NASA

Earth Resources
A Continuing
Bibliography
with Indexes

NASA SP-7041(53)
May 1987

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NASA SP-7041(53)

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 53

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between January 1 and March 31, 1987 in

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

NASA
Scientific and Technical Information Office 1987
National Aeronautics and Space Administration
Washington, DC

This bibliography was prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by RMS Associates.

INTRODUCTION

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

This literature survey lists 604 reports, articles, and other documents announced between January 1 and March 31, 1987 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 techiques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography are also 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 A87-10,000 in ascending accession number order;

STAR entries identified by accession number series N87-10,000 in ascending accession number order.

After the abstract section, there are seven indexes:

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

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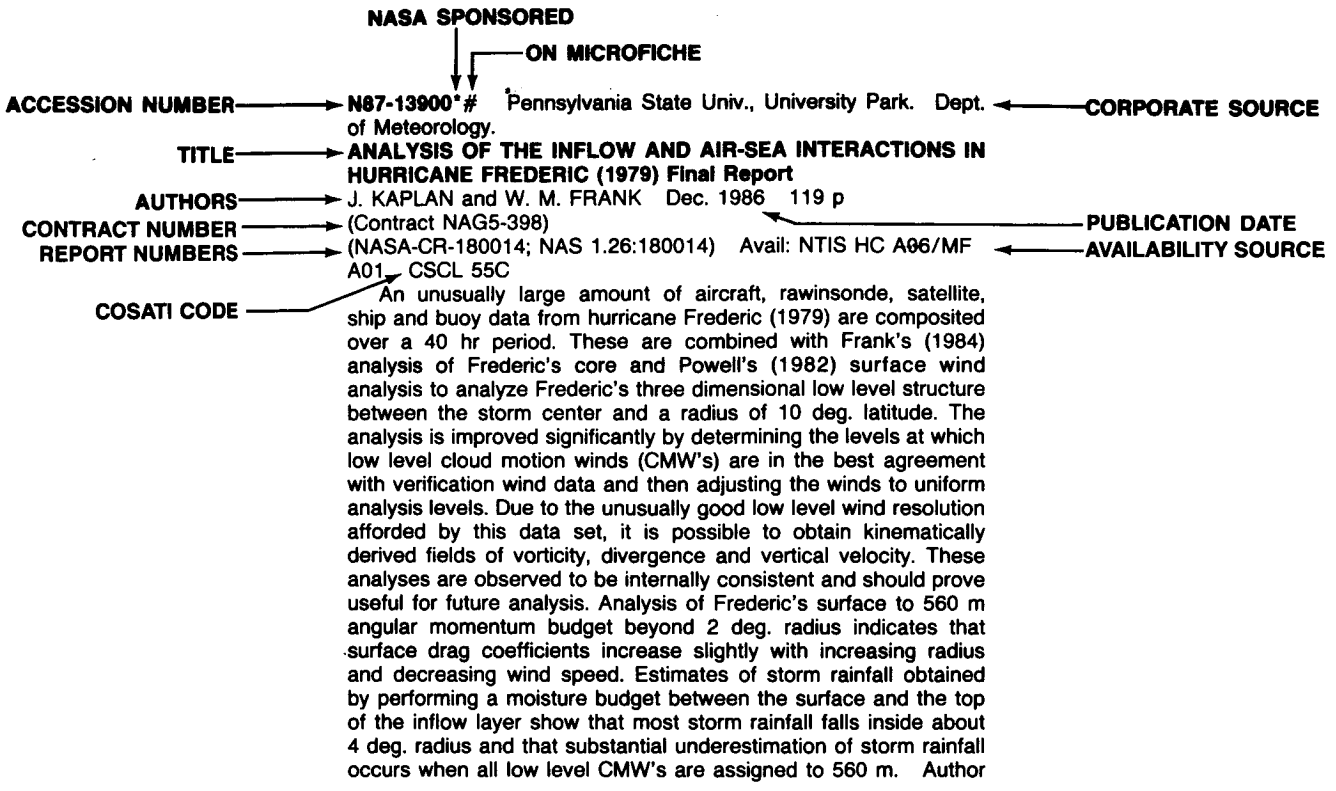
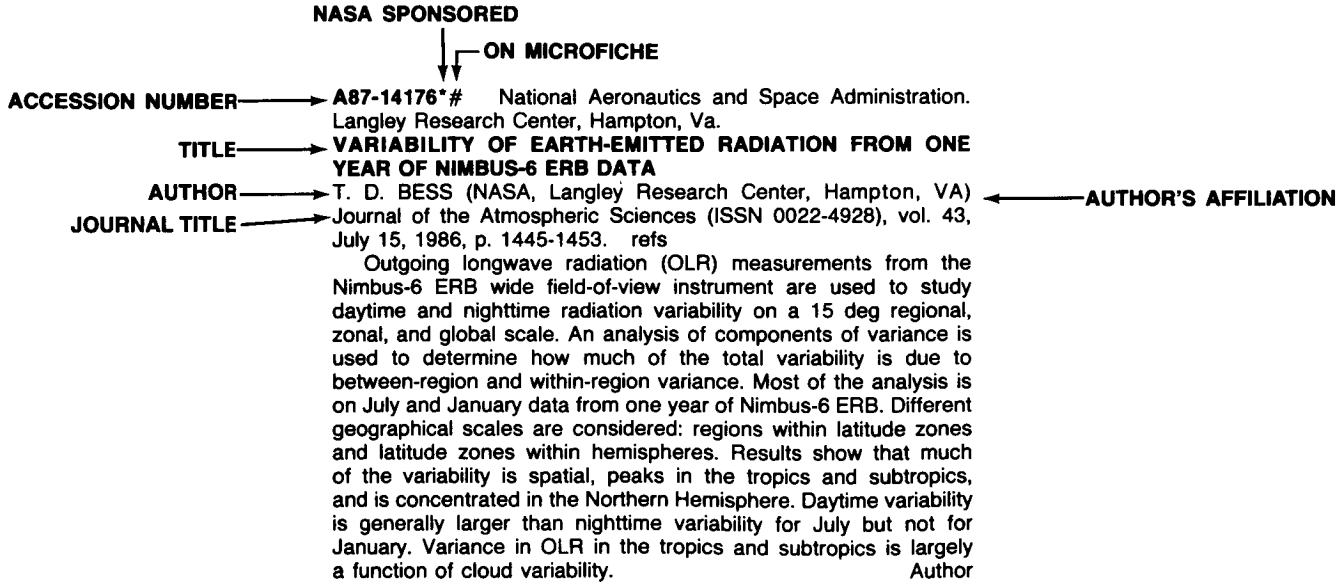


TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



EARTH RESOURCES

A Continuing Bibliography (Issue 53)

MAY 1987

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.

A87-10264#
AIRBORNE INFRARED OBSERVATIONS AND ANALYSES OF A LARGE FOREST FIRE
J. R. STEARNS, M. S. ZAHNISER, C. E. KOLB (Aerodyne Research, Inc., Billerica, MA), and B. P. SANDFORD (USAF, Geophysics Laboratory, Bedford, MA) Applied Optics (ISSN 0003-6935), vol. 25, Aug. 1, 1986, p. 2554-2562. refs

Extensive IR spatial images and spectral signatures were gathered from an active large brush and forest fire by the Flying Infrared Signatures Technology Aircraft of the U.S. Air Force Geophysics Laboratory. Infrared images give the apparent temperatures of actively burning and burned over regions, and aid in identifying the type and intensity of the fire. Spectral signatures of hot regions from interferometer and spatial data can also be used to determine apparent fire temperatures. Gaseous combustion products in the fire plume are quantitatively identified by the IR absorption spectra at 1/cm resolution using the hot fire emission as the radiation source. Concentrations of CO were measured at 50 times higher than ambient levels. The applicability of these techniques to gathering data relevant to important environmental and military problems, including atmospheric pollution from fires and possible short-term climatic effects due to fires ignited in a nuclear exchange, is discussed. Author

A87-10375
RELATIVE UTILITY OF LANDSAT MSS AND MKF-6M DATA FOR SMALL SCALE SOIL MAPPING
R. S. DWIVEDI (National Remote Sensing Agency, Hyderabad, India) Geocarto International, no. 2, 1986, p. 55-61.

An attempt has been made to evaluate Landsat MSS imagery and MKF-6M space photographs over part of the Dharwar district of Kamataka, Southern India for small-scale soil mapping. Dharwar schists, gneiss, and quartzite comprise broad lithological units whereas hills, ridge, and pediplain are major physiographic units. False color composite prints as well as black and white images of these data were interpreted visually in conjunction with lithological, topographical, and available soil information, and limited field check for preparing soil maps. The results reveal that while no remarkable improvement in the abstraction level of soils over Landsat imagery could be made on MKF-6M photographs, further divisions within undulating upland which are associated with different soil taxa could be delineated. Besides, MKF-6M data provided better contrast amongst various landscape units. It could be attributed to better spatial and radiometric resolution of MKF-6M photographs than Landsat MSS. Author

A87-10938
FORESTRY AND RANGE APPLICATIONS OF HIGH ALTITUDE RECONNAISSANCE TECHNOLOGY
J. D. GREER, J. R. BELL, P. ISHIKAWA, JR., and J. F. WARD (USDA, Forest Service, Salt Lake City, UT) IN: Airborne reconnaissance IX; Proceedings of the Meeting, San Diego, CA, August 20, 21, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 47-50.

This paper describes the uses of high altitude reconnaissance photography for various forestry and rangeland applications in the U.S. Department of Agriculture, Forest Service. In recent years the Forest Service has placed a significant emphasis on the use of high altitude photography for resource applications because such technology has the potential for contributing significantly toward the effective evaluation and management of our forest and rangeland resources. Author

A87-11373
INFORMATION RELATED TO AGRICULTURE AND FORESTRY ON THE BASIS OF SATELLITE IMAGERY [LAND- UND FORSTWIRTSCHAFTLICHE INFORMATIONEN AUS SATELLITENBILDDATEN]
W. KIRCHHOF (DFVLR, Institut fuer Optoelektronik, Oberpfaffenhofen, West Germany), W. MAUSER, and H.-J. STIBIG (Freiburg, Universitaet, Freiburg im Breisgau, West Germany) DFVLR-Nachrichten (ISSN 0011-4901), July 1986, p. 34-38. In German. refs

The considered investigations are based on imagery discussed by Staetter (1984) in his report about the development of a scanner for the Thematic Mapper (TM) Simulation. Objectives of the investigations are related to a study of the application possibilities of new Landsat TM and future SPOT imagery. A description of the Landsat and SPOT earth observation systems is provided, and the two West German test areas studied in the summer of 1983 are examined. The feasibility of a recognition and differentiation in the case of areas involving various types of agricultural or forestry-related utilization is discussed, taking into account the exploitation of the information provided by different spectral bands. Questions regarding the possibility of a recognition of agricultural and forestry-related units and line structures as a function of the size of the image elements are also explored. It is found that characterization and classification possibilities improve with an increase in the number of spectral bands. G.R.

A87-12691*# Department of Agriculture, Sydney, Mont.
SPECTRAL RADIANCE ESTIMATES OF LEAF AREA AND LEAF PHYTOMASS OF SMALL GRAINS AND NATIVE VEGETATION
J. K. AASE (USDA, Northern Plains Soil and Water Research Center, Sidney, MT), B. S. BROWN (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA), and J. P. MILLARD IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Sept. 1986, p. 685-692. USDA-NASA-supported research. refs

Similarities and/or dissimilarities in radiance characteristics were studied among barley (Hordeum vulgare L.), oats (Avena fatua L.), spring and winter wheat (Triticum aestivum L.), and short-grass prairie vegetation. The site was a Williams loam soil (fine-loamy mixed, Typic Argiborolls) near Sidney, Montana. Radiances were measured with a truck-mounted radiometer. The radiometer was equipped with four wavelength bands: 0.45 to 0.52, 0.52 to 0.60, 0.63 to 0.69, and 0.76 to 0.90 micron. Airborne scanner

measurements were made at an altitude of 600 m four times during the season under clear sky conditions. The airborne scanner was equipped with the same four bands as the truck-mounted radiometer plus the following: 1.00 to 1.30, 1.55 to 1.75, 2.08 to 2.35, and 10.4 to 12.5 microns. Comparisons using individual wave bands, the near IR/red, (0.76 to 0.90 micron)/(0.63 to 0.69 micron) ratio and the normalized difference vegetation index, ND = (IR - red)/(IR + red), showed that only during limited times during the growing season were some of the small grains distinguishable from one another and from native rangeland vegetation. There was a common relation for all small grains between leaf area index and green leaf phytomass and between leaf area index or green leaf phytomass and the IR/red ratio. Author

A87-12692
DIRECTIONAL THERMAL INFRARED EXITANCE DISTRIBUTIONS FROM A LEAFLESS DECIDUOUS FOREST
L. K. BALICK (EG & G Energy Measurements, Inc., Las Vegas, NV) and B. A. HUTCHINSON (Oak Ridge National Laboratory, TN) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Sept. 1986, p. 693-698. Army-USAF-supported research. refs
(Contract DE-AC08-83NV-10282)

The directional thermal infrared exitance distributions of a 21.5-m-tall leafless deciduous forest were measured using a rotating seven-detector array suspended 33 mm above the forest floor. These distributions are presented for several illumination conditions. Strong directional thermal infrared distributions were observed at high solar elevations on a clear day. Temperature gradients frequently exceeded 3 C per 10-degree change of view angle. At low sun angles and in the early evening, the change of observed temperature with nadir angle was more moderate, and was negligible with azimuth angle. At night and on a cloudy morning, uniform temperature distributions were observed. An interpretation of these directional temperature distributions is given. Author

A87-12693* Yonsei Univ., Seoul (South Korea).
NON-LAMBERTIAN EFFECTS ON REMOTE SENSING OF SURFACE REFLECTANCE AND VEGETATION INDEX
T. Y. LEE (Yonsei University, Seoul, Republic of Korea) and Y. J. KAUFMAN (NASA, Goddard Space Flight Center, Greenbelt; Maryland, University, College Park) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Sept. 1986, p. 699-708. NASA-supported research. refs

This paper discusses the effects of non-Lambertian reflection from a homogeneous surface on remote sensing of the surface reflectance and vegetation index from a satellite. Remote measurement of the surface characteristics is perturbed by atmospheric scattering of sun light. This scattering tends to smooth the angular dependence of non-Lambertian surface reflectances, an effect that is not present in the case of Lambertian surfaces. This effect is calculated to test the validity of a Lambertian assumption used in remote sensing. For the three types of vegetations considered in this study, the assumption of Lambertian surface can be used satisfactorily in the derivation of surface reflectance from remotely measured radiance for a view angle outside the backscattering region. Within the backscattering region, however, the use of the assumption can result in a considerable error in the derived surface reflectance. Accuracy also deteriorates with increasing solar zenith angle. The angular distribution of the surface reflectance derived from remote measurements is smoother than that at the surface. The effect of surface non-Lambertianity on remote sensing of vegetation index is very weak. Since the effect is similiar in the visible and near infrared part of the solar spectrum for the vegetations treated in this study, it is canceled in deriving the vegetation index. The effect of the diffuse skylight on surface reflectance measurements at ground level is also discussed. Author

A87-12695* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A FOURIER-BASED TEXTURAL FEATURE EXTRACTION PROCEDURE
W. D. STROMBERG and T. G. FARR (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Sept. 1986, p. 722-731. NASA-supported research. refs

A procedure is presented to discriminate and characterize regions of uniform image texture. The procedure utilizes textural features consisting of pixel-by-pixel estimates of the relative emphases of annular regions of the Fourier transform. The utility and derivation of the features are described through presentation of a theoretical justification of the concept followed by a heuristic extension to a real environment. Two examples are provided that validate the technique on synthetic images and demonstrate its applicability to the discrimination of geologic texture in a radar image of a tropical vegetated area. Author

A87-13512
THE USE OF MULTITEMPORAL LANDSAT MSS DATA FOR STUDYING FOREST COVER TYPES
D. F. LOZANO-GARCIA and R. M. HOFFER (Purdue University, West Lafayette, IN) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 450-464. refs

The accuracy and cost-effectiveness of single scene classifications, multitemporal/multispectral classifications, and layered multitemporal/multispectral classifications for analyzing multitemporal Landsat data are evaluated. Landsat MSS images of the area near the Monroe Reservoir in the Hoosier National Forest, Indiana were examined. The digital classifications performed using the three classification techniques are described. The abilities of the May classification, June classification, September classification, February data, and multitemporal/multispectral classifications to classify deciduous and coniferous forests, grassland, soil, and water cover types are compared. It is observed that the layered classification technique is more accurate and cost-effective than the other techniques. The layered technique is 99 percent accurate in classifying the forest classes combined and 90 percent accurate in classifying the nonforest classes. I.F.

A87-13513
INTERPRETATION OF SATELLITE AND AIRCRAFT L-BAND SYNTHETIC APERTURE RADAR IMAGERY
P. W. MUELLER and R. M. HOFFER (Purdue University, West Lafayette, IN) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 465-475. refs

The characteristics of various forest cover types on SAR imagery obtained by three different L-band radar sensors are investigated. The SAR images of the forested area in northeastern Florida were acquired using Seasat SAR, Shuttle Imaging Radar-B (SIR-B), and NASA/JPL airborne SAR. Three major tonal groupings, six forest classes, and four other classes were observed in the SIR-B images. The Seasat SAR data resembled the SIR-B data; however, they were darker in tone. The two cross-polarized images (HV and VH) revealed greater contrast between forest and nonforest than the like-polarized images (HH and VV); however, the two like-polarized images discriminated best between deciduous and nondeciduous. The data reveal that L-band SAR at incidence angles between 23I-28 deg can detect forest vegetation having standing water below the canopy and the occurrence of forest clearcutting. It is noted that the NASA/JPL airborne SAR has higher spatial resolution than the two spaceborne SAR images. I.F.

A87-13514
MULTIPLE INCIDENCE ANGLE SHUTTLE IMAGING RADAR DATA FOR DISCRIMINATING FOREST COVER TYPES
R. M. HOFFER, P. W. MUELLER, and D. F. LOZANO-GARCIA (Purdue University, West Lafayette, IN) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 476-485. refs

The effect of incidence angle on the ability of L-band HH-polarized Shuttle Imaging Radar (SIR-B) data to distinguish various forest cover types is examined. The SIR-B data was obtained on October 1984, at 28, 45, and 58 deg incidence angles for an area in northern Florida 65 km west of Jacksonville, FL. A color composite image was analyzed and seven classes of forest cover and five other classes of land cover or land use were detected. It is observed that the varying incidence angles affect the capability of SIR-B data to separate forest and other cover types, and age classes of pine plantations. The data reveal that for the 28 deg incidence angle, deciduous forest swamplands have a relatively high radar backscatter, while pine plantations have only a moderate backscatter, but in the 58 deg incidence angle data set no differences between these major forest cover types are noted. Also three age classes of pine forest, two groups of deciduous swampland forest, agricultural cropland, water, and some classes of cultural land use are differentiated as a function of incidence angle. I.F.

A87-13525
RADIOMETRIC LIMITATIONS TO THEMATIC MAPPER IMAGE INFORMATION CONTENT
P. M. TEILLET, D. G. GOODENOUGH (Canada Centre for Remote Sensing, Ottawa), G. FEDOSEJEVS, R. BYERS, and L. MARJAMA (Intera Technologies, Ltd., Ottawa, Canada) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 892-901. refs

The effect of radiometric destriping and calibration techniques on crop classification is investigated. Dark current variations in TM images of an agricultural area in Webster County, Iowa are studied. No statistically significant change in classification accuracy was observed after radiometric destriping of the images. The processing and analysis of Landsat 4 images of the ocean of the coast of California in the vicinity of San Nicolas Island are described; the images are examined for dark current variations, pixel drop effects, and view angle effects. I.F.

A87-13526
THEMATIC MAPPER EVALUATION FOR AGRICULTURE AND FORESTRY IN CANADA - INITIAL RESULTS
J. CIHLAR, F. J. AHERN, M. BERNIER, and K. P. B. THOMSON (Canada Centre for Remote Sensing, Ottawa) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 902-911. refs

A87-14166
IDENTIFICATION OF TWO SOUTHERN PINE SPECIES IN HIGH-RESOLUTION AERIAL MSS DATA
J. S. HUGHES, D. L. EVANS, P. Y. BURNS, and J. M. HILL (Louisiana State University, Baton Rouge) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Aug. 1986, p. 1175-1180. refs

Aircraft-generated high-resolution Multispectral Scanner (MSS) data were used to evaluate the spectral discrimination of individual longleaf and loblolly pine trees. Training samples centered on specific sunlit crowns were selected to study the spectral reflectance patterns of each species. A simple correlation comparison was used to select the MSS channels best suited for use in a maximum-likelihood classification. Results indicated that the two species could be discriminated on the low-level MSS imagery. No significant difference was found between two-channel and three-channel classifications based on the same sample trees. The near-infrared channel (800 to 890 nm) in combination with a visible channel (650 to 690 nm) was found to be most useful for separation of the subject timber species. Author

A87-14421
PRODUCTION OF LAND-USE AND LAND-COVER MAPS OF CENTRAL GUANGDONG PROVINCE OF CHINA FROM LANDSAT MSS IMAGERY
C. P. LO (Georgia, University, Athens) and T. FUNG (Waterloo, University, Canada) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Aug. 1986, p. 1051-1074. Research supported by the University of Hong Kong. refs

The problems of mapping the land use and land cover of a large area of central Guangdong Province of China from Landsat MSS data were examined with reference to the manual and digital approaches. Based on an intensive field study of a test site in the study area, importance of topographic effects, slopes, seasons, croppig system and the intensity of land use in affecting the accuracy of the resultant maps was discovered. It was concluded that visual interpretation was essential in providing the level of reference required for the image interpreter to perform the digital analysis satisfactorily. In view of the coarse spatial resolution of the Landsat MSS data it is recommended that the most straightforward digital analysis involving the use of the supervised approach with the minimum Euclidean distance classification and an iterative selection of training areas be adopted for the land-use/land-cover mapping of the whole study area to achieve an accuracy of 80 percent for eight level I and fifteen level II categories of the land-use and land-cover classification scheme. Author

A87-14563
STATISTICAL MEASURES OF SURFACE INHOMOGENEITY AND ITS POTENTIAL IMPACT ON BOUNDARY LAYER TURBULENCE
L. M. HECHTEL and R. B. STULL (Wisconsin, University, Madison) IN: Symposium on Turbulence and Diffusion, 7th, Boulder, CO, November 12-15, 1985, Extended Abstracts . Boston, MA, American Meteorological Society, 1985, p. 144-146.
(Contract NSF ATM-84-14371; NSF ATM-82-11842)

Photographic and satellite data from the 1983 Oklahoma Boundary Layer Experiment (BLX83) were used to classify land use patterns such as bare soil, pastureland, and three different cultivated crops. Surface skin temperatures were then correlated with those patterns. Pastureland has been found to be relatively warm during the BLX83 program, while cultivated fields were cool. The spectra of skin temperature data were analyzed. Work is underway to find a means of parameterizing this normalization in terms of pertinent physical forcings, such as soil moisture, season, time of day, and ground covering. An effort is being made to initialize a large-eddy-simulation model, in order to study the effects that land use patterns have on the structure of thermals and the formation of cumulus clouds. D.H.

A87-14674
AERIAL REMOTE SENSING IN THE LOWER PART OF THE ATMOSPHERIC SURFACE LAYER OF AGRICULTURAL FIELDS [AERODISTANTSIONNO-PRIZEMNOE ZONDIROVANIE SEL'SKOKHOZIAISTVENNYKH POLEI]
A. F. CHUDNOVSKII, IU. V. TIMOFEEV, and B. L. SHINDEROV Leningrad, Gidrometeoizdat, 1985, 272 p. In Russian. refs

The work describes techniques for the remote sensing of crop fields from heights not above 100 m using agricultural aircraft (e.g., the AN-2) and helicopters. The feasibility of this approach is substantiated through an examination of principles of atmospheric and soil physics. Appropriate remote-sensing instrumentation is described, and ways to achieve the required measurement precision are examined. Some results obtained with this methodology are presented, with particular attention given to microwave and infrared radiometer measurements of crop fields. B.J.

A87-14856*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
PRELIMINARY REPORT ON MEASUREMENTS OF FOREST CANOPIES WITH C-BAND RADAR SCATTEROMETER AT NASA/NSTL
S.-T. WU (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) (1985 International Geoscience and Remote Sensing Symposium /IGARSS '85/, Amherst, MA, Oct. 7-9, 1985) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Nov. 1986, p. 894-899. refs

This paper presents preliminary results of C-band radar scatterometer measurements of forest canopies of southeastern forests in the vicinity of NASA/NSTL. The results are as follows: radar backscattering coefficients (BSCs) of deciduous forests are higher than those of coniferous forests at a large incidence angle by ranging measurement, the VV polarization BSCs obtain peak value at the first few meters from the canopy top and decrease rather quickly, while the HH polarization BSCs obtain peak value at longer distances from the canopy top and decrease rather slowly through the canopy; and tree canopies with higher attenuations have higher BSCs for all three polarizations, with VV polarization containing the largest differential (2.2 dB). Author

A87-14857* Hunter Coll., New York.
GEOMETRIC-OPTICAL BIDIRECTIONAL REFLECTANCE MODELING OF A CONIFER FOREST CANOPY
X. LI and A. H. STRAHLER (Hunter College, New York) (1985 International Geoscience and Remote Sensing Symposium /IGARSS '85/, Amherst, MA, Oct. 7-9, 1985) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Nov. 1986, p. 906-919. refs
(Contract NAG5-273)

A geometric-optical forest canopy model that treats conifers as cones casting shadows on a contrasting background explains the major anisotropies in bidirectional reflectance measurements of a conifer forest canopy. The model uses parallel-ray geometry to describe the illumination and viewing of conifers as three-dimensional cones. Both computer simulation and analytical closed-form expressions are implemented. The results show a good qualitative agreement with the directional reflectance measurements of the conifer stand, indicating that the three-dimensional nature of the canopy is a key factor in determining its directional reflectance. Author

A87-15128* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
ANGULAR DEPENDENCE OF REFLECTANCE OF LAND COVER SURFACES
C. L. BREST (NASA, Goddard Institute for Space Studies; Sigma Data Services Corp., New York) and W. B. ROSSOW (NASA, Goddard Institute for Space Studies, New York) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 197-200. refs

Preliminary results are discussed from an investigation into the effects of the solar zenith angle on the surface reflectances of cloud types being categorized in the International Satellite Cloud Climatology Project. The analysis is based on AVHRR channel one data at 0.6 micron over the period July 1983-July 1984. Subsatellite scenes of eight geographically separated targets distinguished by their predominant vegetation type were examined pixel-by-pixel. Attempts were made to discover any spatial variability index in each pixel to classify pixels representing clouds by the recorded brightness temperature. M.S.K.

