natural resources is a prerequisite for undertaking planned development activities. Integrated resources survey conducted by a multidisciplinary team brings out the inter-relationship of the resources and enables their planned and judicious exploitation. Remote sensing techniques are ideally suited for this purpose as the same data base is utilized by various disciplines. Multistage sensing facilitates reconnaissance, semi-detailed and detailed type of information. Surveys conducted in the Idukki district of Kerala and the Bundelkhand region of Uttar Pradesh are illustrated in this paper. These surveys generated thematic maps and statistical data on various resources. Information obtained has been extremely useful for resource managers and decision makers. Author

A84-26840
THE INDIAN REMOTE SENSING SATELLITE - A PROGRAMME OVERVIEW
R. R. NAVALGUND (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) and K. KASTURIRANGAN (Indian Space Research Organization, Satellite Centre, Bangalore, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Dec. 1983, p. 313-336. refs

The Indian remote sensing satellite (IRS) program is examined. The principal elements are (1) to design, develop and deploy a three-axis stabilized polar sun-synchronous satellite carrying state-of-the-art payloads using charge coupled devices for acquiring images of the earth, (2) to establish and routinely operate ground-based systems for spacecraft control, data reception and recording, processing, generation of data products, analysis and archival, and (3) to use IRS data either alone or in conjunction with supplementary and complementary data for applications in selected resources surveys. Different elements of the IRS utilization program and their role in the evolution of a national natural resources management systems are also outlined. Author

A84-26842
INTERNATIONAL SCENE IN REMOTE SENSING
Y. S. RAJAN and J. NINAN (Indian Space Research Organization, Bangalore, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Dec. 1983, p. 355-371. refs

A brief survey of the status of remote sensing or earth observations from space as applied to earth-bound resources management is made. Glimpses of space systems under execution and under planning are given. Utilization of the remote sensing technology by developed and developing countries is reviewed, pointing out current problems and future potentials. Author

A84-26843
INTERNATIONAL ISSUES IN REMOTE SENSING
U. R. RAO and S. CHANDRASEKHAR (Indian Space Research Organization, Bangalore, India) Indian Academy of Sciences, Proceedings (Engineering Sciences) (ISSN 0250-5983), vol. 6, Dec. 1983, p. 373-386. refs

The technical, legal, political, and economic issues related to remote sensing satellite systems are examined at the Indian Space Research Organization. Establishing an International Satellite Monitoring Agency is proposed to coordinate remote sensing activities (particularly surveillance). Topics discussed include active and passive remote sensing satellites, the remote sensing programs in various countries, the legal framework for establishing an international organization, the right of free dissemination versus state sovereignty over its natural resources, and the classification

of remote sensing data. It is claimed that the data available do not concur with the only international agreement (between the USSR and nine countries) on remote sensing resolution ranges. Finally, the cost of setting up an International Satellite Monitoring Agency is justified if it can monitor the superpowers and the arms race. C.M.

A84-27390
AGREEMENT AND DISAGREEMENT ON AN INTERNATIONAL SATELLITE MONITORING AGENCY
C. VOUTE (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) International Journal of Remote Sensing (ISSN 0143-1161), vol. 5, Mar.-Apr. 1984, p. 479-483. refs

The proposals submitted to the United Nations General Assembly for the establishment of an international satellite monitoring agency are briefly discussed in the light of suggestions to combine surveillance tasks with socioeconomic (resources management) tasks. It is concluded that confidence building, both with regard to peacekeeping and crisis management on one side, and international co-operation for socioeconomic development on the other side, as well as systems characteristics for the various objectives, call for keeping these tasks completely separated. Author

A84-29586#
INVESTIGATING IN SPACE - NOW, SOON, OR LATER?
J. GREY (American Institute of Aeronautics and Astronautics, New York, NY) Aerospace America (ISSN 0740-722X), vol. 22, April 1984, p. 90-92.