A87-15175
RIVER DYNAMICS AND THE DIVERSITY OF AMAZON LOWLAND FOREST
J. SALO, R. KALLIOLA, I. HAKKINEN, Y. MAKINEN, P. NIEMELA (Turku, University, Finland) et al. Nature (ISSN 0028-0836), vol. 322, July 17, 1986, p. 254-258. Research supported by the Academy of Finland and Turku University Foundation. refs

It is suggested that large-scale natural forest disturbance and primary succession in the lowland rainforests of the Peruvian Amazon are caused by lateral erosion and channel changes of meandering rivers. The results indicate that in the upper Amazon region, primary succession on newly deposited riverine soils is a major mode of forest regeneration. Landsat imagery analyses show that 26.6 percent of the modern lowland forest has characteristics of recent erosional and depositional activity; 12.0 percent of the Peruvian lowland forest is in successional stages along rivers. This successional development is used to clasify the western Amazon reinforests according to their geomorphological erosion-deposition pattern. It is proposed that by causing high site turnover, disturbance, and variation in forest structure, the river dynamics may be a major factor creating and maintaining the high between-habital (beta-type) species diversity characterizing the upper Amazon. Author

A87-15176*# EG and G Washington Analytical Services Center, Inc., Rockville, Md.
GROSS-MERCHANTABLE TIMBER VOLUME ESTIMATION USING AN AIRBORNE LIDAR SYSTEM
G. A. MACLEAN (EG&G Washington Analytical Services Center, Inc., Rockville, MD) and W. B. KRABILL (NASA, Goddard Space Flight Center, Greenbelt, MD) Canadian Journal of Remote Sensing (ISSN 0008-2821), vol. 12, July 1986, p. 7-18. refs

A preliminary study to determine the utility of an airborne laser as a tool for use by forest managers to estimate gross-merchantable timber volume was conducted near the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center, Wallops Flight Facility utilizing the NASA Airborne Oceanographic Lidar (AOL) system. Measured timber volume was regressed against the cross-sectional area of an AOL-generated profile of forest at the same location. The AOL profile area was found to be a very significant variable in the estimation of gross-merchantable timber volume. Significant improvements were obtained when the data were stratified by species. The overall R-squared value obtained was 0.921 with the regression significant at the one percent level. Author

A87-15610#
THE USE OF A SPATIAL AND TABULAR DATA BASE FOR ORDER-THREE SOIL SURVEYS
E. H. HORVATH (Technicolor Government Services, Inc., Sioux Falls, SD), A. A. KLINGEBIEL (SALUT, Inc., Columbia, MD), and D. G. MOORE (USGS Bioscience Applications Office, Sioux Falls, SD) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 151-165. refs
(Contract USGS-14-08-0001-20129; USDA ORDER 0065-SCS-82)

The techniques used to construct physiographic maps (PMs) and a tabular database for three sectors of the Grass Creek Resource Area in west-central Wyoming from Landsat MSS data, digital elevations, topographic maps, ground data on precipitation zones and vegetation, and the results of a conventional soil survey are discussed and illustrated. A general description of the area is given, and the data sources are characterized. The data products are found to be useful in defining and labeling soil taxonomic units, with correlations between physiographic and soil-mapping units and between spectral categories and vegetation types. T.K.

A87-15611#
USE OF PLANT, SPECTRAL AND WEATHER DATA IN MODELING CORN GROWTH
S. J. MAAS, A. J. RICHARDSON, C. L. WIEGAND, and P. R. NIXON (USDA, Agricultural Research Service, Weslaco, TX) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 167-186. refs

A strategy is described for making large-area yield estimates using a simplified crop growth model, weather data and remotely-sensed information. The model was designed to estimate individual-field responses which could be aggregated to produce areal yield estimates. A field study involving corn was conducted to obtain data for demonstrating this technique. Without remotely-sensed information, the model overestimated corn growth over the season. Early-season updating with remote sensing data significantly improved model estimates, while use of such data throughout the season allowed modeled corn growth to closely approximate observed corn growth. Author

A87-15621#
USING A GEOGRAPHIC INFORMATION SYSTEM TO CLASSIFY FOREST PRODUCTIVITY IN NORTHWESTERN CALIFORNIA
L. FOX, III (Humboldt State University, Arcata, CA), J. A. BROCKHAUS (North Carolina State University, Raleigh, NC), and N. D. TOSTA (California Department of Forestry, Sacramento) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 299-310. Research supported by the U.S. Forest Service. refs

Classifications of forest vegetation have been combined with ecological zone location, elevation, slope, and aspect to predict forest land productivity over a very large area (2 million acres). Forest vegetation cover classes were provided by Landsat MSS data through computer classification. Landsat classification and ecozone were significantly correlated with mean site index (obtained from six U.S. Forest Service site classes). Predictive abilities were moderate for six classes of productivity (58 percent correct on sample data, 34 percent correct on test data). Accuracy increased when productivity classes were enlarged to include pairs of classes, overlapped by one class (86 percent correct on sample data, 87 percent on test data). Author

A87-15623#
DETECTION OF HYDROCARBON MICROSEEPS AND RELATED GEOBOTANICAL ANOMALIES USING MULTI-DATE IMAGE SUBTRACTION, RAILROAD VALLEY, NEVADA
D. A. ROBERTS and R. O. GREEN (Stanford University, CA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 323-332. refs

A87-15624#
THE CAPABILITIES OF TWO AIRBORNE MULTISPECTRAL SENSORS FOR CLASSIFYING CONIFEROUS FOREST SPECIES
P. M. TREITZ, P. J. HOWARTH (Waterloo University, Canada), and N. G. LECKIE (Petawawa National Forestry Institute, Chalk River, Canada) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 335-350. refs

The data from two airborne multispectral sensors, possessing contrasting designs, were processed and tested for their ability to classify coniferous forest species based on differences in spectral radiance. MEIS II and Daedalus DS1260 MSS data were collected simultaneously and examined under controlled conditions (i.e. similar spectral, spatial and radiometric resolutions) for a study site in the Great Lakes St. Lawrence Forest Region of Eastern Ontario. In performing a supervised classification, identical training areas for coniferous forest species were located on both images. Training area statistics were subjected to a maximum likelihood classifier. The classified images produced by the linear array detector (MEIS II) did not exhibit a significant improvement in accuracy over the rotating mirror scanner (Daedalus DS1260 MSS) for test area data, but did demonstrate a slight improvement in classifying training area data. The results suggest that, for the conditions tested, design differences between sensors have little effect on classification performance. Author

A87-15625#
DEVELOPMENT OF A MULTISOURCE CROP MONITORING SYSTEM IN THE PRADERA PAMPEANA, ARGENTINA
C. ESPOZ and A. B. BRIZUELA (Comision Nacional de Investigaciones Espaciales, Centro de Sensores Remotos, Buenos Aires, Argentina) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 351-359. Research supported by the Centro di Investigaciones Economicas, Instituto Nacional de Tecnologia Agropecuaria, and Servicio Meteorologico Nacional. refs

A87-15626#
ESTIMATING WHEAT CULTIVATED AREA WITHIN LARGE PRODUCTIVITY REGION IN ARGENTINA USING LANDSAT DATA
R. FRANCISCO V., C. LAC PRUGENT, C. GARGANTINI, M. ANTES, and C. FONDA (Comision Nacional de Investigaciones Espaciales, Centro de Sensores Remotos, Buenos Aires, Argentina) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 361-367. Research supported by the Comision Nacional de Investigaciones Espaciales. refs
(Contract UN PROJECT ARG-81/002)

A87-15627#
REGIONAL INVENTORY OF IRRIGATED AGRICULTURE THROUGH JOINT USE OF AVHRR AND LANDSAT DATA
A. K. M. F. BHUIYAN (Space Research and Remote Sensing Organization, Dhaka, Bangladesh), N. E. G. ROLLER, and J. E. COLWELL (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 369-379.

This paper describes a study in which AVHRR and Landsat-MSS data were jointly used to produce a regional inventory of irrigated agriculture in western Nebraska. The coarse-resolution AVHRR data were used for stratification of the study area and a census (100-percent sample) of the resource. The finer-resolution Landsat-MSS data, covering a representative sample of the study area were used to calibrate (bias correct) the AVHRR estimate. This procedure is similar to regression estimation; however, it does not have the same statistical properties and is distinguished by calling it stratified, Landsat-calibrated, AVHRR estimation. The results of the inventory compare very favorably with traditional crop-reporting-agency estimates of irrigated agriculture area, and the procedure appears to be very cost-effective compared to other alternatives, as well as more timely than traditional methods. It is expected that this same methodology will also prove useful in other parts of the world for rapid, accurate, economical inventory of resources that occur in patches (e.g., fields or groups of fields) with areal extent comparable to or larger than AVHRR resolution (1 sq km). Author

A87-15630#
PREDICTING FOOD SITE PREFERENCES OF RED-WINGED BLACKBIRDS (AGELAIUS PHOENICEUS) USING SIMULATED SPOT DATA
G. DAOUST, A. CYR, and F. BONN (Sherbrooke, Universite, Canada) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 405-414. Research supported by the Ministere de l'Education du Quebec. refs

A87-15631*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HABITAT EVALUATION AND LANDCOVER ANALYSIS USING LANDSAT-4 TM DATA
J. P. ORMSBY, J. C. GERVIN (NASA, Goddard Space Flight Center, Greenbelt, MD), R. LUNETTA (U.S. Army, Corps of Engineers, Detroit, MI), and J. NICKESON (Science Applications Inc., La Jolla, CA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 415-422. refs

A87-15635#
SUMMER CROP IDENTIFICATION THROUGH MULTITEMPORAL ANALYSIS AND DIGITAL PROCESSING
C. E. GARGANTINI (Comision Nacional de Investigaciones Espaciales, Buenos Aires, Argentina) and F. V. REDONDO (Comision Nacional de Investigaciones Espaciales, Buenos Aires, Argentina) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 455-464. refs
(Contract UN PROJECT ARG-81/002)

A87-15643*# Michigan State Univ., East Lansing.
TEMPERATURE AND REFLECTANCE MONITORING FROM SATELLITES AS AN INDICATION OF SHIFT AND IMPACT OF VEGETATION CHANGE
J. BARTHOLIC and K. KITTLESON (Michigan State University, East Lansing) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 545-551. Research supported by the Michigan State University. refs
(Contract NGL-23-004-083; NAS5-29157)

A87-15648#
COMMERCIAL FOREST PLANTATION SURVEY BY LANDSAT (MSS) DIGITAL IMAGE PROCESSING
L. GUILLON (Comision Nacional de Investigaciones Espaciales, Centro de Sensores Remotos, Buenos Aires, Argentina) and J. MESTRES (Direccion de Silvicultura y Citricultura, Parana, Argentina) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 595-605.

A87-15658#
CALIBRATION OF AIRBORNE IMAGING SPECTROMETER DATA TO PERCENT REFLECTANCE USING FIELD SPECTRAL MEASUREMENTS
D. A. ROBERTS, Y. YAMAGUCHI, and R. J. P. LYON (Stanford University, CA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 679-688.

A87-15660#
A STATISTICAL ANALYSIS OF FOREST HARVEST DEPLETION MAPPING ACCURACY USING LANDSAT MSS DATA
P. D. ARCHIBALD (Pamap Graphics, Ltd, Victoria, Canada) and F. J. AHERN (Canada Centre for Remote Sensing, Ottawa) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 697-709. refs

A87-15661#
INTEGRATION OF LANDSAT DIGITAL DATA WITH AGRICULTURAL INFORMATION - AN OPERATIONAL APPROACH TO CROP PREDICTION MODELS
P. J. WOLFAARDT (Rand Afrikaans University, Johannesburg, Republic of South Africa) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 711-720. refs

The integration of Landsat-MSS data with agricultural statistics to analyze, explain, and forecast the spatial variation of crop production in a specific area by means of an operational crop-prediction model is studied. Two analytical phases were executed: the interpretation of the data base (agricultural and Landsat data) and the integration phase (land-use information derived from Landsat integrated with relevant agricultural statistics) employing two integration models. These were an empirical model and an operational model structurally based on it. According to the overall results obtained with this approach to crop forecasting, the operational model holds great potential and is ideally suited to smaller homogeneous areas. Author

A87-15662#
INVESTIGATION OF STRATEGIES FOR ESTIMATION OF CROP YIELD USING MULTI-SOURCE DATA
M. NESSA (Space Research and Remote Sensing Organization, Dhaka, Bangladesh), J. E. COLWELL (Michigan, Environmental Research Institute, Ann Arbor), and R. K. AGGARWALA (Michigan, University, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 721-726.

The purpose of this investigation was to examine some possible approaches for estimating crop yield by suitable combinations of field data, remote sensing data, and meteorological data. The two approaches discussed in this paper are: (1) estimation using a combination of field data and remote sensing data; and (2) estimation using a combination of meteorological data and remote sensing data. The results of this investigation suggest that suitable combinations of field, meteorological, and remote sensing data can improve crop yield estimates compared to any single source of data. Author

A87-15663*# Kansas Univ., Lawrence.
USING LANDSAT TM IMAGERY AND SPATIAL MODELING IN AUTOMATIC HABITAT EVALUATION AND RELEASE SITE SELECTION FOR THE RUFFED GROUSE (GALLIFORMES - TETRAONIDAE)
J. M. PALMEIRIM (Kansas, University, Lawrence; Lisboa, Universidade, Lisbon, Portugal) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 729-738. Research supported by the Kansas Fish and Game Commission. refs
(Contract NGL-17-004-024)

A87-15667#
FOREST INVENTORY IN THAILAND USING REMOTE SENSING TECHNIQUES
T. CHARUPPAT and P. ADISORNPRASERT (Royal Forest Department, Forest Management Div., Bangkok, Thailand) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 765-772.

The Royal Forest Department has been utilizing Landsat imagery in survey and mapping efforts since the launch of Landsat-1 in 1972. At present Landsat images show that Thailand's total forest resources have diminished about 12.69 percent or 65,107 sq km between 1973 (43.21 percent of the land area) and 1982 (30.52 percent of land area). In view of a national policy of conserving 40 percent of the country in forest cover, there is a continuing and urgent need to monitor forest extent and condition on a routine basis. It would appear that satellite observations will continue to be an integral part of this monitoring effort. Author

A87-15671*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WETLAND PHYSICAL AND BIOTIC STUDIES USING MULTISPECTRAL DATA
J. P. ORMSBY, J. C. GERVIN (NASA, Goddard Space Flight Center, Greenbelt, MD), J. E. NICKESON (U.S. Fish and Wildlife Service, Washington, DC), and G. WILLEY IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 799-807. refs

A November 1982 Landsat-4 TM scene and March and September 1984 airborne L-band radar data for a brackish-wetland area of the Blackwater National Wildlife Refuge (near Chesapeake Bay) are analyzed to monitor changes in vegetation and water area. The accuracy of level-I classification of the TM image is found to be 81 percent, but that of the few level-II/III classes for which ground truth was available is only 53 percent. The value of radar images for discriminating water areas obscured by vegetation and estimating plant heights is indicated. T.K.

A87-15675#
CORRELATION ANALYSIS BETWEEN SPECTRAL REFLECTANCE DATA AND WHEAT YIELD IN ARGENTINA
M. C. SERAFINI (Comision Nacional de Investigaciones Espaciales, Centro de Sensores Remotos, Buenos Aires, Argentina) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 839-846. refs

The main objective of this study is to analyze the existent relationship between Landsat spectral values and winter wheat yields in the Partido of Trenque Lauquen (Buenos Aires, Argentina). Ground truth data about planting dates and final yields were collected over wheat fields during 1980/81, 1981/82 and 1982/83 growing seasons. The regression analysis using Landsat spectral values, ratios and vegetation indices yielded a significant correlation with wheat final yield using these field samples. Author

A87-15677#
A DIGITAL GIS BASED ON LANDSAT AND OTHER DATA FOR ELK HABITAT EFFECTIVENESS ANALYSIS
J. R. EBY (Washington, University, Seattle) and L. R. BRIGHT (Oregon Department of Fish and Wildlife, Portland) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 855-863. refs

An elk habitat effectiveness index model is under development by natural resource agencies in Oregon to address resource management concerns. This model was adapted and applied through a digital GIS approach. Landsat and other data sources were used to construct the data planes of cover and forage quality, distance from habitat edge, and road density needed as variables in the model. The data planes were created, manipulated and combined using the VICAR/IBIS image processing software system. The result was an overall effectiveness index number for elk habitat as well as a pixel by pixel evaluation that could be used in resource planning and allocation processes. Author

A87-15783
WHEAT-AREA ESTIMATION USING DIGITAL LANDSAT MSS DATA AND AERIAL PHOTOGRAPHS
M. A. MOREIRA, S. C. CHEN, and G. T. BATISTA International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Sept. 1986, p. 1109-1120. refs

Aerial photographs covering 720 sq km were visually analyzed for wheat area, using a sampling technique based on digital Landsat MSS data. After computer classification with both supervised and unsupervised algorithms, the classification results were spatially filtered with a postprocessing technique, and the wheat area estimated by a regression method employing different sample sizes and sampling units. It is concluded that wheat area estimation obtained by regression estimation is more precise and accurate than that obtained by a direct expansion method. O.C.

A87-15784* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
GLOBAL VEGETATION DYNAMICS - SATELLITE OBSERVATIONS OVER ASIA
J.-P. MALINGREAU (NASA, Goddard Space Flight Center, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Sept. 1986, p. 1121-1146. refs

The weekly global vegetation index (GVI) derived from the NOAA AVHRR instrument has been analyzed for the 1982-1985 period over a wide range of vegetation formations of Asia. Temporal development curves of the index are presented for environments ranging from the desert of central Asia to the tropical forest of Borneo. The paper shows that, despite the coarse resolution of the GVI product, a large set of useful information on ecosystem dynamics and cropping practices can be consistently derived from time series of such data. In addition, it is shown that the impact of the 1982-1983 El Nino Southern Oscillation-related drought can be detected in the GVI data through an analysis of anomalies in the development of selected vegetation formations. The relevance of such analysis for global vegetation monitoring and change detection is then underlined. Author

A87-16434#
VEGETATION CLASSIFICATION OF THE GLOBE USING NOAA VEGETATION INDEX DATA
H. SHIMODA, K. FUKUE, T. HOSOMURA, and T. SAKATA (Tokai University, Tokyo, Japan) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 42-47.

A method for deriving global vegetation maps from Tiros/NOAA vegetation index data (VID) is described. The maximum likelihood method is applied to 67 categories. The classified data are converted to longitude and latitude coordinates, and the acreages of each category are calculated. It is noted that the NOAA VID are suitable for worldwide vegetation monitorings. I.F.

A87-16435#
EVALUATION OF DIGITAL CHANGE DETECTION TECHNIQUES FOR MONITORING TROPICAL DEFORESTATION USING LANDSAT MSS DATA
A. SINGH (Indian Forest Service, Imphal, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 48-53. refs

A87-16436#
DIGITAL PROCESSING TO ASSESS FOREST LAND USE AND OTHER AGRICULTURAL CROPS BY USING LANDSAT MSS DATA
S. TIKUMPONVAROKAS (Royal Forest Department, Bangkok, Thailand), T. LEELASUWANICE, S. KANCHANASUTHAM, V. AMARAKUL, and T. SIRIKUMPUM (Agricultural Economics Office, Bangkok, Thailand) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 54-60.

A87-16437#
VISUAL AND DIGITAL TECHNIQUES OF REMOTE SENSING FOR SOIL AND LAND USE MAPPING
R. L. KARALE, K. V. SESHAGIRI RAO (Department of Agriculture and Cooperation, All India Soil and Land Use Survey, New Delhi), L. VENKATARATNAM, and T. CH. MALLESWARA RAO (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 61-67. refs

Visual interpretation and computer implemented techniques were followed for generating soil and land use maps for an area of 5,000 sq km in Chitradurga district of Karnataka State, India. Landsat digital and analog data in conjunction with aerial photographs were employed for the study. False color composite with linear stretch showed more clarity and disposition of various soil and land use features compared to raw data as well as the band ratio products. The digital data analysis helped better discrimination of soil and land cover classes; the former at the abstraction level of subgroups of Soil Taxonomy. No technique employing Space R.S. data afforded abstraction level below subgroup comparable to aerial data. It was further revealed that interpretation of stretched data prior to supervised classification with computer implemented techniques provide a valid base for selection of training sets, enhancing thereby the efficiency of digital analysis Author

A87-16439#
MONITORING NATURAL FOREST COVER CHANGES IN SRI LANKA
M. BICHSEL and H. DIAS (Survey Department, Centre for Remote Sensing, Colombo, Sri Lanka) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 77-83. refs

Mapping forest cover by using remote sensing techniques has an over 20 years old tradition in Sri Lanka. The Survey Department is monitoring islandwide the forest cover. Satellite image supported interpretation of aerial photographs forms the basis for the production of updated forest cover maps. A comparison between an old and an updated map shows immediately the forest cover changes within a certain area and time. This is the base for decision makers to formulate their aims in planning and to take countermeasures. Author

A87-16441#
STUDIES ON LAND USE PATTERNS AND LAND DEGRADATION USING LANDSAT IMAGERY
P. G. SHANWARE, R. L. KARALE, and G. J. KING (Department of Agriculture and Cooperation, All India Soil and Land Use Survey, New Delhi) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 92-96.

Visual interpretation of false color composites of February and May, 1977 scenes covering 1188 sq km of Nim-Ka-Thana tehsil, Sikar district, Rajasthan was carried out. The landscape facets comprising hills, intermontane valleys, pseudopiedmonts, and aeolian plain were identified and delineated. Land use/land cover classes for each of the landscape units were specified. The February scene, corresponding to Rabi season, displayed four distinct land use patterns, such as: (1) agriculture, (2) wasteland, (3) agropastoral zone, and (4) forest. The image interpretation key valid for such landscapes was drawn up based on field work in specified sample strips. Computations from Landsat data analysis on areal extent of Rabi crops, wastelands and forests gave the validity of over 85 percent when compared with revenue statistics. Author

A87-16468#
AREA ASSESSMENT OF RUBBER CULTIVATION IN SRI LANKA
R. HUMBEL, W. T. G. MENDIS (Survey Department, Centre for Remote Sensing, Colombo, Sri Lanka), and A. DE S. LIYANAGE (Rubber Research Institute, Dartonfield, Sri Lanka) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 265-275. refs

The inconsistency of existing rubber statistics in Sri Lanka has often caused problems in proper planning and management of the rubber industry; therefore an attempt was made to generate rapidly accurate area statistics by the use of remote sensing techniques. The Landuse Map series of the Sri Lanka Center for Remote Sensing, prepared on the basis of airphoto and satellite image interpretation, outlines the rubber areas of the country. These are measured electronically to obtain numerical statistics. This method gives more accurate information than statistics obtained from other data sources. These figures are therefore a close approximation of the real extent under rubber cultivation. Author

A87-16469#
TEMPORAL MONITORING OF FOREST LAND FOR CHANGE DETECTION AND FOREST COVER MAPPING THROUGH SATELLITE REMOTE SENSING TECHNIQUES
T. S. KACHHWAHA (Remote Sensing Applications Centre, Lucknow, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 276-281. refs

A87-16470#
A CASE STUDY ON BENEFIT COST ANALYSIS OF A REMOTE SENSING BASED CROP INFORMATION SYSTEM FOR A MAJOR WHEAT GROWING REGION OF INDIA
B. DAS, A. R. DASGUPTA, A. K. S. GOPALAN (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), T. MADHAVAN, and T. S. VENKATKUMAR (Indian Institute of Management, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 282-287. refs

A87-16471#
SPECTRAL REFLECTANCE OF SUGARCANE (SACCHARUM OFFICINARUM L.) AND ITS RELATIONSHIP WITH LAI AND CHLOROPHYLL CONCENTRATION
S. AVUDAINAYAGAM, P. N. SRIDHAR, V. RAJAMANI (Madras, University, India), and N. LEELANANDA RAO IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 288-291. refs

A87-16472#
USE OF SATELLITE REMOTE SENSING TECHNIQUES IN EXPLORATORY LAND RESOURCE ASSESSMENT - A CASE STUDY OF NAGPUR DISTRICT, MAHARASHTRA
R. K. SAXENA, A. K. BARTHWAL, and S. LAL (National Bureau of Soil Survey and Land Use Planning, Nagpur, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 292-297.

A87-16473#
SOIL RESOURCE INVENTORY OF PUNJAB USING REMOTE SENSING TECHNIQUE
J. L. SEHGAL, P. K. SHARMA (Punjab Agricultural University, Ludhiana, India), and R. L. KARALE (Department of Agriculture and Cooperation, All India Soil and Land Use Survey, New Delhi) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 298-304. refs

A87-16474#
APPLICATION OF REMOTE SENSING IN THE LAND USE PLANNING OF KERALA STATE, INDIA
S. NATARAJAN (Kerala State Land Use Board, Trivandrum, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 305-315. refs

The use of remote sensing to plan land use in Kerala, India is examined. The topography, physiography, and cropping pattern of Kerala are described. Aerial photographs and satellite images were utilized to formulate vegetation, structural, and geomorphological maps. An example revealing the application of remote sensing techniques to land use planning in the Idukki district is presented. Future applications of remote sensing in Kerala such as forest mapping, analysis of watershed characteristics, coastal erosion studies, flood monitoring, and the detection of crop diseases are discussed. I.F.

A87-16485#
ANALYSIS OF MANGROVE FOREST IN OKINAWA USING AIRBORNE REMOTE SENSING DATA
T. HOSHI (Tsukuba, University, Ibaraki, Japan) and K. SATO (University of the Ryukyus, Naha, Japan) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 381-390. refs

A87-16486#
LOCATION AND ESTIMATION OF MANGROVE VEGETATION IN ORISSA, INDIA
G. MOHAPATRA, D. MISHRA, P. DAS, and S. N. TORASIA (Department of Science, Technology, and Environment, Orissa Remote Sensing Application Centre, Bhubaneswar, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 391-395.

A study was conducted to locate and estimate the area of mangrove vegetation in Orissa. The two types of coastal landscape of Orissa are described; the effect of mangrove vegetation on coastal erosion is analyzed. Computer enhanced false color composites of the mangrove vegetation in Orissa are examined. It was determined by the Orissa Remote Sensing Center that the total area of mangrove is 214.58 sq km and that there has been a 20 sq km reduction of area over 10 years. I.F.

A87-16487#
LANDSAT MSS DATA IN PREPARATION OF FOREST WORKING PLAN - A CASE STUDY IN DANGS, GUJARAT AND HIMACHAL/HIMALAYAN REGION
R. N. JADHAV and A. NARAIN (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 396-399.

A map showing the areal extent of forest cover as depicted by density classes or growing stock is used in preparation of forest working plans (also known as treatment plans). This paper illustrates the use of Landsat MSS data in providing this information as specified by the foresters through examples of studies conducted in deciduous (Dangs, Gujarat) and temperate (Himachal/Himalayan region) forests. The main criteria for selecting these areas are species diversity, smaller areas with biotic interference in case of deciduous forest as against homogenous floristic composition with comparatively less biotic interference in case of temperate forest. Maps showing density pattern are prepared for the two forest types using temporal data. This brings out seasonal changes taking place in different forest types. Author

A87-16488#
REMOTE SENSING OF WHEAT GROWN UNDER DIFFERENTIAL IRRIGATION, ROW SPACINGS AND NITROGEN LEVELS
D. K. DAS, G. SINGH, and A. K. SUTRADHAR (Indian Agricultural Research Institute, New Delhi, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 400-405. refs

A87-16489#
RELATIONSHIP OF WHEAT YIELD WITH SPECTRAL AND AGROMETEOROLOGICAL DATA
R. P. DUBEY, T. SHARMA, J. K. GARG, K. D. MALLICK (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), and J. R. PATEL (Gujarat Agricultural University, Vijapur, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 406-411. refs

The use of spectral and meteorological data to estimate crop yield is examined. Spectral sand biometric data for the wheat crops in Vijapur Taluka during the 1981-1982 and 1982-1983 seasons were collected. The correlations between grain yield and spectral data, and spectral and biometric data are studied. It is observed that the spectral data at the time of heading state show poor correlation with grain yield; when different sowing data are utilized the spectral data alone cannot account for all the yield variations caused by the weather. I.F.

A87-16491#
EVALUATION OF THEMATIC MAPPER DATA FOR SOIL RESOURCES MAPPING
R. S. DWIVEDI (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 418-422.

Landsat Thematic Mapper data covering part of Karimnagar district of Andhra Pradesh were interpreted monoscopically in conjunction with lithological and topographical information; and available soil information, for preparing a soil map of the area. A comparison of TM data with that of MSS reveals that the former is superior in terms of landscape boundary delineation. Amongst all the TM bands studied, 5 and 7 appear better than the rest of the bands. Author

A87-16492#
ASSESSMENT OF 90 GHZ RADIOMETER IMAGE FOR LAND USE ANALYSIS
S. MOHAN and R. L. MEHTA (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 423-427.

The use of 90 GHz radiometer data for land applications is studied. Image and ground truth data for the radiometer were collected and compared; the four major land use categories identified on the image are: (1) water bodies, (2) forest, (3) a mix of built-up and forest areas, and (4) agricultural areas. It is observed that the water bodies are easily identified, the separability factor between forest and agricultural land is 0.6, and for build-up area and agricultural land 0.4, and there is an 4-9.5 percent error in estimating area for different land use classes on the radiometer image. I.F.

A87-16493#
DIGITALLY ENHANCED LANDSAT IMAGERY FOR LANDUSE FEATURES - A CASE STUDY FOR THE SIROHI DISTRICT (RAJASTHAN), INDIA
A. K. GUPTA and V. R. RAO (Indian Space Research Organization, Bangalore, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 428-433.

A87-16506#
MAPPING OF VEGETAL COVER IN INDIA (A CASE STUDY OF UTTAR PRADESH)
D. B. MISRA, S. L. DABRAL, and M. K. SHARMA (Forest Survey of India, Dehradun) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 507-512.

The actual forest cover of Uttar Pradesh was assessed via interpretation of the false color composites of the Landsat imagery. Results of the present study were compared with those of a similar study conducted earlier by India's National Remote Sensing Agency and with figures published by the Uttar Pradesh Forest Department. It is found that the classification between forest and nonforest categories can be done quite accurately with the visual interpretation of Landsat imagery but the density classification within the forest area into closed and open forest can be done only approximately. K.K.

A87-16507#
MAPPING OF VEGETATION COVER OF AN EVERGREEN ECOSYSTEM
B. K. RANGANATH, N. V. M. UNNI, and K. S. MURTHY NAIDU (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 513-518. refs

A study was undertaken to map the vegetation cover of Silent Valley and its environs to determine the spatial distribution pattern of different vegetation types and study the ecological status of the area. Aerial photographs have been interpreted to achieve the objectives. The study has indicated that the existing vegetation pattern of Silent Valley and its environs is in close correlation and interaction with the basic components of the landscape, climate and soils and any interference causing alteration in any of these factors. Author

A87-16508#
METHODOLOGY FOR 'TERRA' DATA ANALYSIS AND COMPARATIVE STUDY OF AERIAL, LANDSAT AND TERRA DATA FOR FOREST MAPPING
J. P. AGGARWAL (Gujarat State Forest Department, Ahmedabad, India) and R. N. JADHAV (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 519-523.

Forests of Dangs district, Gujarat, India, has been chosen as the study area. The paper discusses in detail the methodology evolved for data analysis of Kate-140 and MKF-6 data obtained in April 1984 during Salyut-7 overpass. Forest-quality status (virgin forest, closed forest, degraded forest, and blanks) has been demarcated using TERRA data. A comparative study of aerial, Landsat, and TERRA data was made in an intensive test site. Author

A87-16509#
STUDIES ON THE EFFECT OF NUTRIENT STRESS AND PLANT DENSITY ON SPECTRAL RESPONSE OF MAIZE
K. S. SUNDARA SARMA, Y. V. SUBBARAO, and Y. NAGARAJARAO (Indian Agricultural Research Institute, New Delhi, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 524-530. refs

A87-16510#
MONITORING LARGE SCALE LAND RECLAMATION FOR RICE IN KERALA COAST, INDIA
A. N. SINGH (Remote Sensing Applications Centre, Lucknow, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 531-536.

A large area has been reclaimed from the backwaters of Arabian Sea in Kuttanad region of Kerala during the past three decades. Though the revenue records show an increase in rice acreage in the district, its extent may not be free from bias. Landsat data collected during 1973 and 1982 have been studied along with topographical maps (1953-54) to determine accurately the location and extent of reclamation carried out during 1953-73 and 1973-82. Author

A87-16511#
USE OF REMOTE SENSING TECHNIQUE FOR STUDY OF NATURAL SOIL RESOURCE IN RELICT CHAUTANG RIVER BASIN OF HARYANA (INDIA)
R. L. AHUJA, K. SINGH, and V. P. GOYAL (Haryana Agricultural University, Hissar, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 537-543.

A87-16512#
COMPARATIVE STUDY OF LANDSAT IMAGERY, MKF-6M AND KATE-140 PHOTOGRAPHS OBTAINED FROM SALYUT-7 SPACE MISSION FOR SOIL RESOURCES MAPPING
B. R. M. RAO and L. VENKATARATNAM (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 544-551. refs

A87-16517#
IMPACT OF SURFACE WATER IRRIGATION ON GROUND WATER REGIME AND ENVIRONMENTS IN PARTS OF GANGANAGAR DISTRICT, RAJASTHAN - A REMOTE SENSING PROSPECTION
S. C. DHIMAN and K. V. J. R. KRUPANIDHI (Central Ground Water Board, New Delhi, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 577-581.

A87-16938* Technicolor Government Services, Inc., Moffett Field, Calif.
MAPPING PERMAFROST IN THE BOREAL FOREST WITH THEMATIC MAPPER SATELLITE DATA
L. A. MORRISSEY, L. L. STRONG (Technicolor Government Services, Inc., Moffett Field, CA), and D. H. CARD (NASA, Ames Research Center, Moffett Field, CA) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Sept. 1986, p. 1513-1520. NASA-supported research. refs

A geographic data base incorporating Landsat TM data was used to develop and evaluate logistic discriminant functions for predicting the distribution of permafrost in a boreal forest watershed. The data base included both satellite-derived information and ancillary map data. Five permafrost classifications were developed from a stratified random sample of the data base and evaluated by comparison with a photo-interpreted permafrost map using contingency table analysis and soil temperatures recorded at sites within the watershed. A classification using a TM thermal band and a TM-derived vegetation map as independent variables yielded the highest mapping accuracy for all permafrost categories. Author

A87-17219
ASSESSING GRASSLAND BIOPHYSICAL CHARACTERISTICS FROM SPECTRAL MEASUREMENTS
R. L. WEISER, G. ASRAR, G. P. MILLER, and E. T. KANEMASU (Kansas State University of Agriculture and Applied Science, Manhattan) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Oct. 1986, p. 141-152. refs

Remote sensing offers a potential alternative to tedious hand sampling as a means of monitoring vegetation condition and estimating productivity over large areas of grasslands. This study was conducted to assess the use of spectral reflectance measurements in estimating grass canopy leaf area index (LAI) and total above ground green phytomass. Spectral reflectance measurements were made on a tallgrass prairie during 1983 and 1984 with two multiband radiometers. Green leaf-area index and dry matter accumulations (green above-ground phytomass) were

measured on the area monitored by the radiometer. Three indices - near-infrared to red ratio, greenness, and normalized difference - were computed from spectral reflectance data. The direct relationships between these spectral reflectance indices and grass biophysical parameters (LAI and phytomass) were site-dependent and year-specific. Indirect methods of estimating LAI and phytomass from estimates of absorbed, phytosynthetically active radiation, based on measurements of grass canopy spectral reflectance, were found to be more consistent across treatments for the two years of this study. Author

A87-17221
EVALUATION OF SPECTRAL REFLECTANCE MODELS TO ESTIMATE CORN LEAF AREA WHILE MINIMIZING THE INFLUENCE OF SOIL BACKGROUND EFFECTS
B. R. GARDNER and B. L. BLAD (Nebraska, University, Lincoln) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Oct. 1986, p. 183-193. refs

A87-17222
COMPUTER-AIDED BRIGHTNESS TEMPERATURE MAP OF INDIAN SUBCONTINENT - INFERENCE ON SOIL MOISTURE VARIATIONS
K. S. RAO, A. SOWMYA, B. K. MOHAN, P. VENKATACHLAM, N. AHMED (Indian Institute of Technology, Bombay, India) et al. Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Oct. 1986, p. 195-207. refs

An attempt is made to map the Indian satellite Bhaskara-II brightness temperature data, T(B), acquired at 19.35 GHz frequency during April-June 1982 in the time slot of around 0600 hours Indian Standard Time. To facilitate the better interpretation of the map the data is coded with different colors. The soil characteristics of India and their surface moisture conditions are presented. The color T(B) map is interpreted in terms of the soil moisture conditions of the Indian land mass. Author

A87-18376
MULTI-TEMPORAL DATA ANALYSIS FOR ASSESSMENT OF BURNT AREA USING LANDSAT MSS DATA
Y. SUGA (Hiroshima Institute of Technology, Japan), S. TANAKA, H. KIMURA, and T. SUGIMURA (Remote Sensing Technology Center of Japan, Tokyo) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1367-1374.

A87-18586
REMOTE SENSING OF UNCONSOLIDATED DEPOSITS WITH LANDSAT-4 TM ON ANTICOSTI ISLAND (QUEBEC, CANADA) [TELEDETECTION DES DEPOTS MEUBLES AVEC LANDSAT 4 TM, SUR L'ILE D'ANTICOSTI /QUEBEC, CANADA/]
S. PERRAS, J.-M. M. DUBOIS, F. BONN, and Q. H. J. GWYN (Sherbrooke, Universite, Canada) Photo Interpretation (ISSN 0031-8523), vol. 24, May-June 1985, p. 11-14, 15, 17. In French, English, and Spanish.

A87-18591
MANGROVE MAPPING OF THE SE COAST OF BRAZIL USING LANDSAT TM [CARTOGRAPHIE DES MANGROVES DE LA COTE SUD-EST DU BRESIL AVEC LANDSAT TM]
J. POPULUS (Institut Francais de Recherche pour l'Exploitation de la Mer, Brest, France) and R. HERZ (Sao Paulo, Universidade, Brazil) Photo Interpretation (ISSN 0031-8523), vol. 24, Mar.-Apr. 1985, p. 31-34, 35, 37. In French, English, and Spanish.

N87-11235 Centrum voor Landbouwpublikaties en Landbouwdocumentatie, Wageningen (Netherlands).
REMOTE SENSING METHODS TO DETERMINE THE VITALITY OF VEGETATION
B. VANDELUSTGRAAF 1984 61 p In DUTCH; ENGLISH summary
(LITERATUUROVERZICHT-42; ISBN-90-220-0866-5; ETN-86-98073) Avail: Issuing Activity

Technical and methodical details of remote sensing to assess damage to vegetation, particularly due to air pollution, are reviewed. Experiments show that remote sensing is as reliable as traditional methods based on field survey. However, field observation remains necessary since the causal agent usually cannot be identified from the remote sensing image. Large scale stereophotos using IR films give a reliable indication of vegetation vitality. Visual and photometric methods support the photoanalysis. Image enhancement techniques show good performance. Spectroradiometry is promising. Multispectral scanners on aircraft of satellites cannot yet compete with photographic techniques. Photographic remote sensing methods are cheaper than field based methods. ESA

N87-11237*# California Univ., Santa Barbara. Dept. of Geography.
CANOPY REFLECTANCE MODELING IN A TROPICAL WOODED GRASSLAND Annual Report
D. SIMONETT and J. FRANKLIN 15 Sep. 1986 57 p
(Contract NAGW-788)
(NASA-CR-179895; NAS 1.26:179895) Avail: NTIS HC A04/MF A01 CSCL 02F

Geometric/optical canopy reflectance modeling and spatial/spectral pattern recognition are used to study the form and structure of savanna in West Africa. An invertible plant canopy reflectance model is tested for its ability to estimate the amount of woody vegetation cover in areas of sparsely wooded grassland from remotely sensed data. Dry woodlands and wooded grasslands, commonly referred to as savannas, are important ecologically and economically in Africa, and cover approximately forty percent of the continent by some estimates. The Sahelian and Sudanian savanna make up the important and sensitive transition zone between the tropical forests and the arid Saharan region. The depletion of woody cover, used for fodder and fuel in these regions, has become a very severe problem for the people living there. LANDSAT Thematic Mapper (TM) data is used to stratify woodland and wooded grassland into areas of relatively homogeneous canopy cover, and then by applying an invertible forest canopy reflectance model to estimate directly the height and spacing of the trees in the stands. Since height and spacing are proportional to biomass in some cases, a successful application of the segmentation/modeling techniques will allow direct estimation of woody biomass, as well as cover density over significant areas of these valuable and sensitive ecosystems. Sahelian savanna sites in the Gourma area of Mali being used by the NASA/GIMMS project (Global Inventory Modeling and Monitoring System, at Goddard Space Flight Center), in conjunction with CIPEA/Mali (Centre International pour l'Elevage en Afrique) will be used for testing the canopy model. The model will also be tested in a Sudanian zone crop/woodland area in the Region of Segou, Mali. Author

N87-11255# Bern Univ. (Switzerland).
MICROWAVE MODELING OF SNOW AND SOIL
E. SCHANDA *In* ESA of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 99-110 Dec. 1985
Avail: NTIS HC A25/MF A01

Microwave scattering and emission of snow and soil with locally and temporally varying parameters, such as moisture content, surface roughness and subsurface structure, is determined by absorption, surface scattering, and volume scattering. Developments in modeling of microwave scatter, and emission properties of snow and soil are summarized. ESA

N87-11259# Wageningen Agricultural Univ. (Netherlands). Dept. of Land Surveying and Remote Sensing.
EXPERIMENTS ON MODELING RADAR BACKSCATTER OF FOREST STANDS AND RESEARCH ON CLASSIFICATION
D. H. HOEKMAN *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 127-132 Dec. 1985
Avail: NTIS HC A25/MF A01

Radar signatures of forest stands were measured at L and C-band with an airborne multiband scatterometer. Comparison of results with X-band data of the same site shows that radar backscatter levels of coniferous trees increase with increasing wavelength with respect to deciduous trees. At C-band the levels compare. Directional variations of the radar return of two forest stands were investigated. An experiment with big corner reflectors on the forest floor studied the attenuating properties of the forest canopy. At X-band, crowns of deciduous and coniferous trees show high attenuation factors. The attenuation of the canopy as a whole seems to be dominated by canopy architecture and aspect of measurement. Detection probabilities as a function of corner-background ratio are given. ESA

N87-11262# National Aerospace Lab., Amsterdam (Netherlands).
A SCENE RADIATION MODEL BASED ON FOUR-STREAM RADIATIVE TRANSFER THEORY
W. VERHOEF *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 143-150 Dec. 1985
Avail: NTIS HC A25/MF A01

An analytical four-stream radiative transfer model based on Suits's differential equations is applied to the atmosphere-Earth system to investigate the effects of the atmosphere and the view angle on remotely sensed multispectral radiance data from vegetation canopies. This scene radiation model is composed of two atmospheric layers and one vegetation layer resting on a Lambertian soil, combined by the Adding method. Input data for the model are Elterman's data on atmospheric optical depths, Deirmendjian's phase functions for atmospheric haze, visibility, directions of the Sun and of observation, and canopy parameters of the SAIL vegetation reflectance model, such as leaf area index and the leaf angle distribution. ESA

N87-11264# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MODELISATION OF THE OPTICAL SCATTERING BEHAVIOUR OF THE VEGETATION CANOPIES
D. S. KIMES *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 157-163 Dec. 1985
Avail: NTIS HC A25/MF A01

The three dimensional model of Kimes (1984) which can treat three dimensional variability in heterogeneous scenes, was used to test and expand physical scattering mechanisms involved in reflectance distribution dynamics by analyzing modeling and field data. The major physical phenomena causing the directional scattering behavior of vegetation canopies are presented. These include the strong anisotropic properties of the soil, and the anisotropic scattering properties of the vegetation as described by the phase function of the leaves and the geometric effects caused by vertical layers of leaves. This knowledge serves as a basis for defining optimum directional view angles for remote sensing strategies. An example on using knowledge of the scattering behavior of vegetation to develop techniques for extracting vegetation parameters (spectral albedo) from directional reflectance data is presented. ESA

N87-11265# New York State Univ., Binghamton.
ESTIMATION OF CANOPY PARAMETERS FOR ROW-PLANTED VEGETATION CANOPIES FROM REFLECTANCE DATA THROUGH INVERSION OF CANOPY REFLECTANCE DATA
N. S. GOEL and T. GRIER *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 165-169 Dec. 1985
Avail: NTIS HC A25/MF A01

A canopy reflectance (CR) model for row planted vegetation was tested for soybean canopies in three different stages of growth and for corn canopies in two stages of growth. The model fits the field measured bidirectional CR data quite well. It is shown that by inverting this model, the leaf area index and percent ground cover can be estimated quite accurately from measured canopy reflectances. ESA

N87-11267# Centre National de la Recherche Scientifique, Montpellier (France). Lab. d'Ecophysiologie.
EFFECT OF ARCHITECTURAL PARAMETERS AND RADIATIVE CONDITIONS ON THE REMOTE SENSING OF THE LEAF INDEX OF VEGETATION CANOPIES [EFFET DES PARAMETRES ARCHITECTURAUX ET DES CONDITIONS RADIATIVES SUR LA TELEDETECTION DE L'INDICE FOLIAIRE DE COUVERTS VEGETAUX]
J. DAUZAT *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 175-178 Dec. 1985 In FRENCH
Avail: NTIS HC A25/MF A01

A probabilistic radiative transfer model was used to study factors affecting the reflectance of vegetation canopies. It is shown how a leaf area index, practically independent of leafiness and Sun elevation can be established with a three channel radiometer (SPOT satellite type). ESA

N87-11269# Canada Centre for Remote Sensing, Ottawa (Ontario).
GEOMETRIC MODEL SIMULATIONS OF CONIFER CANOPY REFLECTANCE
F. CAVAYAS and P. M. TEILLET *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 183-189 Dec. 1985
Avail: NTIS HC A25/MF A01

A mathematical model to predict the spectral signature of forested terrain as a function of simple canopy parameters, solar illumination geometry, and topography was developed. Basic elements of the forest model are presented, together with simulation results for the reflective spectral bands of the Landsat Thematic Mapper. The model retains basic concepts of the model of Strahler and Li and is also based on the principal of composite spectral signatures. For certain cases of population density and solar zenith angle, the simulation results show very significant changes in pixel reflectance as a function of terrain slope and aspect. ESA

N87-11273# Institut National de la Recherche Agronomique, Paris (France). Station de Bioclimatologie.
DESCRIPTION OF CROP GEOMETRY, RESTRICTED TO PARTS VIEWED [DESCRIPTION DE LA GEOMETRIE D'UNE CULTURE AVEC RESTITUTION AUX PARTIES VUES]
P. BOISSARD *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 209-212 Dec. 1985 In FRENCH
Avail: NTIS HC A25/MF A01

A photogrammetric method for geometric description of the spatial arrangement of plant leaves, stems, and tops was developed. It is a nondestructive, instantaneous method (photography), well suited to heterogeneous canopies like young crops or row structures. The method is illustrated by an example of manual stereoplotting on a maize canopy using a 5 cm contour-interval; and a directional azimuth analysis of highest layer leaves of the same canopy. ESA

N87-11278# Institut National de la Recherche Agronomique, Avignon (France).
UTILIZATION OF HIGH SPECTRAL RESOLUTION TO MONITOR THE EVOLUTION OF WHEAT CROPS [UTILISATION DE LA HAUTE RESOLUTION SPECTRALE POUR SUIVRE L'EVOLUTION DE COUVERTS DEBLE]
I. CHAMPION, F. BARET, G. GUYOT, and A. PODAIRE (Centre National d'Etudes Spatiales, Toulouse (France).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 237-240 Dec. 1985 In FRENCH
Avail: NTIS HC A25/MF A01

The evolution of the reflectance spectra of 16 plots of wheat (4 types sown at 4 different dates) was followed throughout a growth cycle by a high spectral resolution spectroradiometer (1024 bands between 468.5 and 1064 nm). Results show that utilization of narrow spectral bands provides more information than the traditional wide bands. The inflection point on the reflectance curve between 670 and 760 nm and the red dip between 580 and 660 nm provide information on the state of the leaf surfaces and the ratio of ground coverage. A 4 to 5 nm spectral resolution is adequate to reveal the phenomena studied. ESA

N87-11297# Wageningen Agricultural Univ. (Netherlands). Dept. of Land Surveying and Remote Sensing.
MULTISPECTRAL AERIAL PHOTOGRAPHY YIELDING WELL-CALIBRATED REFLECTANCE FACTORS WITH HIGH SPECTRAL, SPATIAL AND TEMPORAL RESOLUTION FOR CROP MONITORING
J. G. P. W. CLEVERS *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 343-346 Dec. 1985
Avail: NTIS HC A25/MF A01

An airborne multispectral photographic system was designed for crop monitoring. Spectral resolution is: 555 to 580 nm (green), 665 to 700 nm (red) and 840 to 900 nm (infrared). Equipment which was easily available and relatively inexpensive was used, resulting in a high temporal resolution (fortnightly). Using a densitometer with an aperture of 0.25 mm diameter, results in a high spatial resolution (3.14 sqm at scale 1:8000 and 0.44 sqm at 1:3000). With low altitude multispectral photography, reference targets were set up in the field for obtaining calibrated spectral data of crops. High temporal and spatial resolution requirements were satisfied by aerial photography. Results prove the validity of the applied procedure for atmospheric correction and radiometric calibration, resulting in information about crops with larger precision than by conventional field sampling methods. ESA

N87-11300# Stockholm Univ. (Sweden). Dept. of Physical Geography.
A COMPARISON BETWEEN LANDSAT-THEMATIC MAPPER (TM) DATA AND GROUND MEASURED RADIANCE AND SOIL DATA
B. LUNDEN and E. FAGERLUND *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 357-360 Dec. 1985
Avail: NTIS HC A25/MF A01

In order to evaluate Landsat-TM radiance data for bare soils in an agricultural area in central Sweden, a satellite registration was compared with black and white IR air photo densities, field measured radiance data (0.4 to 1.1 microns) and soil data (water content, humus content and grain size distribution) from the same 24-hr period. By means of an air photo, the TM pixels were positioned for comparisons with field data. When comparing satellite data with air photo densities, correlation factors (r = Rxy) from 0.87 to 0.90 are obtained and with the radiometer data from 0.82 to 0.84. Correlation between TM data and soil water content, the best correlated soil parameter, varies from -0.86 for band 7 to -0.89 for band 2. ESA

N87-11309# Research Center Graz (Austria).
SPECTRAL ANALYSIS OF A HEAVY METAL-STRESSED FOREST CANOPY USING LANDSAT TM DATA
C. BANNINGER *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 403-407 Dec. 1985 Sponsored by ESA
Avail: NTIS HC A25/MF A01

Landsat Thematic Mapper (LTM) data acquired in the spring over a metal-stressed coniferous tree stand were used to evaluate their usefulness in detecting geobotanical anomalies associated with high concentrations of heavy metals in the underlying soil, and to ascertain which ground parameters exert the greatest influence on the recorded data. Thematic Mapper bands 4 and 5, simple band ratio (R41), normalized difference (ND1), first principal component (PC1), band differences (BD1, BD2, and BD3), and the green and brightness indices (TMG and TMB) best discriminate copper-lead-zinc related stress conditions in a spruce tree stand of 30 TM spectral bands and transformations are evaluated. Overall, ND1 and BD1 are the most useful for detecting heavy metal stress in coniferous forests, followed closely by TMG, R41, and BD3. ESA

N87-11310# Institut National de la Recherche Agronomique, Avignon (France). Dept. de Bioclimatologie.
INVESTIGATION OF THE COMPLEMENTARITY OF THE MIDDLE INFRARED WITH THE VISIBLE AND NEAR INFRARED SPECTRA FOR VEGETATION MONITORING [ETUDE DE LA COMPLEMENTAIRE DU MOYEN INFRAROUGE AVEC LE VISIBLE ET LE PROCHE INFRAROUGE POUR LE SUIVI DE LA VEGETATION]
F. BARET, G. GUYOT, A. BEGUE, P. MAUREL, and A. PODAIRE (Centre National d'Etudes Spatiales, Toulouse (France).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 409-412 Dec. 1985 In FRENCH
Avail: NTIS HC A25/MF A01