Satellite communications and industrial enterprises related to it are already gaining large revenues, while potential businesses based on space manufacturing, space transportation, navigation, remote sensing, and ground servicing have been identified. Space transportation capacity is currently far greater than demand, and will remain so for at least a decade. Satellite communications demand is still growing rapidly at between 20 and 30 percent. This market is, however, already being actively developed by major corporations. Real business prospects regarding remote sensing are difficult to quantify and may very well prove to be illusory, at least in the near term. The biggest long-term potential return lies in exploiting the wholly new materials-processing environment created in an orbiting satellite. However, profits are not expected to appear until perhaps 1988 at best. G.R.

N84-17650# European Space Agency, Paris (France).
REMOTE SENSING: NEW SATELLITE SYSTEMS AND POTENTIAL APPLICATIONS
W. R. BURKE, comp. Sep. 1983 688 p refs Proc. of ASSA Summer School Sem., Alpbach, Austria, 27 Jul.- 5 Aug. 1983 sponsored by ESA, CNES, DFVLR and NTNF
(ESA-SP-205; ISSN-0379-6566) Avail: NTIS HC A09/MF A01

The SPOT, ERS-1 (ESA satellite), Spacelab, and Landsat remote sonsing programs were discussed. Land use, thematic mapping, geological, environmental monitoring, and coastal zone applications were considered. Active and passive sensors were considered.

N84-17652# Centre National d'Etudes Spatiales, Toulouse (France). SPOT IMAGE.
SPOT (FRENCH SATELLITE)
J. C. RIVEREAU *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 11-17 Sep. 1983
Avail: NTIS HC A09/MF A01

The SPOT remote sensing satellite and its data distribution program are described. The spacecraft carries two identical static solid state arrays of detectors (CCD) operating in the visible and near infrared. Ground resolution is 10 m in the panchromatic mode, 20 m in the multispectral mode. Two ground receiving stations and preprocessing centers, receiving direct data over the polar zone, Europe and North Africa as well as worldwide data recorded on the two satellite tape recorders, are supported by a network of regional receiving stations located around the world. A central data bank unit and a worldwide distribution network ensure permanent information regarding data availability; and flexible on request data acquisition. Author (ESA)

N84-17653# Centre National d'Etudes Spatiales, Toulouse (France). SPOT IMAGE.
TYPICAL SPOT DATA AND PRODUCTS: POTENTIAL APPLICATIONS
J. C. RIVEREAU *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 19-23 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

The simulation studies of SPOT satellite for land use, agricultural, and coastal studies data acquisition are summarized. These suggest that SPOT images can replace medium and large scale aerial photographs in thematic applications. The high resolution is well suited to the field and plot sizes most frequently encountered in Europe. The flexibility of satellite programming makes it possible to acquire the repated information essential for crop identification. In town planning, the simulation studies suggest that 10 m resolution permits the identification of most urban features important in the planning process. In coastal studies, it is possible to monitor dynamic phenomena, to investigate foreshore areas and to identify various types of aquatic vegetation. In topographic cartography SPOT imagery is adequate for producing 1:100,000 maps and updating at larger map scales. Stereopairs provide 3D vision in geology and topographic mapping, where altitude and morphology perception is important. Author (ESA)

N84-17654# European Space Agency, Paris (France).
THE FIRST EUROPEAN REMOTE SENSING SATELLITE (ERS-1): OVERALL DESCRIPTION, POTENTIAL APPLICATIONS AND USERS
G. DUCHOSSOIS *In its* Remote Sensing: New Satellite Systems and Potential Appl. p 25-36 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

The ERS-1 satellite and its scientific objectives are described. A C-band scatterometer measures wind speed and direction; a Ku-band radar altimeter measures significant wave height and wind speed at nadir and provides measurements over ice and major ocean currents; a C-band SAR takes all-weather high resolution images over polar caps, coastal zones and land areas, (also operated in a sampled mode with a reduced power level over oceans as a wave scatterometer). Laser retroreflectors are used for satellite tracking and radar altimeter calibration. An along track scanning radiometer completed with a two-frequency microwave nadir sounder measures sea surface temperature and provides information for the wet atmosphere correction for the radar altimeter. A precise range and range rate experiment provides high accuracy tracking information in support of radar altimetry for ocean circulation studies. Author (ESA)

N84-17656# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
TYPICAL REMOTE SENSING DATA PRODUCTS
W. MARKWITZ and R. WINTER *In* ESA Remote Sensing: New Satellite Systems and Potential Appl. p 47-51 Sep. 1983 refs
Avail: NTIS HC A09/MF A01

The West German Remote Sensing Data Center (DFD) is described. The DFD is a technical as well as a scientific service and extends from data acquisition through preprocessing, image processing, analysis and interpretation. Users are mainly German scientists, governmental administration and industry. It operates on a cost basis in national, bilateral and international activities. Applications on sea, land and in the atmosphere are discussed and examples of remote sensing data products from standard photoproducts to digital processed image data are shown. Data sources include LANDSAT MSS, LANDSAT TM, HCMM, NIMBUS 7 CZCS, Seasat SAR, Convair 580 SAR, Meteosat, NOAA 7, aircraft MSS, and Aircraft Metric Camera. Thematic maps for land use, environmental monitoring, renewable and nonrenewable resources are produced, and the carrying capacity and vegetation change in arid and semiarid areas are investigated. Author (ESA)

N84-19974# National Oceanic and Atmospheric Administration, Washington, D. C.

LANDSAT-4 COMMERCIALIZATION UPDATE

K. HODGKINS *In* LANDSAT Tech. Working Group Proc. of the Fourth Meeting of the LANDSAT Tech. Working Group (LTWG) 14 p 1983

Avail: NTIS HC A15/MF A01

A synopsis of a proposed master schedule for transferring civil remote sensing satellites to the private sector is presented along with the statement of the Secretary of Commerce before House Committees in which the administration's proposal is presented and defended. A.R.H.

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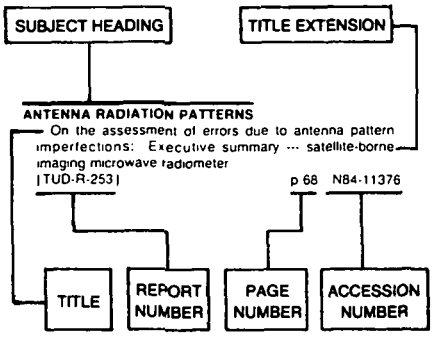

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A

B

C

E

F

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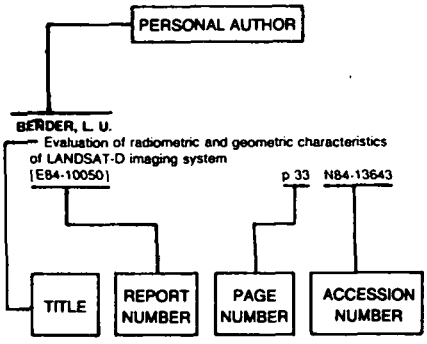

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A

ABRAMS, M.
Mineralogical remote sensing of surface expressions of deep-seated porphyry copper deposits at Safford mining district, Arizona p 36 A84-27782

ABRAMS, M. J.
Mapping hydrothermal alteration using aircraft VNIR scanners at the Rosemont porphyry copper deposit p 31 A84-27740
Evaluation of thermal data for geologic applications [NASA-CR-173211] p 40 N84-16703

ABUSALI, P. A. M.
Non-gravitational force modelling and altimeter measurement modelling for SEASAT-A satellite p 77 N84-20609

ACKLEY, S. F.
Antarctic sea ice microwave signatures and their correlation with in situ ice observations p 46 A84-28785

ADAMS, J. B.
Use of laboratory spectra for determining vegetation assemblages in Landsat images p 6 A84-27786

ADAMS, J. D.
Use of laboratory spectra for determining vegetation assemblages in Landsat images p 6 A84-27786

AFIFI, A.
Determination of the sources of radar scattering p 16 N84-21954

AFONINA, R. G.
Large-scale field-aligned currents and other geophysical phenomena p 69 A84-24126

AGARWAL, R. P.
Landsat analysis in structural delineation for hydrocarbon exploration in parts of Pranhita-Godavary Valley (India) - A case study p 35 A84-27774

AGATSIVA, J.
Applications of remote sensing in earth resources monitoring in Kenya p 1 A84-19865