The advantages of adding a mid IR channel to the visible and near IR ones of the SPOT satellite for vegetation monitoring were assessed by testing the 1660 to 1695, 1560 to 1685, and 2030 to 2235 nm bands (close to Landsat Thematic Mapper 5 and 7 bands). The 1560 to 1685 nm band provides most information. However, vegetation moisture supply has little influence on the spectral response of canopies in this band. The band is most sensitive to surface optical properties (influenced by soil moisture content) governed by leafiness for a given leaf area index. Canopies with different geometrical structures can be distinguished. ESA

N87-11313# Centre National de la Recherche Scientifique, Montpellier (France). Centre Emberger.
ANALYSIS OF SPOT SIMULATION RADIOMETRIC MEASUREMENTS IN ARID AND SUBHUMID MEDITERRANEAN ENVIRONMENTS [ANALYSE DE MESURES RADIOMETRIQUES DE SIMULATION SPOT EN MILIEUX MEDITERRANEENS ARIDE ET SUB-HUMIDE]
B. LACAZE, L. LAHRAOUI, G. DEBUSSCHE, and A. KHELFA *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 425-428 Dec. 1985 In FRENCH
Avail: NTIS HC A25/MF A01

Ground and airborne radiometric measurements were carried out in Mediterranean regions to simulate SPOT satellite performance. Results for the three SPOT channels for the reflectance of the dominant vegetation species are presented. Large scale spatial structure and the average spectral response of the vegetation are revealed. ESA

N87-11315# Sheffield Univ. (England). Dept. of Geography.
CHARACTERISING VEGETATED SURFACES WITH AIRBORNE MSS DATA
P. J. CURRAN and H. D. WILLIAMSON *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 433-436 Dec. 1985
(Contract SERC-GR3/5096)
Avail: NTIS HC A25/MF A01

Airborne multispectral scanner (MSS) data collected in June were used to estimate the green leaf area index (GLAI) of grassland. The initial accuracy of GLAI estimation was 17% to 40% at the 95% confidence level, for a 6 class classification. By refining the methodology, the accuracy increases to 60% to 82% at the 95% confidence level, for a 5 class classification. To test the methodology the experiment was repeated for the same study area using data collected in August. The initial accuracy of GLAI estimation was 5% to 40% at the 95% confidence level for a 6 class classification. Using the refined methodology the accuracy increases to 58% to 93% at the 95% confidence level for a 5 class classification. ESA

N87-11318# Tokyo Univ. (Japan). Inst. of Space and Astronautical Sciences.
MEASUREMENTS OF MICROWAVE BACKSCATTER FROM TREES
H. HIROSAWA, H. ISHIDA, T. OCHI, and Y. MATSUZAKA *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 451-454 Dec. 1985
Avail: NTIS HC A25/MF A01

Microwave backscatter from two kinds of conifers, Sugi (Japanese cedar) and Sawara (Japanese cypress), at C and X bands, using HH, VV, HV, and VH polarizations was measured. The relationship between the backscattering characteristics and the ground truth data: leaf moisture content, volume ratio of leaves, and calculated dielectric characteristics of leaves and the medium is discussed. ESA

N87-11320# Freiburg Univ. (West Germany). Abt. Luftbildmessung und Fernerkundung.
INVESTIGATION OF SPECTRAL REFLECTANCE SIGNATURES ON FOREST DAMAGES USING MULTISPECTRAL DATA
A. KADRO *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 459-462 Dec. 1985
Avail: NTIS HC A25/MF A01

Multispectral visible, near infrared and middle infrared spectra were collected over forests at three flight altitudes. Spectral reflectance signatures and a computer aided classification based on the different signatures, for use in a forest damage inventory, are presented. ESA

N87-11321# Stockholm Univ. (Sweden). Remote Sensing Lab.
REFLECTANCE PROPERTIES OF CONIFERS, MEASURED FROM A HELICOPTER
J. KLEMAN *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 463-466 Dec. 1985 Sponsored by Swedish Board for Space Activities
Avail: NTIS HC A25/MF A01

Radiometer measurements from helicopter were carried out over stands of Norway spruce (Picea abies) and Scotch Pine (Pinus sylvestris) 20 km north of Stockholm, Sweden. Continuous reflectance spectra in the wavelength range 0.4 to 1.7 microns were measured over forest stands with different species, ages, crown densities, and field layers. The average reflectances of pine stands with an age of over 40 yr are higher in all bands than the reflectances for comparable spruce stands. In rank order, bands centered at 0.67, 1.6, and 0.48 microns offer the best separation possibilities. The reflectance variations through the summer are small for the two species. The reflectance of the pine stands varies less with deviations from nadir looking than the reflectance of the spruce stands. ESA

N87-11322# Institut National de Recherche d'Informatique et d'Automatique, Rennes (France).
CHARACTERIZATION OF THE SPECTRAL, SPATIAL AND TEMPORAL SIGNATURE OF VINEYARDS AND ORCHARDS: APPLICATION TO SOIL AND CROP REMOTE SENSING [CARACTERISATION DE LA SIGNATURE SPECTRALE, SPATIALE ET TEMPORELLE DES VIGNES ET VERGERS: APPLICATION A LA TELEDETECTION DU SOL ET DE LA CULTURE]
B. NAERT *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 467-474 Dec. 1985 In FRENCH
Avail: NTIS HC A25/MF A01

The behavior of the spectral signature of pixel components throughout a growth cycle was studied using data from a radiometer operating in the three bands of the SPOT satellite and airborne color infrared photography. Results show that at high resolution, vegetation, bare soil, and shade in vineyards and orchards can be identified. With a decimetric pixel, significant growth stages of the vine are identifiable. At 20 m satellite resolution, only agricultural features are distinguished. Between the two, surface heterogeneity in the plot can be detected. The relationship between wavelength and identifying parameters, such as soil moisture and reflectance, indicates that in complex cultivated areas every signal parameter must be mastered to permit efficient remote sensing. ESA

N87-11324# Valencia Univ. (Spain). Dept. of Thermography.
FOLLOWING THE MICROCLIMATIC ALTERATIONS PRODUCED BY FOREST FIRES BY MEANS OF LANDSAT-5 TM SENSOR
M. J. LOPEZ-GARCIA, V. CASELLES, and J. MELIA *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 481-484 Dec. 1985
Avail: NTIS HC A25/MF A01

The microclimatic variation produced by a forest fire was evaluated by comparing Landsat 5 TM sensor data with reference area temperature and Monitoring Index (MI) B4-B7/B4+B7. A month after the fire, the areas affected present temperatures 2 to 3 C higher than the reference areas, and the MI shows a negative value. These differences decrease with time and are not significant 6 yr after the fire. The sensor is considered to be especially suitable to monitor the reforestation of the areas affected by forest fires. ESA

N87-11325# Reading Univ. (England). Dept. of Geography.
SPECTRAL SIGNATURES OF LAND COVER TYPES IN THE SAHEL FOR GEOBOTANICAL MODELING
A. C. MILLINGTON *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 485-489 Dec. 1985
Avail: NTIS HC A25/MF A01

A geobotanical model based on soil moisture stresses in vegetation for geomorphological mapping is established for the Gambia and central Senegal. Ground radiometric measurements of visible and near IR reflectances were made and the reflectances in the equivalent Landsat multispectral scanner bands 5, 7, 7/5 and the normalized difference vegetation index are calculated and used to test the model. The Mann-Whitney U-test is used to test for statistical separability between land cover classes which are related to geomorphological boundaries. The potential for mapping flood plain geomorphology and exposures of ferricretes is high but it is lower for other applications. ESA

N87-11334# Valencia Univ. (Spain). Dept. of Thermology.
LANDSAT-5 TM APPLICATION TO THE STUDY OF MODIFICATION OF SPECTRAL SIGNATURES OF CITRIC ORCHARDS AFFECTED BY FROSTS
V. CASELLES, S. GANDIA, and J. MELIA *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 531-534 Dec. 1985
Avail: NTIS HC A25/MF A01

A study of the bidirectional reflectance of citrics given by Landsat 5 was used to evaluate the intensity of strong frost on

the Spanish Mediterranean coast in January 1985. Bands 4 and 3 are more useful for monitoring the effects of the cold. The normalized difference index of vegetation calculated from these bands is used to evaluate the zones most influenced (of the order of 55% of the identified citrus orchards). ESA

N87-11337# South Carolina Univ., Columbia. Dept. of Geography.
FEASIBILITY STUDY OF WOOD STORK FORAGING HABITAT MAPPING USING LANDSAT MULTISPECTRAL DATA
J. R. JENSEN, M. E. HODGSON, M. COULTER, and H. E. MACKEY, JR. 1986 19 p Presented at the Freshwater Wetlands and Wildlife Symposium, Charleston, S.C., 24 Mar. 1986 Prepared in cooperation with Du Pont de Nemours (E.I.) and Co., Aiken, S.C.
(Contract DE-AC09-76SR-00001)
(DE86-008904; DP-MS-85-119; CONF-8603101-2) Avail: NTIS HC A02/MF A01

The wood stork is a large wading bird which forages in shallow wetlands up to 70 kilometers from the colony. LANDSAT data were evaluated to determine if remote sensing data were suitable for locating and estimating the extent of potential foraging habitat for this species over such a large range. Thematic Mapper data of north-central Georgia and the Savannah River floodplain in South Carolina were obtained May 5, 1984. Spectral signatures from known foraging sites near a colony in Georgia were identified. Computer clustering techniques were used to identify and map shallow water and marsh wetland foraging habitats. Foraging acreages were computed, and maps of the locations of candidate foraging sites were produced for a 1520-square-kilometer area. Remote sensing appears to provide a feasible method of evaluating the regional wetland foraging habitat available to this wide-ranging species. DOE

N87-12029*# Illinois Natural History Survey, Champaign. Thematic Mapper Working Group.
INTERPRETING FOREST AND GRASSLAND BIOME PRODUCTIVITY UTILIZING NESTED SCALES OF IMAGE RESOLUTION AND BIOGEOGRAPHICAL ANALYSIS Progress Report
L. R. IVERSON, J. S. OLSON (Illinois Univ., Champaign), P. G. RISSER, C. TREWORGY, T. FRANK, E. COOK, and Y. KE 1986 42 p Prepared in cooperation with Oak Ridge National Lab., Tenn.
(Contract NAS5-28781)
(NASA-CR-176803; NAS 1.26:176803) Avail: NTIS HC A03/MF A01 CSCL 08B

Data acquisition, initial site characterization, image and geographic information methods available, and brief evaluations of first-year for NASA's Thematic Mapper (TM) working group are presented. The TM and other spectral data are examined in order to relate local, intensive ecosystem research findings to estimates of carbon cycling rates over wide geographic regions. The effort is to span environments ranging from dry to moist climates and from good to poor site quality using the TM capability, with and without the inclusion of geographic information system (GIS) data, and thus to interpret the local spatial pattern of factors conditioning biomass or productivity. Twenty-eight TM data sets were acquired, archived, and evaluated. The ERDAS image processing and GIS system were installed on the microcomputer (PC-AT) and its capabilities are being investigated. The TM coverage of seven study areas were exported via ELAS software on the Prime to the ERDAS system. Statistical analysis procedures to be used on the spectral data are being identified. B.G.

N87-12031# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TM BAND COMBINATION FOR CROP DISCRIMINATION
S. C. CHEN, G. T. BATISTA, and A. T. TARDIN May 1986 7 p Presented at the International Symposium on Remote Sensity, Resource Development and Environmental Management, Eschede, Netherlands, 25-29 Aug. 1986
(INPE-3905-PRE/946) Avail: NTIS HC A02/MF A01

The LANDSAT Thematic Mapper provides not only more spectral bands but also improved spatial resolutions in the visible and infrared wavelengths as compared to MSS data. However, working with the increased number of wavelength bands presents problems. To learn better how to analyze TM data for agriculture studies, LANDSAT data of a 15x15 Km area in Parana State, Brazil, were acquired on Jan. 19, 1985. The predominant crops were soybeans, corn, and sugarcane. To choose the best combination of the three TM bands to use, the entropy criterion was used. The colors green, red and blue were associated with them according to the magnitudes of their variances to form the color composite. Interpretability of these color images were evaluated visually. For digital analyses the criterion of the Jeffreys-Matusita distance was applied to verify the best band combination if 2,3,4 or 5 TM bands were used. A classification algorithm based on the maximum likelihood decision rule was then employed to classify the study area using the designated TM bands. Classification performances were compared pixel-by-pixel on alphanumeric printouts, the computer time consumed, the classification matrices and the upper bounds of the probability of error. After these analyses, the TM bands which should be used for an effective digital analysis of this agricultural scene were decided. Author

N87-12032*# Illinois Natural History Survey, Urbana. Thematic Mapper Working Group.
INTERPRETING FOREST AND GRASSLAND BIOME PRODUCTIVITY UTILIZING NESTED SCALES OF IMAGE RESOLUTION AND BIOGEOGRAPHICAL ANALYSIS Progress Report
L. R. IVERSON, E. A. COOK, R. L. GRAHAM (Oak Ridge National Lab., Tenn.), J. S. OLSON, T. FRANK (Illinois Univ., Urbana), Y. KE, C. TREWORGY (Illinois State Geological Survey, Urbana), and P. G. RISSER (New Mexico Univ., Albuquerque) 1986 21 p
(Contract NAS5-78781)
(NASA-CR-179739; NAS 1.26:179739; PR-2) Avail: NTIS HC A02/MF A01 CSCL 02C

Several hardware, software, and data collection problems encountered were conquered. The Geographic Information System (GIS) data from other systems were converted to ERDAS format for incorporation with the image data. Statistical analysis of the relationship between spectral values and productivity is being pursued. Several project sites, including Jackson, Pope, Boulder, Smokies, and Huntington Forest are evolving as the most intensively studied areas, primarily due to availability of data and time. Progress with data acquisition and quality checking, more details on experimental sites, and brief summarizations of research results and future plans are discussed. Material on personnel, collaborators, facilities, site background, and meetings and publications of the investigators are included. B.G.

N87-12034*# Washington State Univ., Pullman. Dept. of Agronomy and Soils.
SPECTRAL CHARACTERISTICS AND THE EXTENT OF PALEOSOLS OF THE PALOUSE FORMATION Semiannual Progress Report
B. E. FRAZIER, A. BUSACCA, Y. CHENG, D. WHERRY, J. HART, and S. GILL 1986 12 p
(Contract NAS5-28758)
(NASA-CR-179727; NAS 1.26:179727; SAPR-2) Avail: NTIS HC A02/MF A01 CSCL 08G

Spectral relationships were investigated for several bare soil fields which were in summer fallow rotation on the date of the imagery. Printouts of each band were examined and compared to

aerial photography. Bands with dissimilar reflectance patterns for known areas were then combined using ratio techniques which were proven useful in other studies (Williams, 1983). Selected ratios were Thematic Mapper (TM) 1/TM4, TM3/TM4, and TM5/TM4. Cluster analyses and Baysian and Fastclass classifier images were produced using the three ratio images. Plots of cluster analysis outputs revealed distinct groupings of reflectance data representing green crops, ripened crops, soil and green plants, and bare soil. Bare soil was represented by a line of clusters on plots of the ratios TM5/TM4 and TM3/TM4. The soil line was investigated further to determine factors involved in the distributin of clusters alone the line. The clusters representing the bare soil line were also studied by plotting the Tm5/TM4, TM1/TM4 dimension. A total of 76 soil samples were gathered and analyzed for organic carbon. Author

N87-12036*# Smithsonian Institution, Washington, D. C. Center for Earth and Planetary Studies.
ENVIRONMENTAL PROCESSES AND SPECTRAL REFLECTANCE CHARACTERISTICS ASSOCIATED WITH SOIL EROSION IN DESERT FRINGE REGIONS Semiannual Report
P. A. JACOBBERGER 11 Aug. 1986 53 p
(Contract NAS5-28774)
(NASA-CR-179729; NAS 1.26:179729) Avail: NTIS HC A04/MF A01 CSCL 08M

Two Thematic Mapper (TM) scenes were acquired. A scene was acquired for the Bahariya, Egypt field area, and one was acquired covering the Okavango Delta site. Investigations at the northwest Botswana study sites have concentrated upon a system of large linear (alab) dunes possessing an average wavelength of 2 kilometers and an east-west orientation. These dunes exist to the north and west of the Okavango Swamp, the pseudodeltaic end-sink of the internal Okavango-Cubango-Cuito drainage network. One archival scene and two TM acquisitions are on order, but at present no TM data were acquired for the Tombouctou/Azaouad Dunes, Mali. The three areas taken together comprise an environmental series ranging from hyperarid to semi-arid, with desertization processes operational or incipient in each. The long range goal is to predict normal seasonal variations, so that aperiodic spectral changes resulting from soil erosion, vegetation damage, and associated surface processes would be distinguishable as departures from the norm. B.G.

N87-12063# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Fysische Meteorologie.
TERRAIN CLASSIFICATION FOR REGIONAL TRANSPORT MODELS [TERREINCLASSIFICATIE VOOR REGIONALE VERSPREIDINGSMODELLEN]
G. H. L. VERVER 1986 31 p In DUTCH
(KNMI-TR-81(FM); B8666194; ISSN-0169-1708; ETN-86-98499)
Avail: NTIS HC A03/MF A01

Terrain classification data and derived meteorological parameters for regional pollution transport models are presented. The data bases which contain land cover and soil data are based on a large number of maps; 52 different land types are classified according to height and density of surface elements, variation of land cover with season, and soil humidity. Twenty-one classes of soil are distinguished according to color and structure of the soil and water permeability. ESA

N87-12974*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DESTRIPING AIS DATA USING FOURIER FILTERING TECHNIQUES
C. HLAVKA *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 74-80 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Airborne Imaging Spectrometers (AIS) data collected in 1984 and 1985 showed pronounced striping in the vertical and horizontal directions. This striping reduced the signal to noise ratio so that features of the spectra of forest canopies were obscured or altered by noise. This noise was removed by application of a notch filter to the Fourier transform of the imagery in each waveband. Author

N87-12982*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF AIS DATA OF THE BONANZA CREEK EXPERIMENTAL FOREST, ALASKA
M. A. SPANNER and D. L. PETERSON *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 144-152 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Airborne Imaging Spectrometer (AIS) data were acquired in 1985 over the Bonanza Creek Experimental Forest, Alaska for the analysis of canopy characteristics including biochemistry. Concurrent with AIS overflights, foliage from fifteen coniferous and deciduous forest stands were analyzed for a variety of biochemical constituents including nitrogen, lignin, protein, and chlorophyll. Preliminary analysis of AIS spectra indicates that the wavelength region between 1450 to 1800 namometers (nm) displays distinct differences in spectral response for some of the forest stands. A flat field subtraction (forest stand spectra - flat field spectra) of the AIS spectra assisted in the interpretation of features of the spectra that are related to biology. Author

N87-12983*# Washington Univ., St. Louis, Mo. Center for the Space Sciences.
SOIL TYPES AND FOREST CANOPY STRUCTURES IN SOUTHERN MISSOURI: A FIRST LOOK WITH AIS DATA
G. M. GREEN and R. E. ARVIDSON *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 153-161 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Spectral reflectance properties of deciduous oak-hickory forests covering the eastern half of the Rolla Quadrangle were examined using Thematic Mapper (TM) data acquired in August and December, 1982 and Airborne Imaging Spectrometer (AIS) data acquired in August, 1985. For the TM data distinctly high relative reflectance values (greater than 0.3) in the near infrared (Band 4, 0.73 to 0.94 micrometers) correspond to regions characterized by xeric (dry) forests that overlie soils with low water retention capacities. These soils are derived primarily from rhyolites. More mesic forests characterized by lower TM band 4 relative reflectances are associated with soils of higher retention capacities derived predominately from non-cherty carbonates. The major factors affecting canopy reflectance appear to be the leaf area index (LAI) and leaf optical properties. The Suits canopy reflectance model predicts the relative reflectance values for the xeric canopies. The mesic canopy reflectance is less well matched and incorporation of canopy shadowing caused by the irregular nature of the mesic canopy may be necessary. Preliminary examination of high spectral resolution AIS data acquired in August of 1985 reveals no more information than found in the broad band TM data. Author

N87-12984*# Geological Survey, Reston, Va.
GEOBOTANICAL STUDIES AT PILOT MOUNTAIN, NORTH CAROLINA USING THE AIRBORNE IMAGING SPECTROMETER SPECTROMETER
N. M. MILTON, P. A. WALSH, and T. L. PURDY *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 162-170 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Airborne Imaging Spectrometer (AIS) data were acquired for several vegetation types within the humid temperate eastern United States. The spectral region covered, 0.9 to 2.1 microns, was little used in vegetation studies. A preliminary analysis of spectral curves suggests that variations between vegetation spectra may be useful for discriminating plant communities. Calibration and normalization procedures must be refined to compensate for cloud cover, detector and other system noise, and possible second-order effects. Author

N87-12985*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRACE ELEMENT-INDUCED STRESS IN FRESHWATER WETLAND VEGETATION: PRELIMINARY RESULTS
B. L. WOOD and L. H. BECK (California Univ., Berkeley.) *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 171-179 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Airborne Imaging Spectrometer (AIS) data were acquired over an area of freshwater wetlands in Central California on September 23, 1985. Plant samples were subsequently collected along the flight line with the goal of relating plant tissue chemistry to spectral reflectance in the near-infrared region. It was determined that a consistent relationship existed between spectral response and plant tissue chemistry. This was especially evident in the 1500 to 1700 nm region. Author

N87-12986*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PATTERNS OF VEGETATION IN THE OWENS VALLEY, CALIFORNIA
S. L. USTIN (California Univ., Berkeley.), B. N. ROCK, and R. A. WOODWARD *In its* Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 180-186 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Spectral characteristics of semi-arid shrub communities were examined using Airborne Imaging Spectrometer (AIS) data collected in the tree mode on 23 May 1985. Mesic sites with relatively high vegetation density and distinct zonation patterns exhibited greater spectral signature variations than sites with more xeric shrub communities. Spectral signature patterns were not directly related to vegetation density or physiognomy, although spatial maps derived from an 8-channel maximum likelihood classification were supported by photo-interpreted surface features. In AIS data, the principal detected effect of shrub vegetation on the alluvial fans is to lower reflectance across the spectrum. These results are similar to those reported during a period of minimal physiological activity in autumn, indicating that shadows cast by vegetation canopies are an important element of soil-vegetation interaction under conditions of relatively low canopy cover. Author

N87-12987*# Oregon State Univ., Corvallis. Environmental Remote Sensing Lab.
AIS SPECTRA OF DESERT SHRUB CANOPIES
R. MURRAY, D. L. ISAACSON, B. J. SCHRUMPF, W. J. RIPPLE, and A. J. LEWIS *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 187-193 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Airborne Imaging Spectrometer (AIS) data were collected 30 August 1985 from a desert shrub community in central Oregon. Spectra from artificial targets placed on the test site and from bare soil, big sagebrush (Artemesia tridentata wyomingensis), silver sagebrush (Artemesia cana bolander), and exposed volcanic rocks were studied. Spectral data from grating position 3 (tree mode) were selected from 25 ground positions for analysis by Principal Factor Analysis (PFA). In this grating position, as many as six factors were identified as significant in contributing to spectral structure. Channels 74 through 84 (tree mode) best characterized between-class differences. Other channels were identified as nondiscriminating and as associated with such errors as excessive atmospheric absorption and grating positin changes. The test site was relatively simple with the two species (A. tridentata and A. cana) representing nearly 95% of biomass and with only two mineral backgrounds, a montmorillonitic soil and volcanic rocks. If, as in this study, six factors of spectral structure can be extracted from a single grating position from data acquired over a simple vegetation community, then AIS data must be considered rich in information-gathering potential. Author

N87-12989# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REPORT ON THE ACTIVITIES OF THE IRRIGATED CROP SURVEY IN SAO PAULO STATE FROM REMOTE SENSING PRODUCTS, PHASE 2 [RELATORIO DE ATIVIDADES DO PROJETO CADASTRAMENTO DE AREAS IRRIGADAS NO ESTADO DE SAO PAULO ATRAVES DE DADOS DE SENSORIAMENTO REMOTO, FASE 2]
S. DOSANJOSFERREIRAPINTO, E. M. LEAODEMORAESNOVO, M. V. FILHO, S. C. CHEN, and R. ROSA Jul. 1986 63 p In PORTUGUESE; ENGLISH summary Original document contains color illustrations
(INPE-3950-RPE/513) Avail: NTIS HC A04/MF A01

The methodology used in the project Irrigated Crop Survey in Sao Paulo State and its main results are presented. The project developed through a joint agreement between INPE/MCT and DAEE/S.P. The Itatiba/Braganca Paulista (SP) test site was selected. Sequential TM/LANDSAT data were applied with the objective of evaluating the total irrigated area. Field data were collected which permitted comparison between two methods for irrigated area estimation: direct expansion model using only field data collected in sample segments, regression model combining ground information extracted from remote sensing products. The performance of TM composites TM 2 (BLUE); TM 3 (GREEN) and TM 4 (RED); TM 5 (BLUE); TM 3 (GREEN) and TM 4 (RED) were compared to identify the best mix to detect irrigated crops. The results demonstrated that a reduction of 94.02% in the estimated variance was obtained by using the regression model. The comparison of the increase of date-to-date irrigated area from May to October showed that the 3 first overpasses were sufficient to map some 90% of the total irrigated area. The performance of the TM composites were not significantly different in relation to its potential for detecting irrigated crops. Author

N87-12992# Pacific Northwest Labs., Richland, Wash.
REMOTE SENSING TO DETECT ECOLOGICAL IMPACTS ASSOCIATED WITH ACID DEPOSITION Final Report
P. VANVORIS and G. E. WUKELIC May 1986 67 p
(Contract DE-AC06-76RL-01830)
(DE86-011649; EPRI-EA-4607) Avail: NTIS HC A04/MF A01

A planning study was conducted to determine the potential applications of remote sensing for detecting ecological impacts that have been reportedly caused by acid deposition. The project was divided into two phases: a technology assessment phase (Phase I) and a prototype demonstration (Phase II). The emphasis of the project was on detecting ecological change, not on determining the cause of that change. The latter is the role of ground-based research. Phase I consisted of an assessment of terrestrial and aquatic components that are indicative of sensitivity to acid deposition. The assessment identified remote sensing as the optimal cost-effective method for measuring the rate of change of land use, crop type, and forest canopy health over large geographic areas. In Phase II, spectral reflectance in the near-infrared region of the spectrum from forest canopies of Camel's Hump State Forest from two Landsat scenes from the summers of 1976 and 1983 were compared. Significant increases in spectral reflectance from the forest were detected when the pixels were compared, and it is hypothesized that this increase is indicative of a decline in forest growth and canopy closure. However, because of project limitations, no ground-truth data were collected by Battelle-Northwest scientists to verify the findings of the remote sensing analyses. A comprehensive research program is recommended to further investigate the use of remote sensing to detect ecological damage and its relationship to possible causative agents. Future research should also focus on the use of remote sensing for identifying ecosystems that may be sensitive to perturbations like acid deposition and improving our ability to model ecological processes. Priority should be given to detecting, monitoring, and modeling changes in forested watersheds. DOE

N87-13474# Centre National d'Etudes Spatiales, Toulouse (France).
STUDY OF VEGETATION AND POSEIDON TELEMETRY IN THE TMCU BAND [SPOT 3: ETUDE DE LA TRANSMISSION DES TELEMESURES VEGETATION ET POSEIDON DANS LA BANDE TMCU]
M. GRONDIN 23 Sep. 1985 22 p In FRENCH; ENGLISH summary
(CNES-CT/DRT/TIT/TR-168-T; ETN-86-98417) Avail: NTIS HC A02/MF A01

A solution to integrate the additional telemetry payloads of the SPOT 3 satellite in the spectrum of the satellite signal transmission is found. A frequency plan is proposed. Link power budgets and C/I ratios are calculated. It is shown that it is possible to transmit in the 8200 to 8310 MHz band all the telemetry signals. The detailed parameters are given. ESA

N87-13834# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF DATA OBTAINED FROM THE LANDSAT THEMATIC MAPPER FOR IMPLEMENTATION OF COLONIZATION PROJECTS OF THE MICROREGION OF THE UPPER PURUS RIVER, EASTERN ACRE STATE M.S. Thesis - Sep. 1985 [AVALIACAO DE DADOS OBTIDOS PELO TM LANDSAT PARA IMPLANTACAO DE PROJETOS DE COLONIZACAO DE MICROREGGIAO DO ALTO PURUS ESTADO DO ACRE]
A. LUCHIARI May 1986 74 p In PORTUGUESE; ENGLISH summary
(INPE-3907-TDL/226) Avail: NTIS HC A04/MF A01

The potential use of LANDSAT TM imagery to obtain information concerning drainage and vegetation in the Microregion of the Upper Purus River, Eastern Acre State, is evaluated in this study. An intense occupation process has taken place in this area by means of the establishment of several settlement projects. The information concerning both the drainage and vegetation are important data for the occupation planning, considering that such data are not available in this area. The analysis of the images through digital processing provided some auspicious results. The evaluation of these results allowed many considerations on the potential of LANDSAT TM imagery and its applicability in areas covered by tropical rain forests. Author

N87-13835*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AGRISTARS Research Report, Fiscal Year 1983
Jun. 1984 124 p Sponsored by NASA, USDA, Department of Commerce, Department of the Interior and the Agency for International Development Original contains color illustrations
(NASA-CR-171947; JSC-18920; NAS 1.26:171947) Avail: NTIS HC A06/MF A01 CSCL 02C

An introduction to the overall AgRISTARS program, a general statement on progress, and separate summaries of the activities of each project, with emphasis on the technical highlights are presented. Organizational and management information on AgRISTARS is included in the appendices, as is a complete bibliography of publication and reports. Author

N87-13836*# Washington Univ., Seattle. Dept. of Geological Sciences.
AN EVALUATION OF A SIRA IMAGE TO DETERMINE FOREST DENSITY UNDER CONDITIONS OF MODERATE TOPOGRAPHICAL VARIATION Final Report
M. SMITH and J. ADAMS Oct. 1985 10 p Sponsored by NASA
(NASA-CR-179956; JPL-9950-1194; NAS 1.26:179956) Avail: NTIS HC A02/MF A01 CSCL 02F

Many studies have shown that radar images have increased classification accuracy over spectral classifications using only LANDSAT Multispectral Band Scanner (MSS) images. It was the objective to determine if a SIRA image taken over Hayfork when used alone or inconjuction with LANDSAT MSS data would increase separation of units not identified by LANSAT spectral mixture models. Areas in the LANDSAT model of varying vegetation density (0 to 50%) that had proven to be accurate by field surveys were compared. It was found in the Hayfork area that SIRA did not increase or help delineation of vegetation or ultramific units over LANDSAT MSS. B.G.

N87-13838*# Hunter Coll., New York. Dept. of Geology and Geography.
PRELIMINARY EVALUATION OF THE AIRBORNE IMAGING SPECTROMETER FOR VEGETATION ANALYSIS IN THE KLAMATH NATIONAL FOREST OF NORTHEASTERN CALIFORNIA Final Report
A. H. STRAHLER, C. E. WOODCOCK, and F. X. AVILA 31 May 1985 46 p
(Contract JPL-956585)
(NASA-CR-179964; NAS 1.26:179964; TR-1) Avail: NTIS HC A03/MF A01 CSCL 02F

The experiences and results associated with a project entitled Preliminary Evaluation of the Airborne Imaging Spectrometer for Vegetation Analysis is documented. The primary goal of the project was to provide ground truth, manual interpretation, and computer processing of data from an experimental flight of the Airborne Infrared Spectrometer (AIS) to determine the extent to which high spectral resolution remote sensing could differentiate among plant species, and especially species of conifers, for a naturally vegetated test site. Through the course of the research, JPL acquired AIS imagery of the test areas in the Klamath National Forest, northeastern California, on two overflights of both the Dock Well and Grass Lake transects. Over the next year or so, three generations of data was also received: first overflight, second overflight, and reprocessed second overflight. Two field visits were made: one trip immediately following the first overflight to note snow conditions and temporally-related vegetation states at the time of the sensor overpass; and a second trip about six weeks later, following acquisition of prints of the images from the first AIS overpass. Author

N87-13848# Centre National d'Etudes Spatiales, Toulouse (France).
VEGETATION IN X-BAND. LINK ANALYSIS [BILAN DE LIAISON VEGETATION EN BANDE X]
L. FRECON 16 Oct. 1985 16 p In FRENCH; ENGLISH summary
(CNES-85/181/CT/DRT/TIT/TR; ETN-86-98418) Avail: NTIS HC A02/MF A01

The link budget for the transmission of vegetation images of the SPOT-3 X band to the ground is examined. The frequency of 8.25 GHz is chosen to follow international regulations. The details of the transmission system are described. It is shown that it is possible to limit the ground station antenna diameter to 2m, which requires 6W transmission power. ESA

N87-13849# Centre National d'Etudes Spatiales, Toulouse (France).
TRANSMISSION OF VEGETATION TELEMETRY IN THE TMCU BAND [SPOT 3: TRANSMISSION DE LA TELEMESURE VEGETATION DANS LA BANDE TMCU, COMPLEMENT D'ETUDE]
M. GRONDIN 30 Oct. 1986 6 p In FRENCH; ENGLISH summary
(CNES-CT/DRT/TIT/TR/190-T; ETN-86-98419) Avail: NTIS HC A02/MF A01

The possibility to enhance the power emitted by the vegetation mission of the SPOT-3 satellite was studied in order to allow reception of the signal by a 2m diameter antenna. Compatibility with CCIR requirements and jamming of the SPOT-3 signal by vegetation are examined. The analysis shows no major obstacle to increasing transmission power in the X band. ESA

N87-14764# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF THE BURNED AREA AND REGENERATION OF VEGETATION AFFECTED BY THE FIRE IN THE PARQUE NACIONAL DE BRASILIA THROUGH TM/LANDSAT DATA [AVALIACAO DA AREA QUEIMADA E DA REGENERACAO DA VEGETACAO AFETADA PELO FOGO NO PARQUE NACIONAL DE BRASILIA ATRAVES DE DADOS DO TM/LANDSAT]
F. J. PONZONI, D. C. L. LEE, and P. H. FILHO Nov. 1986 24 p In PORTUGUESE; ENGLISH summary
(INPE-4035-RPE/522) Avail: NTIS HC A02/MF A01

A study utilizing TM/LANDSAT multitemporal images in the monitoring, burned area evaluation and the vegetation regeneration following a fire is done in the Parque Nacional de Brasilia (PNB). Author

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.

A87-10372
THE APPLICATIONS OF HIGH RESOLUTION SATELLITE DATA FOR COASTAL MANAGEMENT AND PLANNING IN A PACIFIC CORAL ISLAND
L. LOUBERSAC and J. POPULUS (Institut Francais de Recherches pour l'Exploitation de la Mer, Brest, France) Geocarto International, no. 2, 1986, p. 17-31. refs

Coastal tropism is a worldwide phenomenon. It induces urgent needs for observation, inventories, and management of coastal environment, mainly in developing countries. High resolution satellite data may solve some aspects of the problems. Three examples based upon the potential use of shrimp aquaculture sites in tropical salt marshes, the biotopes mapping in coral reef environments for biologic stock assessments, and the characterization and quantification of evolutionary stages of coral platforms are developed. All three are relative to the same tropical Pacific Island with respect, for the first and second examples, to actual needs for the management of mangroves and coral reefs and for the third, to a scientific approach related to the evolutionary theory of reef platforms in lagoons. Methodology and results based upon digital image processing and computer assisted photointerpretation are exposed. New trends in digital processing and associated digital cartography are listed. Author

A87-10373
MICRO COMPUTER-BASED GEOGRAPHIC INFORMATION SYSTEM TECHNOLOGY FOR RESOURCE ASSESSMENT AND RURAL DEVELOPMENT PLANNING
G. SCHULTINK (Michigan State University, East Lansing) Geocarto International, no. 2, 1986, p. 33-43.

A87-14168
APPLICATIONS OF LANDSAT DATA AND THE DATA BASE APPROACH
D. T. LAUER (USGS, Sioux Falls, SD) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Aug. 1986, p. 1193-1199. refs

A generalized methodology for applying digital Landsat data to resource inventory and assessment tasks is currently being used by several bureaus and agencies within the U.S. Department of the Interior. The methodology includes definition of project objectives and output, identification of source materials, construction of the digital data-base, performance of computer-assisted analyses, and generation of output. The U.S. Geological Survey, Bureau of Land Management, U.S. Fish and Wildlife Service, Bureau of Indian Affairs, Bureau of Reclamation, and National Park Service have used this generalized methodology to assemble comprehensive digital data bases for resource management. Advanced information processing techniques have been applied to these data bases for making regional environmental surveys on millions of acres of public lands at costs ranging from $0.01 to $0.08 an acre. Author

A87-15601*
INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, 19TH, ANN ARBOR, MI, OCTOBER 21-25, 1985, PROCEEDINGS. VOLUMES 1 & 2
Symposium organized by the Environmental Research Institute of Michigan; Sponsored by the Canada Centre for Remote Sensing, Environmental Research Institute of Michigan, NASA, et al. Ann Arbor, MI, Environmental Research Institute of Michigan, 1986. Vol. 1, 580 p.; vol. 2, 582 p. For individual items see A87-15602 to A87-15698.

The technology and applications of terrestrial remote sensing (RS) are discussed in reviews and reports. Topics examined include the future of the NASA earth-sciences program, NOAA plans for earth observations in the 1990s, space RS in France, international coordination of RS satellite programs, and applications of geocoded imagery. Consideration is given to spatial and tabular databases for order-three soil surveys, an AVHRR and Landsat regional inventory of irrigated agriculture, classification of wetlands, microwave radiometry of ocean surface winds and sea ice, and floodplain land-cover mapping with Thematic-Mapper data. T.K.

A87-15604#
INTERNATIONAL COORDINATION OF AND CONTRIBUTIONS TO ENVIRONMENTAL SATELLITE PROGRAMS
L. R. SHAFFER (NOAA, National Environmental Satellite, Data and Information Service, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 49-65.

A87-15605#
APPLICATIONS OF EUROPEAN ENVIRONMENTAL SATELLITES
C. HONVAULT (ESA, Paris, France) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 67-74. refs

Nonmeteorological applications of the ESA Meteosat series of GEO satellites and ERS-1 (planned launch 1989) are surveyed. Meteosat uses examined include sea-surface-temperature extraction for fisheries use, solar-radiation mapping to plan solar-energy facilities, drought monitoring over Africa, and transmission of in situ environmental measurements via the Meteosat data-collection system. The value of the ERS-1 altimeter, ATSR, and C-band active microwave instrumentation for different types of applications is indicated in a table and briefly discussed. T.K.

A87-15614#
SEGMENTATION AND SPATIAL ANALYSIS OF URBAN SCENES
R. W. CONNERS, C. A. HARLOW, and M. M. TRIVEDI (Louisiana State University, Baton Rouge) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 205-225. refs
(Contract DAAG29-82-K-0189)

The accuracy of segmentation and spatial analysis of high resolution scenes requires robust computer vision system methodologies. In particular it seemingly requires capable early vision operators, ones capable of matching a level of human performance. In this paper the development of such operators is described. These operators make certain perceptual organization principles explicit. Hence it is hoped they will provide a mechanism

by which scene specific information will not have to be applied at the first stages of the analysis process. Author

A87-15622#
SIR-A AND LANDSAT MSS OBSERVATIONS OF EOLIAN SAND DEPOSITS ON THE AL LABBAH PLATEAU, SAUDI ARABIA
G. L. BERLIN (USGS, Saudi Arabian National Center for Science and Technology, Flagstaff, AZ), M. A. TARABZOUNI, K. M. SHEIKHO, and A. AL-NASER (Saudi Arabian National Center for Science and Technology, Riyadh, Saudi Arabia) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 311-321. Research supported by the Saudi Arabian National Center for Science and Technology. refs

A87-15629#
ENVIRONMENTAL CHANGE ANALYSIS OF TOKYO DURING 1972/1985 BY LANDSAT MSS AND TM DATA
T. SUGIMURA, S. TANAKA (Remote Sensing Technology Center of Japan, Tokyo), and K. KAMEDA (Nihon University, Tokyo, Japan) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 393-404.

A87-15638#
A STUDY OF THE LAND USE INVESTIGATION USING THE SIR-A IMAGE
X. TENG (Chinese Academy of Sciences, Changchun Institute of Physics, People's Republic of China), J. LIU (Chinese Academy of Sciences, Institute of Remote Sensing Application, Beijing, People's Republic of China), and J. XIAO (Chinese Academy of Sciences, Institute of Geochemistry, Guiyang, People's Republic of China) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 491-500. refs

A SIR-A image in the south of Tianjin acquired in November 1981 was interpreted manually with the aid of an image-processing system. The methods of image processing involved density slicing with statistical training, producing normalized false-color composite images through coregistration of the SIR-A and Landsat-MSS-image data sets, and unsupervised clustering classification to different images. The land-use interpretation keys for the SIR-A image were established after investigation in situ and analysis of soil dielectric and moisture properties. The research indicates that the SIR-A data can remedy some defects of Landsat MSS data due to the better response of SIR-A to residential areas and linear features. The SIR-A/Landsat-MSS normalized composite image incorporated the strong points of both. Author

A87-15672#
MONITORING DESERTIFICATION THROUGH DETECTION OF LAND COVER CHANGES BY ALBEDO MAPPING WITH AVHRR DATA
N. E. G. ROLLER, J. E. COLWELL (Michigan, Environmental Research Institute, Ann Arbor), and R. AGGARWALA (Michigan, University, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 809-820. refs

A87-15680#
THE STUDY OF URBAN CLIMATES THROUGH THERMAL IMAGES FROM METEOROLOGICAL SATELLITES
M. A. LOMBARDO (Sao Paulo, Universidade, Brazil) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 885-890. refs

Eight NOAA-7/8 thermal images of the Greater Sao Paulo region are analyzed to obtain temperature maps. The temperatures calculated for different locations are presented in tables and briefly characterized. It is found that the temperature at the city center is higher than that of the surrounding rural area by 10 C or more, especially during stable conditions with low winds. T.K.

A87-15781* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULTANEOUS EARTH OBSERVATIONS FROM TWO SATELLITES
H. E. MONTGOMERY (NASA, Goddard Space Flight Center, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Sept. 1986, p. 1083-1087. Previously announced in STAR as N85-27325.

Simultaneous co-located observations from two different orbits lead to several advantages (i.e., cross calibration of sensors and a wider range of solar-zenith and sensor look angles). The question was asked how many times per year (on the average) do the sub-satellite points of two satellites simultaneously come within D kilometers of each other? For the Space Station (altitude: 500 km, inclination: 28 deg) and a Sun synchronous satellite (altitude 705 km, inclination 98.21 deg) the answers are 16, 41 and 82 times per year for encounter distances D of 20, 50, and 100 km respectively. The relationship between encounters per year and distance D is linear. The answers were obtained in two ways: (1) a closed form statistical approach which led to a simple algebraic expression, and (2) a Monte Carlo type computer solution. The largest difference between the two solutions was less than 12 percent. Author

A87-16433#
REMOTE SENSING IN MONITORING NATURAL RESOURCES AND ENVIRONMENTAL HAZARDS IN THE INDIAN DESERT
S. SINGH and K. A. SHANKARNARAYAN (Central Arid Zone Research Institute, Jodhpur, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 35-41.

Based on airborne, spaceborne and ground data, major natural resources viz; landforms, soils, vegetation, surface and ground water resources have been identified and mapped. Since the landforms are more conspicuously visible on aerial photographs and Landsat imageries than other resources, identification, delineation and mapping of these resources is based on the geomorphological findings. Some resources like landforms and vegetation were digitally analyzed and evaluated. The extent of the areas desertified under different landforms (ecosystems) by water erosion, wind erosion/deposition and salinity/alkalinity hazards has been mapped and computed. The computer analysis of Landsat MSS band 5 has made it possible to digitally classify and evaluate the vulnerability of the landforms to different environmental hazards. Author

A87-16438#
REMOTE SENSING FOR PLANNING - EXAMPLES FROM SRI LANKA
S. JAYATILAKE, M. BICHSEL, and R. HUMBEL (Survey Department, Centre for Remote Sensing, Colombo, Sri Lanka) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 68-76. refs

The use of remote sensing for planning is considered. The acquisition and availability of satellite images of Sri Lanka are discussed. The development of a land use map, based on a 24 categories land use classification system, is described. In Sri Lanka the main purpose of the satellite data is for land use and landscape planning, agriculture, urban development, forestry planning, plantation crop management, coastal monitoring and protection, and archeology. Three examples of remote sensing applications in Sri Lanka (the improvement of infrastructure for the tea industry, rice yield forecasting, and cattle breeding) are presented. I.F.

A87-16440#
ENVIRONMENTAL GEOMORPHOLOGY AND LANDSCAPE MANAGEMENT OF TAMILNADU USING REMOTE SENSING DATA
M. SAMBASIVA RAO (Madurai Kamaraj University, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 85-91. refs

A87-16442#
LAND COVER CLASSIFICATION BY THEMATIC MAPPER DATA OF LANDSAT SATELLITE
H. MASAHARU, H. MURAKAMI, and I. KAMIYA (Ministry of Construction, Geographical Survey Institute, Yatabe, Japan) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 97-102. Research supported by the Science and Technology Agency of Japan.

The application of an image classification system based on the maximum likelihood method to Landsat Thematic Mapper (TM) data is studied. The procedures, hardware system, and software programs utilized in the classification process are described. The need for proper selection of classification categories and training areas are discussed. Examples revealing the classification of TM data for the Ishikawa and Osaka regions are presented. I.F.

A87-16443#
MAPPING AND CHANGE DETECTION IN URBAN LAND USE OF SURAT CITY
M. H. KALUBARME, B. SAHAI (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), and S. U. AVARANI (Town Planning and Valuation Department of Gujarat, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 103-108.

A study was undertaken to map the urban land use and monitor the urban spread and direction of growth of Surat city using remote sensing techniques. The aerial color infrared (CIR) and black-and-white (B/W) imagery on 1:50,000 and 1:30,000 scale acquired during November 1980 and May 1981 were interpreted for detailed mapping of urban land use, transport network, slum typologies, quality and density of housing, residential encroachment on agricultural land, and open spaces in the city. The CIR imagery on 1:30,000 scale was found to be very useful for interpretation of detailed urban land use. The Landsat data of Surat city and its environs acquired during December 1972, December 1978 and May 1984 were analyzed both by visual as well as digital analysis techniques for monitoring changes in urban land use and deducing the growth pattern of the city. The supervised and unsupervised classification techniques were attempted to classify the urban built-up land as dense, moderate and sparse. Different enhancement techniques e.g. linear stretching, ratio of MSS 7/MSS 5, MSS 4/MSS 6 and principal component analysis have been found useful for discrimination of built-up land. Author

A87-16444#
A STUDY OF SIR-A IMAGE APPLICATION TO LAND USE INVESTIGATION
J. LIU (Chinese Academy of Sciences, Institute of Remote Sensing Applications, Beijing, People's Republic of China), X. TENG (Chinese Academy of Sciences, Changchun Institute of Physics, People's Republic of China), and J. XIAO (Chinese Academy of Sciences, Institute of Geochemistry, Guiyang, People's Republic of China) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 109-114.

The use of SIR-A images for land use investigation is studied. An SIR-A image of Tangguantum in Jinghai County, China collected on November 1981 was interpreted and processed. The effects of the dielectric properties of soil and surface characteristics on the gray-scale values of SIR-A images are investigated, and an image interpretation key for land-use types is derived. The classification accuracy of the land use interpretation of the image is evaluated and it is determined that SIR-A images are applicable to land use investigations. I.F.

A87-16466#
ENVIRONMENTAL AND RESOURCE ASSESSMENTS BY MEANS OF METRIC MULTISPECTRAL PHOTOGRAPHY
K.-H. MAREK, K.-H. JOHN (Akademie der Wissenschaften der DDR, Zentralinstitut fuer Physik der Erde, Potsdam, East Germany), and S. JAEHN IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 252-257.

A87-16475#
SPECIFIC LAND USE AND SOCIOECONOMIC STUDIES OF RURAL SETTLEMENTS THROUGH CIR IMAGERIES
D. NIYOGI and S. R. ROY (Indian Institute of Technology, Kharagpur, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 316-321.

A87-16504#
ASSESSMENT OR RESOLUTION CAPACITY OF LANDSAT TM AND MSS DATA IN INDIAN METROPOLITAN AREAS
V. SHARMA, S. KESAVAN, N. C. GAUTAM, and L. R. A. NARAYAN (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 493-497.

A study is conducted to assess the resolution capability of Landsat Thematic Mapper (TM) data via delineation of the following in India's metropolitan areas: (1) transport networks, (2) residential patterns, (3) industrial complexes, and (4) recreational centers. A comparison is made with corresponding Multispectral Scanner images and it is found that TM data are of a much higher quality. It is noted tha bands 4, 5, and 7 may be instrumental in the study of cultural features. K.K.

A87-16513#
COMPUTER PROCESSING OF LANDSAT DATA TO IDENTIFY AND MAPPING OF ENVIRONMENTAL HAZARDS IN PARTS OF ANDHRA PRADESH
G. CH. CHNNAIAH, L. VENKATRATNAM, and L. R. A. NARAYAN (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 552-557.

An area of about 8500 sq/kms in parts of Andhra Pradesh, India, has been surveyed using Landsat MSS data to delineate and map the spatial distribution of land use and land cover association with the help of computer systems such as Multi Spectral Data Analysis System (MDAS) and Multi Spectral Interactive Data Analysis System (MIDAS) available with National Remote Sensing Agency (NRSA), Hyderabad. Environmental hazards like aeolian and gully eroded areas and an indication of desertification conditions are found in an area of about 800 sq/kms around Hazipuram, Kanigiri and Chinnagollapalli villages in Prakasam district of Andhra Pradesh. Different classification Algorithms viz., Maximum likelihood, Minimum distance and parallellopiped developed at NRSA have been utilized to classify the Landsat data. Author

A87-16514#
A LANDSAT STUDY FOR ECO-DEVELOPMENT STRATEGY AROUND PALNI HILLS OF WESTERN GHATS IN TAMIL NADU
B. SUKUMAR (Centre for Earth Science Studies, Trivandrum, India), V. RAGHAVASWAMY, and N. C. GAUTAM (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 558-563. refs

The Palni Hills in Tamil Nadu constitute the biocomplex of Western Ghats with a relief of 400 to 2400 meters above mean sea level. The once-dense vegetation cover of the hills is being-disturbed due to the human intervention. Present study used

multidate Landsat FCC imagery of February 1973 and January 1982 and mapped land-use/land-cover categories using visual interpretation techniques. The study concludes that Landsat imagery, integrated with other types of data, provides a useful base for environmental monitoring and development studies.
Author

A87-16526#
MONITORING LAND USE AND URBAN AREAS COVER MONASTIR (TUNISIA) USING SPACEBORNE SAR AND MSS COREGISTERED DATA
PH. REBILLARD and P. N. PASCAUD (Societe Europeenne de Propulsion, Puteaux, France) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 627-632. refs

A87-18464
MEASUREMENT OF THE EARTH'S SURFACE ROUGHNESS BY LANDSAT DATA AND THE RECIPROCITY LAW ON SURFACE SCATTERING
H. OKAYAMA (Chiba University, Japan) and I. OGURA (Tokyo, University, Japan) IN: Space exploitation and utilization; Proceedings of the Symposium, Honolulu, HI, December 15-19, 1985 . San Diego, CA, Univelt, Inc., 1986, p. 199-209. refs
(AAS PAPER 85-622)

A measurement and evaluation of the earth's surface roughness are made by obtaining the indicatrices of radiation over the sand of a seashore, a downtown area of Tokyo, and some of its suburban areas by the use of Landsat MSS data. When the earth's surface roughness is obtained from Landsat MSS data, an assumption of the reciprocity on light scattering is needed. Therefore an experimental verification of reciprocal response in light scattering from rough surfaces is made using ground glass and a sphere.
Author

N87-10527# Defense Mapping Agency Aerospace Center, St. Louis, Mo.
WORLD GEODETIC SYSTEM 1984
B. L. DECKER Apr. 1986 27 p Presented at the 4th International Geodetic Symposium on Satellite Positioning, Austin, Tex., 28 Apr. - 2 May 1986
(AD-A167570) Avail: NTIS HC A03/MF A01 CSCL 08E

The Defense Mapping Agency (DMA) has developed World Geodetic System 1984 (WGS 84) as a replacement for WGS 72. The defining parameters and reference frame orientation of the WGS 84 Ellipsoid, and the WGS 84 ellipsoidal gravity formula, are those of the internationally-sanctioned Geodetic Reference System 1980. The WGS 84 Earth Gravitational Model (EGM), complete through degree (n) and order (m) 180, was developed using various types of data. The low degree and order portion of the WGS 84 EBM (through n=m=41) was developed from a weighted least squares solution based on use of surface gravity data, satellite radar altimetry, laser and Doppler satellite tracking data, range difference data (from NAVASTAR satellites), and lumped coefficient data. The WGS 84 EGM coefficients above n=m=41 were determined from a spherical harmonic analysis of a worldwide residual 1 deg x 1 deg mean free-air gravity anomaly field from which the effect of the coefficients through n=m=41 had been removed. The WGS 84 Geoid was formed using a spherical harmonic expansion and the WGS 84 EGM (through n=m=180). Local Geodetic System-to-WGS 84 datum shifts are available for converting geodetic coordinates of approximately 80 local geodetic systems to WGS 84. GRA

N87-10661# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.
AN OBSERVATIONAL STUDY OF TROPICAL CLOUD CLUSTER EVOLUTION AND CYCLOGENESIS IN THE WESTERN NORTH PACIFIC
C. S. LEE and W. M. GRAY Sep. 1986 261 p
(Contract NSF ATM-84-19116)
(CSU-ASP-403) Avail: NTIS HC A12/MF A01

A combination of rawinsonde composite and individual case analyses using First GARP Global Experiment (FGGE) III-b data was used to study the evolution of precyclone tropical cloud clusters and those prominent cloud clusters which do not develop into tropical cyclones in the western North Pacific. These two types of cloud clusters are defined as genesis and nongenesis cases. The individual FGGE analyses indicate three possible large scale surges: the cross-equatorial surges, trade wind surges, or summer monsoon surges within the North Indian Ocean. A convection burst and a low-level vorticity buildup are generally found to be associated with these surges. Tropical cyclone formation generally occurs when these surges reach the inner region of the pre-cyclone cloud cluster. The results also indicate large variations between different individual formation cases.
Author

N87-11236*# Utah Univ., Salt Lake City. Center for Remote Sensing and Cartography.
FOLLOW-ON PROPOSAL IDENTIFYING ENVIRONMENTAL FEATURES FOR LAND MANAGEMENT DECISIONS
P. M. WRIGHT and M. K. RIDD 1986 26 p
(Contract NAGW-95)
(NASA-CR-179703; NAS 1.26:179703) Avail: NTIS HC A03/MF A01 CSCL 08B

Urban morphology (an examination of spatial fabric and structure), natural ecosystem (investigations emphasizing biophysical processes and patterns), and human ecosystem (emphasizing socio-economic and engineering parameters) were studied. The most critical variable, transpiration, in the ASPCON model, created by Jaynes (1978), describing the hydrology of aspen to conifer succession was studied to improve the accuracy. Transpiration is determined by a canopy transpiration model which estimates consumptive water use (CWU) for specific species and a plant activity index. Also studied was Pinyon-Juniper woodland erosion.
B.G.