AGUIRRE, J. L. D. B.
CNPq/INPE LANDSAT system [E84-10071] p 64 N84-16618

AKOVETSKII, V. I.
Photointerpretation p 58 A84-21576
Current status and prospects of the further development of methods and equipment for photointerpretation p 59 A84-23752

ALEKSEEV, A. S.
Spaceborne methods for investigating the natural environment of Siberia and the Far East p 16 A84-21601
Complex methods for the processing of aerial and spaceborne photographic data to reveal crustal structural features in Siberia and the Far East p 25 A84-21602
Hardware and software at a regional center for the automated processing of aerial and space images p 58 A84-21615

ALEX, T. K.
Advanced low altitude infrared earth sensors p 74 A84-28599

ALEXANDER, J. C.
Higher harmonic effects of the earth's gravitational field from post-glacial rebound as observed by Lageos p 20 A84-21421

ALLAN, T. D.
Seasat measurements of wind and waves on selected passes over JASIN p 45 A84-27385

ALLEN, C. T.
Relating the microwave backscattering coefficient to leaf area index p 3 A84-22388

ALLEY, R. E.
Evaluation of thermal data for geologic applications [NASA-CR-173211] p 40 N84-16703

ALMEIDAFILHO, R.
Multiseasonal and geobotanical approach in remote detection of greisenization areas in the Serra da Pedra Branca Granite, Goias State, Brazil [E84-10070] p 40 N84-16617

AMANTOV, V. A.
Results of the interpretation of TV and IR spaceborne photographs of lands adjacent to the BAM route p 25 A84-21588

ANDERSON, J. E.
An initial analysis of LANDSAT 4 Thematic Mapper data for the classification of agricultural, forested wetland, and urban land covers [E84-10073] p 7 N84-16620

ANDERSON, K. E.
Land use and land cover digital data [GS-CIRC-895-E] p 19 N84-19987

ANDO, K. J.
Advanced multispectral remote sensing technology and applications; Proceedings of the Conference, Arlington, VA, May 6, 7, 1982 p 71 A84-27195

ANDREWS, M. K.
Small Doppler shifts on low latitude transequatorial path VLF signals p 42 A74-20413

ARKING, A.
Design concept for an optimized earth radiation budget sensor p 71 A84-27200

ARYA, L. M.
Accomplishments of the NASA Johnson Space Center portion of the soil moisture project in fiscal year 1981 [E84-10090] p 10 N84-19961

ASRAR, G.
Intercepted photosynthetically active radiation estimated by spectral reflectance p 3 A84-22386
Analysis of seasonal multispectral reflectances of small grains p 3 A84-22390
Intercepted photosynthetically active radiation estimated by spectral reflectance [E84-10109] p 12 N84-21927

ASTARAS, T.
Land classification of part of central Macedonia (Greece) by the use of remote-sensing techniques p 17 A84-27379

AUSTIN, R. W.
Coastal upwellings and Rhone River extension in the Gulf of Lions (Mediterranean Sea) - Visualization by analysis of chlorophyll frontal boundaries on the basis of Nimbus-7 CZCS radiometer data p 45 A84-28296

B

BADHWAR, G.
A study of the relation between crop growth and spectra reflectance parameters p 13 N84-21936
A study of the relation between crop growth and spectra reflectance parameters p 15 N84-21949

BADHWAR, G. D.
Automatic corn-soybean classification using Landsat MSS data. I - Near-harvest crop proportion estimation. II - Early season crop proportion estimation p 2 A84-22385

BAEHR, H.-P.
Evaluation of geometrical error components in multispectral classification p 20 A84-20750

BAGAIOKO, A.
Features characterizing the interpretation of multispectral space photographs of the central delta of the territory of the Republic of Mali p 60 A84-25143

BAGLAI, R. D.
Problem-oriented complex for the processing of aerial and spaceborne data p 58 A84-21616