N87-11301# Joint Research Centre of the European Communities, Ispra (Italy).
ANALYSIS OF MULTILEVEL MEASUREMENTS OF SPECTRAL SIGNATURES FOR LESS-FAVORED AREAS
G. MARRACHI, G. ANDREOLI, P. GRASSI, B. HOSGOOD, and M. VERBRUGGHE *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 361-363 Dec. 1985
Avail: NTIS HC A25/MF A01

The role of remote sensing in economically less-favored areas was studied using spectral signatures measured in situ; airborne radiometer data; and thematic mapper satellite data. Data analysis reveals the difficulties in comparing space and ground data owing to the heterogeneity of the spatial element from which they derive. The spectral signature concept is quite well defined at ground level while the spatial averaging effect becomes more important from higher view level (500 m) up to satellite level at which the effect due to mixed pixels can completely alter the results. The analysis is intended to provide the limits of a reliable classification based on spectral signatures. An attempt to develop the analysis on a multitemporal scale is described. ESA

N87-12064# Environmental Protection Agency, Research Triangle Park, N.C.

STANDARD REFERENCE PHOTOMETER NETWORK FOR VERIFICATION AND CERTIFICATION OF OZONE STANDARDS Final Report

C. F. SMITH and K. A. REHME May 1986 11 p (PB86-205465; EPA-600/D-86-107) Avail: NTIS HC A02/MF A01 CSCL 13B

A nationwide network of regionally located Standard Reference Photometers (SRP) for the assay of ozone concentrations has been established to allow state and local air monitoring agencies to compare their ozone standards with authoritative standards maintained and operated under closely controlled conditions. The SRP was developed by the National Bureau of Standards and the Environmental Protection Agency (EPA) as a highly stable, highly precise, computer-controlled instrument for the assay of ozone concentration. EPA's Environmental Monitoring System Laboratory at Research Triangle Park, N. C. is operating an SRP network in cooperation with EPA Regional Office or State Agencies. Currently, network sites are located in RTP, NC; Edison, N.J.; Chicago, Ill; Houston, Tex.; Denver, Col.; and Sacramento, Calif. Each network SRP was fabricated and certified by the NBS before deployment and is recertified annually by EPA. To date 86 comparisons of local 03 standards have been performed with the network SRP's. Of the 55 verifications of local 03 primary standards conducted, 46 comparison results (84%) were within the acceptable range (+ or - 3% agreement). Of the 31 verifications of local 03 transfer standards conducted, all 31 comparison results (100%) were within the acceptable range (+ or - 5% agreement) with 29 (94%) within + or - 3%. GRA

N87-12065# Environmental Protection Agency, Research Triangle Park, N.C. Environmental Monitoring Systems Lab.

GLOBAL ATMOSPHERIC BACKGROUND MONITORING FOR SELECTED ENVIRONMENTAL PARAMETERS BAPMON DATA FOR 1981. VOLUME 2: PRECIPITATION CHEMISTRY, CONTINUOUS ATMOSPHERIC CARBON DIOXIDE AND SUSPENDED PARTICULATE MATTER

Jun. 1985 201 p Sponsored in part by United Nations Environment Programme, World Meteorological Organization and NOAA

(PB86-208360; EPA-600/4-85-015-VOL-2; WMO/TD-47-VOL-2) Avail: NTIS HC A10/MF A01 CSCL 13B

The report is the seventh in series reporting precipitation data from stations participating in the World Meterological Organization's network. The report consists of tables of raw data received from network sites around the world. GRA

N87-12216# Canada Centre for Remote Sensing, Ottawa (Ontario).

INTEGRATION OF REMOTELY SENSED DATA AND GEOGRAPHIC INFORMATION SYSTEMS Abstract Only

D. G. GOODENOUGH *In* Canadian Information Processing Society Graphics Interface 1986: Proceedings 1 p 1986

Avail: Canadian Information Processing Society, 243 College Street, 5th Floor, Toronto, Ontario $30.00 Canada, $35.00 USA

Canada is heavily dependent upon the effective utilization of its resources. To better manage the resources, resource managers are increasingly turning to computer-based technologies. Two particularly important technologies for resource information management systems are remote sensing and geographic information systems (GIS). Operational resource managers are using the geographic information systems to store digital representations of their resource maps. Associated with these graphical digital maps are databases contaning the attributes of map features. The efforts in integrating remote sensing data and GIS are reviewed and the approach at the Canada Centre for Remote Sensing is presented. A brief discussion of the problem of exchanging data among geographic information systems will also be addressed. Author

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A87-10348

THE EXISTENCE OF A THIN LOW-VISCOSITY LAYER BENEATH THE LITHOSPHERE

C. H. CRAIG and D. MCKENZIE (Cambridge University, England) Earth and Planetary Science Letters (ISSN 0012-821X), vol. 78, no. 4, July 1986, p. 420-426. refs

The horizontal temperature gradient at the base of the lithosphere at an oceanic fracture zone, where plate of different ages is juxtaposed, is expected to drive a local circulation, the characteristics of which can be constrained by the amplitude, wavelength and age-dependence of the geoid. Two-dimensional numerical models of convection in a fluid layer overlain by a solid conducting lid have been used to generate theoretical geoid profiles at right angles to the fracture zone. Only a thin, low-viscosity layer provides a reasonable fit to the data. The best model so far obtained has a fluid layer 150 km thick with viscosity 1.5 times 10 to the 19th Pa s under a 75 km lid. Such a layer, which is incapable of transmitting strong horizontal shear stresses, could provide the decoupling mechanism between plate and deep mantle flow required to balance the forces on the plates. Author

A87-14774* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

NORTH AMERICAN-PACIFIC RELATIVE PLATE MOTION IN SOUTHERN CALIFORNIA FROM INTERFEROMETRY

G. A. LYZENGA and M. P. GOLOMBEK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Science (ISSN 0036-8075), vol. 233, Sept. 12, 1986, p. 1181-1183. NASA-supported research. refs

VLBI measurements of baselines crossing the San Andreas fault zone in southern California have provided observational constraints on rates of elastic tectonic strain accumulation. The single site located near this fault (the JPL site) moves in a direction concordant with the Pacific plate motion vector but at approximately half the net rate relative to North America. This motion agrees approximately in amount with geologically determined displacement rates on the San Andreas fault alone but not with the local strike of the fault. When considered together with complementary geodetic data, these results suggest a complex relation between the short-term accumulation of elastic strain and its permanent accommodation on existing faults. Author

A87-15647#

REGISTRATION OF SPACEBORNE SAR DATA TO LARGE SCALE TOPOGRAPHIC MAPS

E. H. MEIER and D. R. NUEESCH (Zuerich, Universitaet, Zurich, Switzerland) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 581-594. refs

This paper reviews the fundamentals of spaceborne-SAR data registration to topographic maps and shows a potential procedure applied to Seasat image data for a mountainous region. With the aid of control points, the Doppler frequencies and the pulse transit times are derived for use in image correlation. After deriving the squint angle and the slant ranges, taking into account the position and the motion of the platform as well as a digital terrain model, a geometric correction is applied through an indirect transformation. An average misregistration in azimuth and range of 30 m is achieved in an area of 74 x 76 km where elevations of 300 m and 2500 m above sea level occur. Author

A87-16001*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GLOBAL TRACKING NETWORKS FOR CRUSTAL DYNAMICS
R. J. COATES (NASA, Goddard Space Flight Center, Greenbelt, MD) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 7 p. refs
(IAF PAPER 86-301)

Highly accurate Satellite Laser Ranging (SLR) and Very-Long-Baseline Interferometry (VLBI) have been implemented by the NASA Crustal Dynamics Project and many cooperating groups in many countries to form global SLR and VLBI networks for geodetic measurements of global plate motion, plate deformation, regional deformations in areas of high earthquake activity, and accurate measurements of the earth's polar motion and changes in rotation rate. These systems are measuring vector baselines between stations to an accuracy of 2-5 cm. New improvements being implemented will improve the accuracy to about 1 cm. Author

A87-16445#
COST EFFECTIVE OPERATIONAL MAPPING USING SATELLITE REMOTE SENSING
H. D. MOORE, A. F. GREGORY, and J. GUERETTE (Gregory Geoscience, Ltd., PRISM Div., Ottawa, Canada) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 115-120. refs

Mapping techniques that have been developed for programs in Geology, Forestry, Land use, and Mine Waste Inventory, are presently being used to revise maps in the Canadian National Topographic Series at 1:250,000 and 1:50,000 scales. To date over 5000 maps covering an area in excess of 3 million square kilometers (approximately the area of India) have been completed. The cost effectiveness of this type of mapping is demonstrated by a benefit-to-cost ratio of at least 10 to 1. Author

A87-17865
SPHERICAL EARTH MODELLING OF THE SCALAR MAGNETIC ANOMALY OVER THE INDIAN REGION
M. RAJARAM and B. P. SINGH (Indian Institute of Geomagnetism, Bombay, India) Geophysical Research Letters (ISSN 0094-8276), vol. 13, Sept. 1986, p. 961-964. refs

A87-19361#
GPS RECEIVER TECHNOLOGIES
J. ASHJAEE (Trimble Navigation, Sunnyvale, CA) IN: Institute of Navigation, Annual Meeting, 42nd, Seattle, WA, June 24-26, 1986, Proceedings . Washington, DC, Institute of Navigation, 1986, p. 99-105. refs

Data obtained during the development of a multiple channel C/A code GPS receiver (the 4000S GPS SURVEYOR) for geodetic applications are presented. The accuracy of measured observables is discussed with emphasis placed on carrier phase, Doppler measurements, cycle slips and time tags. Also discussed is the impact of external error sources, i.e., satellite orbit errors, satellite clock errors, the ionosphere, and troposphere. BASELINER data processing and cycle slip/loss of lock concatination are also considered. K.K.

N87-11055*# Jet Propulsion Lab., California Inst. of Tech., Pasadena. Tracking Systems and Applications Section.
DEMONSTRATION OF THE FIDUCIAL CONCEPT USING DATA FROM THE MARCH 1985 GPS FIELD TEST
J. M. DAVIDSON, C. L. THORNTON, S. A. STEPHENS, S. C. WU, S. M. LICHTEN, J. S. BORDER, O. J. SOVERS, T. H. DIXON, and B. G. WILLIAMS *In its* The Telecommunications and Data Acquisition Report (date] p 301 - 306 15 Aug. 1986
Avail: NTIS HC A14/MF A01 CSCL 03A

The first field test of NASA's Global Positioning System (GPS) Geodetic Program took place in March of 1985. The principal objective of this test was the demonstration of the feasibility of the fiducial station approach to precise GPS-based geodesy and orbit determination. Other objectives included an assessment of the performance of the several GPS receiver types involved in these field tests and the testing of the GIPSY software for GPS data analysis. In this article, the GIPSY (GPS Inferred Positioning System) software system is described and baseline solutions are examined for consistency with independent measurements made using very long baseline interferometry. Author

N87-11270# Centre National d'Etudes Spatiales, Toulouse (France). Lab. d'Etudes et Recherches en Teledetection Spati
INFLUENCE OF TOPOGRAPHY AND THE ATMOSPHERE ON RADIOMETRIC MEASUREMENTS IN MOUNTAINOUS REGIONS: TESTS OF A SIGNAL INVERSION MODEL ON LANDSAT THEMATIC MAPPER (TM) DATA [INFLUENCE DE LA TOPOGRAPHIE ET DE L'ATMOSPHERE SUR LES MESURES RADIOMETRIQUES EN REGION MONTAGNEUSE: TEST D'UN MODELE D'INVERSION DU SIGNAL SUR DES DONNEES TM]
C. PROY and C. LEPRIEUR *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 191-197 Dec. 1985 In FRENCH; ENGLISH summary
Avail: NTIS HC A25/MF A01

Superposition of a digital terrain model on a Landsat image of the Pyrenees mountains was used to study altitude and exposure effects on the radiometry of each pixel and to assess correction methods. The influence of direct illumination, diffuse anisotropic illumination, and local relief was studied. A method for estimating atmospheric functions from image data was derived. The estimates are used in an inversion model that successively integrates the corrections. ESA

N87-13033# Air Force Geophysics Lab., Hanscom AFB, Mass.
BALLOON-BORNE, HIGH ALTITUDE GRAVIMETRY: THE FLIGHT OF DUCKY 1A (11 OCTOBER 1983) Interim Scientific Report, Nov. 1982 - Dec. 1985
A. R. LAZAREWICZ, B. J. SCHILINSKI, R. J. COWIE, C. L. RICE, P. MOSS, and L. N. CARTER (Bedford Research Associates, Mass.) 31 Dec. 1985 86 p
(Contract AF PROJ. 7600)
(AD-A169942; AFGL-TR-85-0342; AFGL-ERP-943) Avail: NTIS HC A05/MF A01 CSCL 08E

Gravity measurements from a high-altitude balloon were made in late September to verify global and upward-continued gravity models. The first flight was intended to provide balloon motion and environment data with a preliminary estimate of the quality of measured gravity values. A balloon operates in a dynamic, largely unpredictable environment; thus, the gravimeter senses accelerations due to balloon motions as well as gravitational acceleration. Independent measurements of balloon motions from an intertial navigation package (three accelerometers, three rate gyros, three-axis magnetometer and two tiltmeters) combined with ground tracking (X, Y and Z position and velocity) will allow for separation of balloon-induced accelerations from gravitational acceleration to 1 mGal, using tracking data to an accuracy of about 5 cm/sec in velocity for Eotvos corrections, and position to 1 m. This first engineering flight was planned to coincide with the lowest seasonal wind velocities over Holloman AFB, where AFGL has its permanent balloon launch facility. Mild wind velocities are desired to provide the most benign environment possible during the testing phase, and to keep the balloon within tracking range. The experiment design, launch, and flight operations, and a first look at the data are presented. GRA

N87-13880*# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
DEVELOPMENT OF HIGH ACCURACY AND RESOLUTION GEOID AND GRAVITY MAPS Final Technical Report, 1 Aug. 1983 - 31 Mar. 1985
E. M. GAPOSCHKIN 1986 33 p
(Contract NAG5-360)
(NASA-CR-179978; NAS 1.26:179978) Avail: NTIS HC A03/MF A01 CSCL 55O

Precision satellite to satellite tracking can be used to obtain high precision and resolution maps of the geoid. A method is demonstrated to use data in a limited region to map the geopotential at the satellite altitude. An inverse method is used to downward continue the potential to the Earth surface. The method is designed for both satellites in the same low orbit. Author

N87-14687*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEOSCIENCE LASER ALTIMETRY/RANGING SYSTEM (GLARS)
S. C. COHEN, J. J. DEGNAN, J. L. BUFTON, J. B. GARVIN, and J. B. ABSHIRE Sep. 1986 19 p
(NASA-TM-87803; REPT-87B0018; NAS 1.15:87803) Avail: NTIS HC A02/MF A01 CSCL 20E

The Geoscience Laser Altimetry Ranging System (GLARS) is a highly precise distance measurement system to be used for making extremely accurate geodetic observations from a space platform. It combines the attributes of a pointable laser ranging system making observations to cube corner retroreflectors placed on the ground with those of a nadir looking laser altimeter making height observations to ground, ice sheet, and oceanic surfaces. In the ranging mode, centimeter-level precise baseline and station coordinate determinations will be made on grids consisting of 100 to 200 targets separated by distances from a few tens of kilometers to about 1000 km. These measurements will be used for studies of seismic zone crustal deformations and tectonic plate motions. Ranging measurements will also be made to a coarser, but globally distributed array of retroreflectors for both precise geodetic and orbit determination applications. In the altimetric mode, relative height determinations will be obtained with approximately decimeter vertical precision and 70 to 100 meter horizontal resolution. The height data will be used to study surface topography and roughness, ice sheet and lava flow thickness, and ocean dynamics. Waveform digitization will provide a measure of the vertical extent of topography within each footprint. The planned Earth Observing System is an attractive candidate platform for GLARS since the GLAR data can be used both for direct analyses and for highly precise orbit determination needed in the reduction of data from other sensors on the multi-instrument platform. (1064, 532, and 355 nm)Nd:YAG laser meets the performance specifications for the system. Author

N87-14766# Analytic Sciences Corp., Reading, Mass.
AIDED-AIRBORNE GRAVITY GRADIOMETER SURVEY SYSTEM (GGSS) STUDY Final Report, Sep. 1983 - Sep. 1985
S. J. BRZEZOWSKI and R. C. MERENYI Mar. 1986 132 p
(Contract F19628-83-C-0146)
(AD-A170749; TASC-TR-4769-2; AFGL-TR-86-0059) Avail: NTIS HC A07/MF A01 CSCL 17G

Several mechanization variants of the GGSS baseline configuration have been analyzed to assure an optimal and robust design and to establish confidence in the various navigation back-up modes. The analysis determined the current and anticipated performance of several sensors, individually and then in appropriate combination with the GGSS. Until more of the full Global Positioning System (GPS) constellation is in place, the currently planned precise reference clock and altimeter aides are capable of providing the increased visibility intervals and navigation accuracies required for GGSS airborne testing and initial survey operations. Moving-receiver radio interferometry to GPS is the most promising approach for satisfying the stringent navigation accuracies which may be required for GGSS surface testing. Furthermore, an improved measurement of gravity can be attained by augmenting a GGSS aiding gravimeter with interferometrically derived position and velocity. GRA

04

GEOLOGY AND MINERAL RESOURCES

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

A87-13515
GEOLOGICAL ANALYSIS OF LANDSAT MSS DATA IN WUMIN-DAMINSHAN AREA - GUANGXI AUTONOMOUS REGION, CHINA
D. ZHANG (China Institute for Mining, Xuzhou, People's Republic of China), R. R. P. DEISTER, and D. J. BARR (Missouri-Rolla, University, Rolla) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 506-516.

A87-13516
A COMPARISON OF LINEARS AND CURVILINEARS MAPPED FROM DIGITALLY PROCESSED LANDSAT THEMATIC MAPPER DATA TO FAULTS DEPICTED ON GEOLOGIC MAPS
D. M. BAUMGARTEN (DMA, Louisville, KY) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 526-537. refs

Linear and curvilinears from thematic mapper (TM) data are compared to faults on geologic maps. The Wells Creek structure in Tennessee is examined and the characteristics of the structure are described. The Kuiper one-sample test, the Kuiper two-sample test, and the Mardia-Watson-Wheeler tests were performed on the data. The data reveal that the distribution of mapped faults is uniform; however, the TM data distribution is nonuniform with a strong E-NE trend. The fracturing and its effect on dolines, caves, and surface drainage are studied. It is noted that there is little correlation between the faults and TM data. I.F.

A87-13519
SPATIAL PATTERNS INTERPRETED FROM NOAA-N AVHRR SATELLITE DATA
R. K. HOLZ, P. L. PHILLIPS, and R. S. NEREM (Texas, University, Austin) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 705-714. Research supported by the University of Texas. refs

The spatial patterns on Advanced Very High Resolution Radiometer (AVHRR) data of the Nile delta, the northern part of the Eastern Desert, and the Sinai Peninsula of Egypt are examined for environmental resource assessment. The vegetation, sediment deposits, and water and desert areas observed on the AVHRR channel 1-5 images are described. It is detected that each channel has one or more advantage for interpreting spatial patterns on landscape and a comparison of channels is useful for improved identification of landscape. The geology of the Eastern Desert and Sinai Peninsula is analyzed. The presence of granite, clastic, and basaltic rocks, and alluvium and limestone are detected in the AVHRR images. I.F.

A87-13527* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ENHANCED ROCK DISCRIMINATION USING LANDSAT-5 THEMATIC MAPPER (TM) DATA
H. W. BLODGET (NASA, Goddard Space Flight Center, Greenbelt, MD), C. G. ANDRE (Smithsonian Institution, Washington, DC), and R. F. MARCELL (Science-Applications Research, Inc., Lanham, MD) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 912-921. refs

The application of TM data to rock discrimination is discussed. Sixteen specific terrains derived from geologic maps are examined on TM images of the Arabian shield obtained on Apr. 14, 1984; visual enhancement procedures are applied to the images. The rock types observed in the test site are described; the major sedimentary formations in the test area are laterite and sandstone. The data reveal that the layered rocks in the outcrop consist of a variety of metamorphosed volcanics, metamorphosed sediments, and amphibolite, and the intrusive complex is composed of several classes of mafic and acidic rocks. I.F.

A87-14167
A GEOLOGICAL EXAMPLE OF IMPROVING CLASSIFICATION OF REMOTELY SENSED DATA USING ADDITIONAL VARIABLES AND A HIERARCHICAL STRUCTURE
K. CONRADSEN and J. GUNULF (Danmarks Tekniske Hojskole, Lyngby, Denmark) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Aug. 1986, p. 1181-1187. refs
(Contract CEC-112-79-1-MPP(DK))

A87-14643
TECTONIC FRAMEWORK OF GROOVED TERRAIN ON GANYMEDE
R. BIANCHI, R. CASACCHIA, P. LANCIANO, S. POZIO (CNR, Istituto di Astrofisica Spaziale, Rome, Italy), and R. G. STROM (Arizona, University, Tucson) Icarus (ISSN 0019-1035), vol. 67, Aug. 1986, p. 237-250. refs

The Ganymede surface is distinct in that predominant surface features are grooves that all but obliterate the impact craters common to other objects in the solar system. The orientations of all grooves detected on the Ganymede surface with Voyager imagery were examined to find any regional or global patterns. The analysis was performed by plotting azimuthal frequency diagrams for the groove orientations. The database drew on images of 7200 grooves and 2600 prominent structures covering 35 percent of the Ganymede surface. Predominant NE-SW and NW-SE orientations of the grooves fit in with a global tectonic framework of great circles inclined 35-40 deg to the equatorial plane. The stress pattern could have been caused by rising and falling convection plumes. The limited amount of the surface imaged, however, will constrain models of the underlying tectonic evolution until the Galileo probe acquires more data. M.S.K.

A87-15636#
DISCRIMINATION OF GRANITOID ROCKS IN THE CENTRAL EASTERN DESERT OF EGYPT USING LANDSAT-MSS AND SIR-A IMAGERY
M. Y. MENEISY and I. A. EL-KASSAS (University of Qatar, Doha) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 465-477. refs

A87-15641#
A COMPARATIVE FIELD STUDY OF SPECTRORADIOMETERS AND RADIOMETERS AS USED IN GEOLOGIC MAPPING OF A PORPHYRY COPPER AT YERINGTON, NEVADA
Y. YAMAGUCHI and R. J. P. LYON (Stanford University, CA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 523-532.

A87-15649#
SELECTED COMPARISONS OF AIRCRAFT-BORNE AND ORBITAL IMAGING RADAR DATA - AND THE GEOLOGIC SIGNIFICANCE OF THIS
A. M. FEDER (Western Geophysical Company of America, Aero Service Div., Houston, TX) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 607-616. refs

A87-15651#
STUDY OF THE GEOLOGICAL STRUCTURES OF THE ANDHRA COAST INDIA USING LANDSAT MSS IMAGERY AND THEIR SIGNIFICANCE TO OIL AND MINERAL OCCURRENCES
A. K. GUPTA and V. R. RAO (Indian Space Research Organization, Earth Observation Systems Program Office, Bangalore, India) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 621-630. refs

A87-15652#
DISCRIMINATION OF ALTERED AND UNALTERED BASALTIC ROCKS IN SOUTHWESTERN U.S. BY LANDSAT THEMATIC MAPPER DATA-ANALYSIS
G. L. BERLIN, P. S. CHAVEZ, JR., and P. A. DAVIS, JR. (U.S. Geological Survey, Flagstaff, AZ) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 631, 632.

A87-15666#
ASSESSMENT OF MULTITEMPORAL LANDSAT MSS DATA FOR GEOBOTANICAL REMOTE SENSING IN THE SPANISH PYRITE BELT
C. BANNINGER (Technische Universitaet und Forschungszentrum Graz, Austria) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 757-763. refs

A87-15670#
AIRBORNE VIDEO THERMAL INFRARED - DETECTION OF GEOTHERMAL AREAS ON MOUNT ST. HELENS, WASHINGTON
W. V. CLEMENT (U.S. Army, Engineer District, Portland, OR) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 791-798. refs

A video output, uncalibrated video imaging system was utilized to map residual heat from the 1980 volcanic eruptions of Mount St. Helens in Washington State. Aerial vertical images were collected, rectified, mosaicked, and correlated with surface and subsurface temperatures measured on the debris avalanche. The imagery was subjected to a variety of image processing techniques such as a histogram stretch, spatial filtering, and level slicing. An isothermal map of a portion of the debris avalanche was generated for subsequent use in hydrologic analyses. Author

A87-15676#
A METALANGUAGE FOR SPECTRAL GEOBOTANY
J. A. C. FORTESCUE (Ontario Geological Survey, Toronto, Canada) and V. H. SINGHROY (Ontario Centre for Remote Sensing, Toronto, Canada) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 849-854.