BAILEY, G.
Integrating 128 element InSb array - Recent results p 73 A84-27215

BAILEY, G. B.
Extraction of geologic information from Landsat multispectral scanner and thematic mapper simulator data from the Uinta and Piceance Basins, Utah and Colorado p 30 A84-27730
Evaluation of image processing of Landsat data for geologic interpretations of the Qaidam Basin, China p 35 A84-27770

BAIRD, A. K.
Rapid discrimination of granitic rock compositions by low-resolution near-infrared reflectance p 39 A84-28788

BAKALOVA, K. P.
Spectrometry of clouds from board of the meteor-priroda satellite p 69 A84-23684

BAKER, M. C W.
Relationships between mineralization and silicic volcanism in the Central Andes p 24 A84-20575

BAKER, M. C. W.
Relationships between mineralization and silicic volcanism in the central Andes p 27 A84-24727

BALCI, M.
Interpretation of SIR-A imagery of southeastern Turkey p 28 A84-24921

BALI, Y. P.
Soil mapping using remote sensing techniques p 5 A84-26833

BANNER, M. L.
A comparative study on synthetic aperture radar and optical imagery of ocean waves p 43 A84-21467

BARBOSA, M. N.
Current status of th Brazilian LANDSAT facilities p 66 N84-19977

BARNES, J. C.
Determination of snowpack properties from satellite passive microwave measurements p 56 A84-23242

BARNETT, M. E.
Multiband thermal infrared imagery as a discriminant for surface rock types p 29 A84-27394

BARRETT, E. C.
AgRISTARS stage 3: The Bristol interactive scheme (BIAS) for satellite-improved rainfall monitoring: Further developments, testing and method description [PB84-150630] p 16 N84-21976

BARTHEL, G.
Instrument development for applications in remote sensing, photogrammetry, geophysics, and geodesy p 20 A84-25411

BATES, J.
Use of VAS multispectral data for sea surface temperature determination p 54 N84-21967

BATES, J. J.
Navy tactical applications guide. Operational environmental satellites. Polar-orbiting satellites geostationary satellites, spacecraft, sensors, imagery [AD-A135466] p 76 N84-17240

C

D

E

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G

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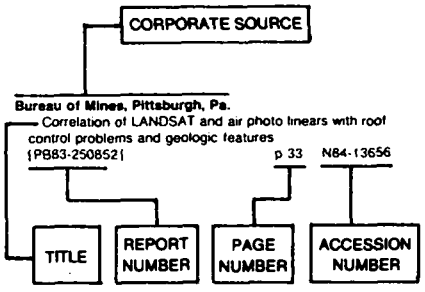

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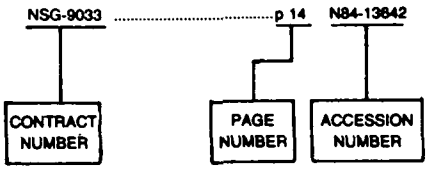

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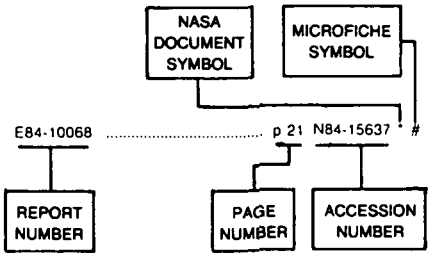

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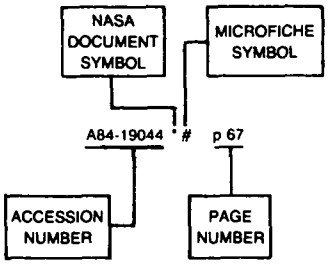

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15. Supplementary Notes

16. Abstract

This bibliography lists 541 reports, articles and other documents introduced into the NASA scientific and technical information system between April 1 and June 30, 1984. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economical analysis.

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University, MS 38677
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(406) 243-6700

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BA/SS Documents Division
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Chester Fritz Library
Documents Department
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(614) 462-7051

OKLAHOMA DEPT. OF LIB.
Government Documents
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Oklahoma City, OK 73105
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OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
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Documents Department
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Portland, OR 97207
(503) 229-3673

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Government Pub. Section
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(717) 787-3752

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Public Services Department
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Austin, TX 78753
(512) 471-2996

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