The terminology used in spectral geobotany (SG, the identification of geological features from their own spectral signatures and those of the vegetation growing on them) is considered, with reference to the concept of a metalanguage. The aim of an SG metalanguage is to use the same terms to describe spectral, botanical, and landscape information, taking into account the hierarchies of space, time, problem complexity, and scientific effort. The difference between prospecting and retrospecting (determining whether SG would have been able to locate known mineral deposits) is explained, and the use of simple numbered landscape domains (instead of traditional geological or botanical categories) to subdivide study regions is recommended. T.K.

A87-15679#
MONITORING FEDERALLY OWNED MINERALS VIA LANDSAT
R. E. ARNDT, T. R. FEAGAN, and W. J. BONNER, JR. (U.S. Bureau of Land Management, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 875-883.

A87-16144#
CHARACTERISTICS OF THE GREGORY RIFT (KENYA) DYNAMICS, GROUND STRUCTURAL ANALYSIS AND REMOTE SENSING
G. F. VIDAL IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 12 p. refs
(IAF PAPER ST-86-15)

A method for dynamic ground structural analysis, which combines literature review and synthesis, processing and analysis of remote-sensing images, and field observations, is described. In this method, standard image processing consists of simple enhancement by stretching the spectral range of the data; small windows of high interest are extracted from the source image. Advanced image processing (e.g., decorrelation processing, filtering, etc.) is then applied to produce special detailed maps. The method was applied to describe the dynamics of the Gregory Rift in Kenya. I.S.

A87-16447#
ANALYTICAL ASPECTS OF REMOTE SENSING TECHNIQUES FOR GROUND WATER PROSPECTION IN HARD ROCKS
K. C. B. RAJU, P. N. RAO, G. V. K. RAO, and B. J. KUMAR (Central Ground Water Board, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 127-132.

The use of remote sensing for ground water prospection in hard rocks is examined. The identification and analysis of fracture systems in massive, hard rock areas on aerial photographs and satellite imagery are discussed; the characteristic photographic features of the fracture patterns and their field configurations are studied. Four case studies representing the use of fracture systems to locate ground water in hard rocks are presented; frequency diagrams for the case studies are given. I.F.

A87-16451#
GEOLOGICAL APPRAISAL OF SIR-A IMAGERY OF SELECTED TERRAIN TYPES OF INDIA
K. KRISHNANUNNI, R. K. CHOUDHARY, E. V. R. PARTHASARADHI, T. V. RAMACHANDRAN, P. PRAKASH (Geological Survey of India, Bangalore) et al. IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 155-160. refs

An assessment is made of the extent of discrimination of different lithogroups, structural details and morphological features as depicted on satellite radar imagery of diverse geological provinces, in comparison with Landsat MSS, Satellite camera photography and aeromagnetic data. The complementarity of the different data types is brought out. Author

A87-16453#
REFLECTANCE DATA OF ROCK TYPES/SURFACE MATERIALS AND THEIR UTILITY FOR MAPPING
M. RAO, R. K. GOEL, A. R. DASGUPTA (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), B. P. PATHOLE, and N. MADHUKARA (Directorate of Geology and Mining, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 170-175.

While multispectral data have been earlier used for geologic mapping, after enhancements, a study was proposed to develop classification techniques for mapping. The first part of the study was to collect ground based reflectance data and evolve a model/technique to identify the rock types/surface materials. The second part of the study was to implement the model on aerial/satellite scanner data. This paper deals with the first part of the study. A simple model has been used to average the M(2)S and MSS Mark-II reflectance values from these spectral curves, which are approximately 41 in number. An approach to obtain ratio values of these averaged scanner reflectances has been developed. A discriminant analysis of these averaged values will rank the bands/ratios based on discriminability of the rock types. Author

A87-16454#
GEOLOGICAL APPRAISAL OF LANDSAT DATA VIS-A-VIS AEROMAGNETIC DATA - CASE STUDIES FROM SOUTH INDIA
E. V. R. PARTHASARADHI, T. V. RAMACHANDRAN, U. S. N. REDDY, and M. K. BALAGOPALAN (Geological Survey of India, Bangalore) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 176-181. refs

Conjunctive analysis of Landsat and aeromagnetic data has been attempted in the highly metamorphosed Archaean granulitic and gneissic terrain of Kerala-Karnataka-Tamil Nadu (Western Ghats) and the Proterozoic meta-sediments of the Cuddapah basin and adjacent crystallines in Andhra Pradesh, Rayalaseema, to elucidate the geological and tectonic picture and the extent of correlation between the two types of data. While the western Ghats area, flown by high altitude aeromagnetic surveys (at 7000-9500 ft barometric heights), highlights the regional first order structural fabric, in the latter area, covered by low altitude drape flying (500 ft), the magnetic responses from shallow bodies and basin configuration are brought out more clearly. Author

A87-16455#
APPLICATION OF DIGITALLY ENHANCED LANDSAT MULTISPECTRAL DATA FOR REGIONAL GEOMORPHOLOGICAL MAPPING IN PARTS OF CENTRAL RAJASTHAN, INDIA
RAJASTHAN, INDIA
SM. RAMASAMY and P. C. BAKLIWAL (Geological Survey of India, Jaipur) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 182-188. refs

A87-16456#
INTEGRATED REMOTE SENSING FOR EXPLORATION OF STRATABOUND SULPHIDE MINERAL DEPOSITS IN PART OF PRECAMBRIAN TERRAIN OF RAJASTHAN
K. S. MISRA and V. KUMAR (Geological Survey of India, Jaipur) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 189-194. refs

A87-16464#
BIOGEOCHEMICAL ANOMALIES AND LANDSAT IMAGERY - A COMPARISON IN THE WOLLASTON LAKE AREA, SASKATCHEWAN
S. ARONOFF (DIPIX Systems, Ltd., Applications Dept., Ottawa, Canada), C. DUNN (Saskatchewan Geological Survey, Regina, Canada), and G. REILLY (Urangesellschaft Canada, Ltd., Toronto) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 241-246. Research supported by Urangesellschaft Canada, Ltd. refs

In a recent biogeochemical study in the Wollaston Lake area of Saskatchewan, anomalously high concentrations of uranium were found in spruce twigs. The location of the anomalies appeared inconsistent with other existing geologic data. A study was undertaken to see if Landsat data could be used to delineate vegetation having high concentrations of uranium. Five Landsat 1 images, acquired between April and October 1974 were analyzed. A supervised classification of the August scene was used to stratify the vegetation types. After the other scenes had been registered to the August image, the reflectance values of sites with high and low uranium concentration within a vegetation stratum were compared for each band of each scene and for selected band combinations. Preliminary results indicate that the anomalous areas are coincident with coniferous vegetation having a low near-infrared reflectance (Landsat Band 7) in the late May image. This may indicate retarded green-up of the vegetation in the high uranium areas. Author

A87-16477#
GEOLOGICAL MAPPING AND DISCRIMINATION OF MINERALISED GRANITE AND MIGMATITE AREAS FROM REMOTELY SENSED DATA ANALYSIS AND CORRELATION OF RADIOACTIVE OCCURRENCES IN CHANDRAPUR-GADCHIROLI AREA, MAHARASHTRA, INDIA
N. V. A. S. PERUMAL, V. RAJAGOPLAN (Department of Atomic Energy, Atomic Minerals Div., Hyderabad, India), and A. V. PHADKE IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 328-334. refs

A87-16478#
GEOMORPHOLOGY VERSUS LINEAMENT PATTERN - A CORRELATIVE STUDY IN PARTS OF CALICUT AND MALLAPPURAM DISTRICTS OF KERALA
K. M. NAMBOODIRI, C. U. PAUL, A. RAJA MOHAMED (Action for Food Production, Coimbatore, India), and K. N. DEWANGAN (Action for Food Production, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 335-341.

A87-16496#
A COMPARISON OF VISUALLY INTERPRETED SPACE-BORNE DATA FOR GEOMORPHOLOGICAL AND GEOLOGICAL DATA EXTRACTION
P. K. GUPTA, G. VENKATARAMAN, and S. VISWANATHAN (Indian Institute of Technology, Bombay, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 448-452. refs

A87-16497#
POTENTIAL OF RADAR IMAGES FOR GEOLOGICAL, GEOMORPHOLOGICAL AND LAND USE/LAND COVER STUDIES
R. K. SOOD, N. S. MEHTA (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), V. D. BHATE, S. B. SHARMA (Geological Survey of India, Magpur), and P. C. BAKLIWAL (Geological Survey of India, Jaipur) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 453-458. refs

Thematic maps depicting geological, geomorphological, lineament, and land cover features of parts of India were prepared using data of the Space Shuttle SIR-A and compared with the maps prepared using the Landsat MSS and RBV data and with the ground truth data. Information on drainage using SIR-A images was comparable with that found from Landsat images, while the lithological mapping was easier, and the geomorphological information was better than that from Landsat MSS/RBV images. SIR-A images have better contrast and are good for mapping land use/land cover categories. I.S.

A87-16498#
TECTONIC MODEL OF KUTCH MAINLAND, WESTERN INDIA-INTERPRETATION FROM LANDSAT DATA
V. S. HEGDE and S. K. BHAN (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 459-463.

Visual interpretation of Landsat data has been carried out with the aim of delineating lithological and structural features useful in deciphering tectonic set up of Kutch Mainland in Western India, which is well known for its Mesozoic and Tertiary rocks. Owing to lack of vegetation and limited soil cover in the region all major rock groups prevailing in the area could be differentiated on the Landsat imagery based mainly on their spectral responses. On the basis of the results, tectonic model of Kutch Mainland and the role of Landsat data in preparation of small scale tectonic maps have been discussed. Author

A87-16499#
SPECTRAL CHARACTERISTICS AND COMPUTER-AIDED MAPPING OF CERTAIN RAJASTHAN PHOSPHORITE DEPOSITS
S. VISWANATHAN, R. NAGARAJAN, A. B. INAMDAR, and V. SHREEDHARA (Indian Institute of Technology, Bombay, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 464-468. refs

A computer-aided map of phosphorite mineralization associated with Aravalli quartzite, phyllite and dolomite in the vicinity of Udaipur, Rajasthan, has been obtained through digital analysis of Landsat data. Laboratory and field radiometric data of phosphorite and associated rocks have also been collected. Quartzites record high reflectance in channel D (0.8-1.1 microns). Low (less than 15 percent) and high (greater than 30 percent) grade phosphorites are distinguished in channel A (0.5-0.6 microns). It is found that the supervised and unsupervised classification of Landsat MSS data bring out major lithological boundaries. Author

A87-16519#
REMOTE SENSING APPLICATION FOR EXPLORATION OF TIN IN KORAPUT DISTRICT, ORISSA, INDIA
B. K. MOHANTY, N. K. DAS, and R. C. MAHARANA (Directorate of Mining and Geology, Orissa, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 588-592.

A87-16520#
INTEGRATED MULTISENSOR AIRBORNE REMOTE SENSING AND LANDSAT STUDIES IN SINGHBHUM URANIUM-COPPER BELT, BIHAR, INDIA
N. V. A. S. PERUMAL, C. SHANTI KUMAR, and T. M. MAHADEVAN (Department of Atomic Energy, Atomic Minerals Div., Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 593-598. refs

A87-16521#
LITHOSTRATIGRAPHIC AND STRUCTURAL INTERPRETATION OF GONDWANA FORMATIONS IN TALCHER COALFIELD EXTENSION AREA, ORISSA STATE, INDIA BY REMOTE SENSING TECHNIQUE
R. C. SAMAL and N. K. DAS (Directorate of Mining and Geology, Orissa, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 599-604.

A87-16527#
OPTIMIZATION OF SPECTRAL RANGES FOR THE ROCK TYPES USING PORTABLE SPECTRO RADIOMETER IN DARIBA ZINC PROSPECT, RAJASTHAN, INDIA
V. KUMAR and A. K. GROVER (Geological Survey of India, Jaipur) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 633-638.

The radiance characteristics of the different rock types in the Dariba Zinc Prospect were measured to evolve a key for optimizing the spectral ranges of multispectral scanners. Over 200 in situ measurements of spectral responses were collected in the area using a ground spectroradiometer operating at 400-1010 nm. In this range, vein quartz, granitic gneiss, and quartzites are clearly distinguishable from each other, as these rocks have contrasting spectral responses (45-60, 28-36, and 17-24 percent, respectively). Graphitic mica schist, staurolite schist, gossan, and ferruginous chert breccia are not distinguishable among each other, but are separable from the former set of rocks. Quartzites and dolomites are separable from each other at 700-1010 nm. Author

A87-17571
THERMODYNAMICS IN REMOTE SENSING [TERMODINAMIKA V DISTANTSIONNOM ZONDIROVANII]
B. M. BALTER and V. V. EGOROV (AN SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) Priroda (ISSN 0032-874X), Aug. 1986, p. 33-45. In Russian. refs

An analogy between thermodynamics and remote sensing is suggested in an effort to extend thermodynamic methods to remote sensing, i.e., to liken the spaceborne remote sensing of the earth to the measurement of the parameters of thermodynamic systems. It is found that the analogy with thermodynamics yields a novel class of models for the global characteristics of geosystems, which can be investigated via remote sensing. An automatic control system for the geosystem is proposed. B.J.

A87-17699
THE STRUCTURE OF THE EARTH CRUST IN CENTRAL ASIA DEPICTED USING SPACE DATA [STRUKTURA ZEMNOI KORY SREDNEI AZII PO KOSMICHESKIM DANNYM]
O. M. BORISOV, D. A. MAGZUMOVA, L. I. MOROZOVA, and M. N. TKHAI Tashkent, Izdatel'stvo Fan, 1985, 180 p. In Russian. refs

Photographs obtained by Meteor and Landsat satellites over Central Asia were used for geomorphologic and landscape zonation and to study ancient and young tectonic deformations, as well as the material composition of major rock complexes. Deeply buried structures were detected either by using space-image components of surface features or by integrating different-scale aerial and space photographs. Schematic maps depicting geological, geomorphological, and tectonic characteristics of the Central Asian crust are presented. I.S.

A87-18379
AN ANALYSIS OF GEOLOGIC STRUCTURE BASED ON LANDSAT MSS DATA
K. TSUCHIYA, R. TATEISHI (Chiba University, Japan), and K. CHI (Korea Institute of Energy and Resources, Seoul, Republic of Korea) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1387-1392. MOESC-supported research. refs

Through analyses of Landsat MSS data together with ground truth and other data, the following new findings are obtained on the geologic structure of the central part of Korean Peninsula. The regional folding structure is anticlinorium. Two faults which were commonly believed to be thrust faults are not true faults, and it is considered that they are formed due to the difference of resistance of two geologic formations. Author

N87-10589 Centre National de la Recherche Scientifique, Orleans (France). Lab. de Physique et Chimie de l'Environnement.
STUDY OF VLF EMISSIONS APPARENTLY ASSOCIATED WITH EARTHQUAKES FROM GROUND-BASED AND GEOS SATELLITES DATA
M. PARROT and F. LEFEUVRE *In* CNES Results of the ARCAD 3 Project and of Recent Programs in Magnetospheric and Ionospheric Physics p 701-711 1985
Avail: CEPADUES, Toulouse

Very low frequency emissions associated with earthquakes were independently observed at the Kerguelen station and on the GEOS-1 and GEOS-2 satellites, at frequencies less than 10 kHz. Kerguelen observations were made on magnetic antennas, in a period when earthquakes of moderate intensity (M = 4.7) took place near the station. The GEOS observations were made from magnetic and electric antennas. The analysis used cases for which intense earthquakes (M greater than 5) occurred in regions close to the satellite longitude (GEOS-2 is geostationary and its geographical longitude is 22 E) with the satellite operating in a VLF mode. Methods of distinguishing between correlations and coincidences are discussed. ESA

N87-11277# Canada Centre for Remote Sensing, Ottawa (Ontario).
NARROW-BAND MULTISPECTRAL IMAGERY OF THE VEGETATION RED REFLECTANCE EDGE FOR USE IN GEOBOTANICAL REMOTE SENSING
R. P. GAUTHIER and R. A. NEVILLE *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 233-236 Dec. 1985
Avail: NTIS HC A25/MF A01

The MEIS 2, an airborne pushbroom imager having high sensitivity and high spatial resolution, provided narrow band (3 nm) imagery over areas of geological interest in Canada. Six spectral passbands were selected at wavelengths in the spectral range 680 to 800 nm to resolve the vegetation red reflectance edge. The imagery obtained in these bands was processed to give spectral reflectances. Problems in geobotanical remote sensing to be solved are discussed. A linear model for producing imagery of parameters which characterize the red reflectance edge is introduced. ESA

N87-11281# Department of Civil Engineering, Indore (India).
RADIOMETRIC DATA CHARACTERIZE QUANTIZATION OF SOIL FORMING MINERALS
H. S. MEHTA *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 249-251 Dec. 1985
Avail: NTIS HC A25/MF A01

Spectral signatures of the soil forming minerals like serpentine, gypsum, clay, quartz, barium sulfate, calcite, dolomite, feldspar, chlorite, biotite, and bentonite were studied. Ground truth was measured by a radiometer compatible to Landsat MSS bands and ISRO model, spectrometer operating in 460 to 1010 nm range with 10 nm spectral resolution, and a spectrophotometer. The spectroradiometer and spectrophotometer data are used to

correlate field and laboratory data, respectively. Statistical and graphical analysis of all data show that barium sulfate has the highest spectral reflectance and biotite the lowest. ESA

N87-11289# Academia Sinica, Guiyang (China). Inst. of Geochemistry.
MICROWAVE DIELECTRIC PROPERTIES OF MINERALS AND ROCKS
J. K. XIAO *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 293-296 Dec. 1985
Avail: NTIS HC A25/MF A01

The resonant cavity perturbation method at 9.4 GHz was used to measure the dielectric constants of minerals and rocks. Dielectric properties of the minerals and rocks are summarized. The effects of composition, moisture, and other factors on dielectric properties are discussed. Application of dielectric constant to microwave remote sensing and the correlation between the dielectric constant of the geological objects and the gray-scale values of the SIR-A image are analyzed. ESA

N87-11308# Academia Sinica, Guiyang (China). Inst. of Geochemistry.
SPECTRAL STUDY OF ROCKS AND SOME IRON DEPOSITS FROM EASTERN CHINA
B. L. YANG and X. DING *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 399-402 Dec. 1985
Avail: NTIS HC A25/MF A01

Iron deposits and related rocks from Eastern China are measured to acquire visible and near infrared reflection and infrared absorption spectra on powders and natural outcrops. The study shows that spectral features are related with chemical and mineral compositions of rocks and ores. The absorption bands are caused by H2O and OH (1-) at 1400, 1900, and 2200 nm; CO3 (2-) causes the spectral band at 2300 nm. The absorption bands near 900 and 1100 nm are caused by Fe (3+) and Fe (2-). Infrared spectra of rock alteration products show that kaolinite, quartz, and albite are spectrally sensitive. The typemorphic band of kaolinite is 915 nm. Quartz displays a well-defined double band at 800 and 780 nm, and albite associated absorption spectra (784, 758, 740, and 720 nm). ESA

N87-11311# Hunting Geology and Geophysics Ltd., Boreham Wood (England).
AN INVESTIGATION OF SPECTRAL SIGNATURES FROM MINERALISED ROCK OUTCROP AS DEFINED BY AIRBORNE TM DATA OF THE SAUDI ARABIAN SHIELD
A. C. BIRD, G. R. GARRARD, A. R. ILES, W. P. LOUGHLIN, M. A. TAWFIQ, and C. A. LEGG *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 413-417 Dec. 1985
Avail: NTIS HC A25/MF A01

Mineral exploration test sites were selected from an airborne thematic mapper data set covering 30,000 sq km of the Saudi Arabian Shield. In order to study the 11 waveband characteristics of the data, a variety of surface materials was selected from each of 4 test sites and average DN values extracted. The results are presented in tables that rank the surface materials in order of brightness and in graphs that present normalized radiance curves. The tables and graphs aid selection of color composites for discriminating materials. It is also possible to suggest more complex processes that would be useful for the interpretation of the data. The results support the band combination selected for the existing hard copy. ESA

N87-11312# Paris VI Univ. (France). Lab. de Mineralogie et Cristallographie.
EVALUATION OF SPOT FOR MAPPING SEDIMENTARY AND VOLCANIC ROCKS [EVALUATION DE SPOT POUR LA CARTOGRAPHIE DE ROCHES SEDIMENTAIRES ET VOLCANIQUES]
B. CERVELLE, J. CHOROWICZ, L. EPIARD-MOREAU, J. P. RUDANI, and A. BOTHOREL *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 419-423 Dec. 1985 In FRENCH Sponsored by SPOT IMAGE, and CNES, Toulouse, France
Avail: NTIS HC A25/MF A01

A SPOT satellite simulation in the Coconino plateau (Arizona) determined the spectral signatures of sedimentary and volcanic rocks from three types of data: laboratory spectra from samples taken from outcrops; ground radiometric measurements in the three SPOT bands; and airborne radiometry data from eight bands, including the thermal infrared. Comparisons show that the SPOT bands cannot identify the lithologies directly (except for hematite soils) but can only differentiate them with respect to known, calibrated zones. The SPOT spatial resolution greatly increases the chances of obtaining petrologically homogeneous pixels. Analysis of airborne data reveals the utility of adding a 1.6 or 2 micron, or thermal, band. ESA

N87-11323# Paris VI Univ. (France). Lab. de Mineralogie et Cristallographie.
SPECTRAL SIGNATURES AND MAPPING OF MINERAL DEPOSITS OF SOUTH MOROCCO [SIGNATURES SPECTRALES ET CARTOGRAPHIE DE GISEMENTS MINIERS AU SUD DU MAROC]
B. CERVELLE, P. BOUCHER, J. CHOROWICZ, G. TAMAIN, and E. M. ALEM *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 475-480 Dec. 1985 In FRENCH Sponsored by Ministere de la Recherche et de la Technologie
Avail: NTIS HC A25/MF A01

Landsat multispectral scanner data of three arid zones containing mineral deposits of different types were analyzed to obtain spectral signatures and to map their lithologies (mineral bearing or not). The digital data associated with pixels characteristic of geological structures were corrected for atmospheric absorption and transformed to surface reflectance values. This enabled them to be compared with ground radiometer data and to calibrate them using laboratory spectrometric measurements on weathered rocks. A map of the three deposits was made. ESA

N87-11327# Open Univ., Milton (England). Dept. of Earth Sciences.
AGE-DEPENDENT CHANGES IN THE SPECTRAL RESPONSE OF LAVA SURFACES DUE TO WEATHERING, GROWTH OF LICHEN AND SPREAD OF VASCULAR PLANTS
D. A. ROTHERY, R. H. LEFEBVRE (Grand Valley State Coll., Allendale, Mich.), and F. BEVIS *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 495-498 Dec. 1985 Sponsored by UK Science and Engineering Research Council
Avail: NTIS HC A25/MF A01

The Craters of the Moon (USA) basaltic lavas were studied using Landsat MSS imagery. The appearance of pahoehoe flows with Blue Dragon crusts changes systematically with age. In situ measurements of the bidirectional reflectance factor of natural rock surfaces in the area shows that the aging of the remotely sensed spectral response is a combination of physicochemical changes in the rock surface, colonization of the surface by lichen, with percentage cover and species diversity increasing with age (these effects cause little further change after 8000 yr) and development of vascular plant cover (causing progressive change beyond 8000 yr). ESA

N87-11357# National Academy of Sciences - National Research Council, Washington, D. C. Geophysics Study Committee.
ACTIVE TECTONICS: PART 2: EPEIROGENIC AND INTRAPLATE MOVEMENTS
L. D. BROWN (Cornell Univ., Ithaca, N.Y.) and R. E. REILINGER (Air Force Geophysics Lab., Hanscom AFB, Mass.) 1986 16 p Avail: NTIS HC A02/MF A01

The major deformations of the Earth's surface are largely consistent with the tenets of plate tectonics, which predict that such activity should be focused at the various boundaries along which massive lithospheric plates collide, pull apart, or slide past one another. Yet crustal deformations also occur well into the interior of these plates. Some may represent the distributed effects of distant plate boundaries, as, for example, the earthquakes of the intermontane western United States. Some, such as the geodetically observed uplift over a deep magma chamber in the Rio Grande rift of New Mexico, may correspond to incipient foundation of a new plate boundary. Others, like the subtle, broad uplifts and subsidences in the nominally stable cratonic interiors, are much more puzzling. Such motions often appear estranged, if not divorced, from accepted plate-tectonic processes. Postglacial rebound, a well-known phenomenon in portions of North America and Europe, also appears to be an inadequate explanation for many observations. Understanding contemporary motions of plate interiors is often hindered by the paucity and uncertain accuracy of relevant geophysical and geodetic observations. Yet intraplate tectonics constitutes more than a scientific enigma. Even seemingly slow vertical motions may threaten river courses or seafront properties on socially relevant time scales, and the subtle strain accumulating elsewhere may portend future earthquakes or volcanoes in the least predictable places. Author

N87-12035*# Cornell Univ., Ithaca, N.Y. Dept. of Geological Sciences.
THEMATIC MAPPER STUDY OF ALASKAN OPHIOLITES Semiannual Report
J. M. BIRD 1986 16 p
(Contract NAS5-28739)
(NASA-CR-179728; NAS 1.26:179728) Avail: NTIS HC A02/MF A01 CSCL 08B

The combinations of Thematic Mapper (TM) bands that best distinguish basalts of the Brooks Range ophiolites were determined. Geochemical analyses, including major, trace, and rare earth elements (REE), are being done in order to study the significance of TM spectral variations that were observed within some of the sampled rock units. An image of the topography of the western Brooks Range and Colville Basin was constructed. Elevation data for the rest of Northern Alaska are being acquired to expand the area covered by the topography image. Two balanced cross sections (one along the eastern margin, the other along the western margin of the Brooks Range) are being constructed, using the techniques of fault-bend and fault-propagation folding. These are being used to obtain regional shortening estimates for the Brooks Range in an attempt to constrain tectonic models for the evolution of Northern Alaska. The TM data are being used to confirm reconnaissance maps and to obtain structural data where no maps exist. Along with the TM data, digital topography, seismic reflection profiles, and magnetic and gravity surveys are examined to better understand the evolution of the Colville Basin, north of the Brooks Range. B.G.

N87-12067*# Nevada Univ., Reno. Dept. of Geological Sciences.
NATURE AND ORIGIN OF MINERAL COATINGS ON VOLCANIC ROCKS OF THE BLACK MOUNTAIN, STONEWALL MOUNTAIN AND KANE SPRINGS WASH VOLCANIC CENTERS, SOUTHERN NEVADA Semiannual Progress Report, Jan. - Jul. 1986
J. V. TARANIK, D. C. NOBLE, L. C. HSU, A. HUTSINPILLER, and D. SPATZ Jul. 1986 36 p
(Contract NAS5-28765)
(NASA-CR-179738; NAS 1.26:179738) Avail: NTIS HC A03/MF A01 CSCL 08G

Surface coatings on volcanic rock assemblages that occur at select tertiary volcanic centers in southern Nevada were investigated using LANDSAT 5 Thematic Mapper imagery. Three project sites comprise the subject of this study: the Kane Springs Wash, Black Mountain, and Stonewall Mountain volcanic centers. LANDSAT 5 TM work scenes selected for each area are outlined along with local area geology. The nature and composition of surface coatings on the rock types within the subproject areas are determined, along with the origin of the coatings and their genetic link to host rocks, geologic interpretations are related to remote sensing units discriminated on TM imagery. Image processing was done using an ESL VAX/IDIMS image processing system, field sampling, and observation. Aerial photographs were acquired to facilitate location on the ground and to aid stratigraphic differentiation. E.R.

N87-12070*# Bechtel Corp., San Francisco, Calif.
TECTONIC EVALUATION OF THE NUBIAN SHIELD OF NORTHEASTERN SUDAN USING THEMATIC MAPPER IMAGERY Interim Report
Aug. 1986 101 p Original document contains color illustrations Sponsored by NASA
(NASA-CR-177045; NAS 1.26:177045; IR-2) Avail: NTIS HC A06/MF A01 CSCL 08G

Bechtel is nearing completion of a one-year program that uses digitally enhanced LANDSAT Thematic Mapper (TM) data to compile the first comprehensive regional tectonic map of the Proterozoic Nubian Shield exposed in the northern Red Sea Hills of northeastern Sudan. The status of significant objectives of this study are given. Pertinent published and unpublished geologic literature and maps of the northern Red Sea Hills to establish the geologic framework of the region were reviewed. Thematic mapper imagery for optimal base-map enhancements was processed. Photo mosaics of enhanced images to serve as base maps for compilation of geologic information were completed. Interpretation of TM imagery to define and delineate structural and lithogologic provinces was completed. Geologic information (petrologic, and radiometric data) was compiled from the literature review onto base-map overlays. Evaluation of the tectonic evolution of the Nubian Shield based on the image interpretation and the compiled tectonic maps is continuing. Author

N87-12959# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GEOLOGIC REMOTE SENSING AT INPE: AN OVERVIEW
C. C. LIU, J. E. RODRIGUES, and P. R. MARTINI Aug. 1986 18 p Presented at the Seminar on Geologic Applications of Remote Sensing, Sao Jose dos Campos, Brazil, Dec. 1985
(INPE-3975-PRE/987) Avail: NTIS HC A02/MF A01

In Brazil, LANDSAT imagery has been used for regional geological and mineral resources mapping. The launching of the first LANDSAT is a milestone in the history of geological surveys by remote sensing techniques in this country. Because LANDSAT images give a bird's eye view of the earth's surface, this regional geological mapping has been carried out first, and then followed by structural and geotectonic studies. On the other hand, because LANDSAT data in digital format on Computer Compatible Tapes (CCT) are available to be analyzed by computer-processing techniques, research for mineral deposits and rock formation identification have been possible especially in recent years. Author

N87-12968*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCEEDINGS OF THE SECOND AIRBORNE IMAGING SPECTROMETER DATA ANALYSIS WORKSHOP
G. VANE, ed. and A. F. H. GOETZ, ed. 15 Aug. 1986 218 p Workshop held in Pasadena, Calif., 6-8 May 1986 Sponsored by NASA
(NASA-CR-179924; JPL-PUB-86-35; NAS 1.26:179924) Avail: NTIS HC A10/MF A01 CSCL 05B

Topics addressed include: calibration, the atmosphere, data problems and techniques, geological research, and botanical and geobotanical research.

N87-12975*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.
ABUNDANCE AND DISTRIBUTION OF MINERAL COMPONENTS ASSOCIATED WITH MOSES ROCK (KIMBERLITE) DIATREME
J. F. MUSTARD and C. M. PIETERS *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 81-85 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

The surface mineralogy in and around Moses Rock diatreme, a kimberlite-bearing dike in SW Utah, was examined using internally calibrated Airborne Imaging Spectrometer (AIS) data. Distinct near-infrared absorption characteristics of clays, gypsum, and serpentine (a key marker for kinberlite concentration) allowed the surface units containing these components to be identified spatially and the relative abundance of each component measured. Within the dike itself, channels and dispersed components of kimberlite and blocks of country rocks were accurately determined. Author

N87-12976*# Stanford Telecommunications, Inc., Sunnyvale, Calif. Dept. of Applied Earth Sciences.
COMPARISON OF THE 1984 AND 1985 AIS DATA OVER THE SINGATSE RANGE (YERINGTON), NEVADA
R. J. P. LYON *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 86-95 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

The Singatse Range is composed of a series of 53 types of volcanic, plutonic, metamorphic, and sedimentary rocks. In addition the Jurassic plutonic rocks are also of economic interest for their copper mineralization which is contained in a porphyry dike swarm. The 1984 and 1985 flight results from the Airborne Imaging Spectrometer (AIS) instrument flown in the NASA/JPL C-130 aircraft are contrasted and compared. The 1984 data are less noisy than the 1985, in which many sets of vertical stripings from bad detectors can be seen. Significantly however, enough of the hydrothermal alteration patterns can be seen in each line at the mutual crossing points that one can say that the specific targets were detected in both year's flights. The spectra of both years are corrupted by the second-order effect from the grating, but 0-H bond absorption at essentially correct wavelengths for sericite and/or kaolinite can be seen. Author

N87-12977*# Nevada Univ., Reno. School of Mines.
IDENTIFICATION OF HYDROTHERMAL ALTERATION ASSEMBLAGES USING AIRBORNE IMAGING SPECTROMETER DATA
S. C. FELDMAN and J. V. TARANIK *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 96-101 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Airborne Imaging Spectrometer (AIS) data, field and laboratory spectra and samples for X-ray diffraction analysis were collected in argillically altered Tertiary volcanic rocks in the Hot Creek Range, Nevada. From laboratory and field spectral measurements in the 2.0 to 2.4 micron range and using a spectroradiometer with a 4 nm sampling interval, the absorption band centers for kaolinite were loacted at 2.172 and 2.215 microns, for montmorillonite at 2.214 micron and for illite at 2.205. Based on these values and the criteria for resolution and separtion of spectral features, a spectral sampling interval of less than 4 nm is necessary to separate the clays. With an AIS spectral sampling interval of 9.3 nm, a spectral matching algorithm is more effective for separating kaolinite, montmorillonite, ad illite in Hot Creek Range than using the location of absorption minima alone. Author

N87-12978*# Nevada Univ., Reno. School of Mines.
DETECTION OF HYDROTHERMAL ALTERATION AT VIRGINIA CITY, NEVADA USING AIRBORNE IMAGING SPECTROMETRY (AIS)
A. HUTSINPILLER and J. V. TARANIK *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop 102-108 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Airborne Imaging Spectrometer (AIS) data were collected over Virginia City, Nevada; an area of gold and silver mineralization with extensive surface exposures of altered volcanic rocks. The data were corrected for atmospheric effects by a flat-field method, and compared to library spectra of various alteration minerals using a spectral analysis program SPAM. Areas of strong clay alteration were identified on the AIS images that were mapped as kaolinitic, illitic, and sericitic alterations zones. Kaolinitic alteration is distinguishable in the 2.1 to 2.4 and 1.2 to 1.5 micrometer wavelength regions. Montmorillonite, illite, and sericite have absorption features similar to each other at 2.2 micrometer wavelength. Montnorillonite and illite also may be present in varying proportions within one Ground Instantaneous Field of View (GIFOV). In general AIS data is useful in identifying alteration zones that are associated with or lie above precious metal mineralization at Virginia City. Author

N87-12979*# Commonwealth Scientific and Industrial Research Organization, Ryde (Australia). Div. of Mineral Physics and Mineralogy.
PRELIMINARY GEOLOGICAL INVESTIGATION OF AIS DATA AT MARY KATHLEEN, QUEENSLAND, AUSTRALIA
J. F. HUNTINGTON, A. A. GREEN, M. D. CRAIG, and T. D. COCKS *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 109-131 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

The Airborne Imaging Spectrometer (AIS) was flown over granitic, volcanic, and calc-silicate terrain around the Mary Kathleen Uranium Mine in Queensland, in a test of its mineralocial mapping capabilities. An analysis strategy and restoration and enhancement techniques were developed to process the 128 band AIS data. A preliminary analysis of one of three AIS flight lines shows that the data contains considerable spectral variation but that it is also contaminated by second-order leakage of radiation from the near-infrared region. This makes the recognition of expected spectral absorption shapes very difficult. The effect appears worst in terrains containing considerable vegetation. Techniques that try to predict this supplementary radiation coupled with the log residual analytical technique show that expected mineral absorption spectra can be derived. The techniques suggest that with additional refinement correction procedures, the Australian AIS data may be revised. Application of the log residual analysis method has proved very successful on the cuprite, Nevada data set, and for highlighting the alunite, linite, and SiOH mineralogy. Author

N87-12980*# Geological Survey, Denver, Colo. Geologic Div.
USE OF DIGITAL MUNSELL COLOR SPACE TO ASSIST INTERRETATION OF IMAGING SPECTROMETER DATA: GEOLOGIC EXAMPLES FROM THE NORTHERN GRAPEVINE MOUNTAINS, CALIFORNIA AND NEVADA
F. A. KRUSE, D. H. KNEPPER, JR., and R. N. CLARK *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 132-138 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Techniques using Munsell color transformations were developed for reducing 128 channels (or less) of Airborne Imaging Spectrometer (AIS) data to a single color-composite-image suitable for both visual interpretation and digital analysis. Using AIS data acquired in 1984 and 1985, limestone and dolomite roof pendants

and sericite-illite and other clay minerals related to alteration were mapped in a quartz monzonite stock in the northern Grapevine Mountains of California and Nevada. Field studies and laboratory spectral measurements verify the mineralogical distributions mapped from the AIS data. Author

N87-12981*# Geological Survey, Reston, Va.
NEAR-INFRARED DETECTION OF AMMONIUM MINERALS AT IVANHOE HOT SPRINGS, NEVADA
M. D. KROHN *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 138-144 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Airborne Imaging Spectrometer (AIS) data were collected over the fossil hot spring deposit at Ivanhoe, Nevada in order to determine the surface distribution of NH4-bearing minerals. Laboratory studies show that NH4-bearing minerals have characteristic absorption features in the near-infrared (NIR). Ammonium-bearing feldspars and alunites were observed at the surface of Ivanhoe using a hand-held radiometer. However, first look analysis of the AIS images showed that the line was about 500 m east of its intended mark, and the vegetation cover was sufficiently dense to inhibit preliminary attempts at making relative reflectance images for detection of ammonium minerals. Author

N87-13837*# Tennessee Univ., Knoxville. Dept. of Geological Sciences.
APPLICATION OF SHUTTLE IMAGING RADAR TO GEOLOGIC MAPPING Final Report
T. C. LABOTKA 28 Feb. 1986 8 p
(Contract JPL-957201)
(NASA-CR-179952; NAS 1.26:179952) Avail: NTIS HC A02/MF A01 CSCL 08G

Images from the Shuttle Imaging Radar - B (SIR-B) experiment covering the area of the Panamint Mountains, Death Valley, California, were examined in the field and in the laboratory to determine their usefulness as aids for geologic mapping. The covered area includes the region around Wildrose Canyon where rocks ranging in age from Precambrian to Cenozoic form a moderately rugged portion of the Panamint Mountains, including sharp ridges, broad alluviated upland valleys, and fault-bounded grabens. The results of the study indicate that the available SIR-B images of this area primarily illustrate variations in topography, except in the broadly alluviated areas of Panamint Valley and Death Valley where deposits of differing reflectivity can be recognized. Within the mountainous portion of the region, three textures can be discerned, each representing a different mode of topographic expression related to the erosion characteristics of the underlying bedrock. Regions of Precambrian bedrock have smooth slopes and sharp ridges with a low density of gullies. Tertiary monolithologic breccias have smooth, steep slopes with an intermediate density of gullies with rounded ridges. Tertiary fanglomerates have steep rugged slopes with numerous steep-sided gullies and knife-sharp ridges. The three topographic types reflect the consistancy and relative susceptibility to erosion of the bedrock; the three types can readily be recognized on topographic maps. At present, it has not been possible to distinguish on the SIR-B image of the mountainous terrain the type of bedrock, independent of the topographic expression. Author

N87-13840# Naval Postgraduate School, Monterey, Calif.
USER INTERFACE DESIGN FOR TWO DIMENSIONAL POLYGONALLY ENCODED GEOLOGICAL SURVEY MAPS
J. M. AMMANN, R. B. MCGHEE, and M. J. ZYDA Jul. 1986 80 p
(AD-A170612; NPS52-86-017) Avail: NTIS HC A05/MF A01 CSCL 08B

This study presents an overview of a cartographic processing pipeline for the generation and maintenance of polygonally encoded data bases from published U.S. Geological Survey maps. The focus of this research centers on the development of an interactive editing system. The editor, serving as the final step in the overall project, provides the user with the capability to correct and modify dated topographic characteristics. A variety of processing and digitizer induced errors introduced into the data base from previous utility steps can also be corrected. Included is a discussion on the internal indexing scheme used for managing revisions and the techniques and algorithms for updating the data bases. GRA

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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.

A87-10048* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOPEX/POSEIDON - MAPPING THE OCEAN SURFACE
C. A. YAMARONE, S. ROSELL, and D. L. FARLESS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) IN: Space Congress, 23rd, Cocoa Beach, FL, April 22-25, 1986, Proceedings . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1986, p. 8-10 to 8-22. NASA-supported research. refs

Global efforts are under way to model the earth as a complete planet so that weather patterns may be predicted on time scales of months and years. A major limitation in developing models of global weather is the inability to model the circulation of the oceans including the geostrophic surface currents. NASA will soon be initiating a satellite program to correct this deficiency by directly measuring these currents using the science of radar altimetry. Measurement of the ocean topography with broad, frequent coverage of all ocean basins for a long period of time will allow the derivation of the spatial and temporal behavior of surface ocean currents. The TOPEX/POSEIDON mission is a cooperative effort between NASA and the French Centre National d'Etudes Spatiales. This paper describes the goals of this research mission, the data type to be acquired, the satellite and sensors to be used to acquire the data, and the methods by which the data are to be processed and utilized. Author

A87-10350
INTRODUCTION TO SATELLITE OCEANOGRAPHY
G. A. MAUL (NOAA, Atlantic Oceanographic and Meteorological Laboratory, Miami, FL) Dordrecht, Martinus Nijhoff Publishers, 1985, 615 p. refs

The application of the technology of aerospace electromagnetic remote sensing to the study of the oceans is examined. The use of photographic cameras, televisions, spectroradiometers, radar, and radio receivers to collect temperature, water depth, salinity, radiance, surface wind, and suspended particulate data is discussed; examples of collected data are given. Various measurement techniques and orbits for remote sensing vehicles are described. The nature of radiation, the interaction of electromagnetic waves with matter, polarization, radiometry, and radiance across an interface are considered. The instrumentation, optical properties of the atmosphere, water, and air, radiative transfer equations, and applications for infrared, visible, and microwave remote sensing are analyzed. I.F.

A87-10439
DETERMINATION OF THE GROUP STRUCTURE AND WEAKLY NONLINEAR INTERACTIONS OF SEA WAVES ON THE BASIS OF SPATIAL SPECTRA OF INTRINSIC RADIO EMISSION AND SCATTERED RADIO WAVES [OPREDELENIE GRUPPOVOI STRUKTURY I SLABONELINEINYKH VZAIMODEISTVII MORSKIKH VOLN PO PROSTRANSTVENNYM SPEKTRAM SOBSTVENNOGO I RASSEIANNOGO RADIOIZLUCHENIIA]
M. G. BULATOV, M. D. RAEV, E. I. SKVORTSOV, and V. S. ETKIN (AN SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 289, July-Aug. 1986, p. 201-204. In Russian. refs

The present study assesses the feasibility of the remote-sensing determination of nonlinear interactions of surface waves on the basis of mutual spatial power spectra of intrinsic and scattered signals in the microwave range. Experimental results were obtained off the coast of Kamchatka with an airborne radiometer-scatterometer operating at a wavelength of 2 cm. The results indicate that the proposed technique can effectively perform the remote diagnostics of nonlinear wave processes on the sea surface. B.J.

A87-12427
RADIOMETER METHOD FOR MEASURING THE SEA STATE [RADIOMETRICHESKII METOD IZMERENIIA BALL'NOSTI MORSKOGO VOLNENIIA]
A. P. BARABANOV, A. N. REZNIK, and K. S. STANKEVICH (Nauchno-Issledovatel'skii Radiofizicheskii Institut, Gorki, USSR) Radiofizika (ISSN 0021-3462), vol. 29, no. 5, 1986, p. 511-518. In Russian. refs

A sea-state measurement method is proposed which involves the determination of the maximum frequency in the brightness-temperature fluctuation spectrum of the surface thermal emission. These spectra are calculated as a function of sea surface state with reference to aircraft and satellite measurements. Minimum surface turbulence intensities measured by the proposed method are estimated. A radiometer implementing the proposed method was constructed, and its performance in laboratory conditions was evaluated. B.J.

A87-12696
A THREE-DIMENSIONAL FORMULATION FOR SYNTHETIC APERTURE RADAR IMAGES OF OCEAN WAVES IN ORBITAL MOTIONS
K. WAKASUGI, N.-F. KISHI, and M. MATSUO (Kyoto Institute of Technology, Matsugasaki, Japan) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Sept. 1986, p. 732-737. refs

An analytic model of ocean-surface SAR images with a three-dimensional framework is developed following the formalism presented by Swift and Wilson (1979) for a trochoidal swell propagating through a uniform field of Bragg-type distributed scatterers. Two-dimensional SAR images are calculated for the interpretation and prediction of actual SAR images of the ocean surface as a function of ocean-wave amplitude, wave frequency, and propagation direction and radar frequency, off-nadir angle of the antenna, and spatial resolution. Author

A87-12697
THE INFLUENCE OF SURFACE OIL ON C- AD KU-BAND OCEAN BACKSCATTER
K. P. SINGH (Banaras Hindu University, Varanasi, India), A. L. GRAY, R. K. HAWKINS, and R. A. ONEIL (Canada Centre for Remote Sensing, Ottawa) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Sept. 1986, p. 738-744. refs

A comparative study of ocean backscatter depression due to surface oil has been carried out using Ku-band and C-band scatterometers supported by some X-band and C-band imagery. The depression of radar backscatter for both C and Ku HH-polarized radiation has been measured for the incidence -angle range from 20 to 50 deg on two days, September 16 and 17, 1983, on which the average wind and wave-height conditions were 3-6 m/s, 0.3 m and about 10-14 m/s, 1.2 m, respectively. Results show that the depression in Ku-band backscatter increases from approximately 3-5 dB at 20 deg to about 10 dB or more at 30-40 and then decreases at the larger incidence angles. Generally, the angular dependence of C-band backscatter depression was similar to that at Ku-band, but the peak depression was shifted to slightly larger angles and usually exceeded Ku peak 1-2 dB. The Ku-band results are in good agreement with the results of Johnson and Crosswell (1982), which tentatively explained the angular results of backscatter depression on the basis of a selective damping of the First-order Bragg resonant waves by the oil film. This explanation, however, is inconsistent with the results of the present work when both C-band and Ku-band are considered. The significance of the data is discussed in the context of present and future radar systems (e.g., the ESA ERS-1 SAR and the Radarsat SAR). Author

A87-12734
METHODS FOR THE LASER MEASUREMENT OF THE STATISTICAL PROPERTIES OF THE SEA SURFACE [METODY LAZERNOGO IZMERENIIA STATISTICHESKIKH SVOISTV MORSKOI POVERKHNOSTI]
K. I. VOLIAK, V. G. MIKHALEVICH, T. B. SHEVCHENKO, and I. V. SHUGAN (AN SSSR, Institut Obshchei Fiziki, Moscow, USSR) (Vsesoiuznaia Konferentsiia po Kogerentnoi i Nelineinoi Optike, 12th, Moscow, USSR, Aug. 26-29, 1985) Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia (ISSN 0367-6755), vol. 50, June 1986, p. 1111-1116. In Russian. refs

A technique for the remote laser measurement of the statistical characteristics of sea waves is described which is based on the continuous sounding of the sea surface from an aircraft and the recording of back-reflected signals. The energy spectrum and correlation function of the two-dimensional random sea surface can be determined from a statistical analysis of the random surface of reflection points. The results demonstrate the promise of this laser-sounding method for a variety of meteorological conditions. B.J.

A87-12900
MAPPING NATURAL OBJECTS OF THE SHELF ON THE BASIS OF SPACE PHOTOGRAPHS [O KARTOGRAFIROVANII PRIRODNYKH OB'EKTOV SHEL'FA PO KOSMICHESKIM FOTOSNIMKAM]
V. A. MUSATOV Geodeziia i Kartografiia (ISSN 0016-7126), June 1986, p. 46-50. In Russian. refs

A87-13874* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
WAVENUMBER SPECTRA OF PACIFIC WINDS MEASURED BY THE SEASAT SCATTEROMETER
M. H. FREILICH (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and D. B. CHELTON (Oregon State University, Corvallis) Journal of Physical Oceanography (ISSN 0022-3670), vol. 16, April 1986, p. 741-757. NASA-supported research. refs

Vector winds measured by the Seasat-A Satellite Scatterometer (SASS) are analyzed to determine the spatial structure of oceanic surface winds over wavelengths from 200 to 2200 km. The analysis is performed in four latitudinal bands in the Pacific Ocean. The salient features of the results are summarized as follows: (1) for each of the four geographic regions, the spectra of meridional and zonal wind components and of kinetic energy are consistent with a power-law dependence on wavenumber; for midlatitude regions in both the Northern and Southern hemispheres the wave-number dependence of kinetic energy is k exp -2.2, while for tropical regions in both hemispheres it is k exp-1.9, (2) for each individual region, the spectral dependence on wavenumber is nearly the same for both velocity components and for kinetic energy, (3) comparisons of zonal and meridional component spectra indicate that midlatitude winds may be isotropic, while tropical winds may be significantly anisotropic, and (4) the coherence between wind components is small everywhere. Author

A87-14373* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE MICROWAVE AND IN SITU OBSERVATIONS OF THE WEDDELL SEA ICE COVER AND ITS MARGINAL ICE ZONE
J. C. COMISO (NASA, Goddard Space Flight Center, Greenbelt, MD) and C. W. SULLIVAN (Southern California, University, Los Angeles, CA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Aug. 15, 1986, p. 9663-9681. NASA-supported research. refs
(Contract NSF DPP-82-18752)

The radiative and physical characteristics of the Weddell Sea ice cover and its marginal ice zone are analyzed using multichannel satellite passive microwave data and ship and helicopter observations obtained during the 1983 Antarctic Marine Ecosystem Research. Winter and spring brightness temperatures are examined; spatial variability in the brightness temperatures of consolidated ice in winter and spring cyclic increases and decrease in brightness temperatures of consolidated ice with an amplitude of 50 K at 37 GHz and 20 K at 18 GHz are observed. The roles of variations in air temperature and surface characteristics in the variability of spring brightness temperatures are investigated. Ice concentrations are derived using the frequency and polarization techniques, and the data are compared with the helicopter and ship observations. Temporal changes in the ice margin structure and the mass balance of fresh water and of biological features of the marginal ice zone are studied. I.F.

A87-14374* National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
MESOSCALE OCEAN EDDY MEASUREMENTS BY MULTIBEAM ALTIMETRY
H. S. LEE (EG&G Washington Analytical Services Center, Inc., Wallops Island, VA) and C. L. PARSONS (NASA, Wallops Flight Center, Wallops Island, VA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, Aug. 15, 1986, p. 9693-9699. NASA-supported research. refs

A multibeam microwave radar altimeter concept is numerically simulated to evaluate its capability to remotely sense mesoscale oceanographic features and eddies in particular. The study tests the sensitivity of the sensor to variations of systematic and environmental parameters, including sensor attitude angle, sensor position, and system errors. A novel concept of computing eddy vorticity from the multibeam data is explored. Application of this concept to the detection of simulated ocean eddies in the presence of tracker noise data gives excellent results; the technique is shown to be simple and accurate. The minimum size of the eddy detectable by the multibeam altimeter is presented for a given performance characteristic of the radar. Author

A87-14417
OPERATIONAL MEASUREMENT OF SEA SURFACE TEMPERATURES AT CMS LANNION FROM NOAA-7 AVHRR DATA
N. CASTAGNE, P. LE BORGNE, J. LE VOURCH, and J.-P. OLRY (Meteorologie Nationale, Centre de Meteorologie Spatiale, Lannion, France) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Aug. 1986, p. 953-984. refs

Data from the NOAA-7 Advanced Very-High-Resolution Radiometer have been used on a routine basis for sea surface temperature (SST) retrieval at the Centre de Meteorologie Spatiale (CMS) in Lannion (France) since September 1983. Operational SST retrieval is still practised at CMS, using NOAA-9 data. Two methods are used. The first, which is automatic, produces numerical fields (resolution; 15 x 15 nautical miles); the second is manual and produces graphic documents (resolution about 10 km). The accuracy of satellite SSTs has been tested by various methods, the results of which are discussed. Some case studies of SST time variability in the Mediterranean are presented. One of the main conclusions is the need for mesoscale (10 km) numerical SST fields produced as often as possible (daily) by interactive methods. Author

A87-14418
DISCRIMINATION BETWEEN CRUDE-OIL SPILLS AND MONOMOLECULAR SEA SLICKS BY AIRBORNE RADAR AND INFRARED RADIOMETER POSSIBILITIES AND LIMITATIONS
H. HUEHNERFUSS (Hamburg, Universitaet, West Germany), W. ALPERS (Bremen, Universitaet, West Germany), and K. RICHTER (Deutsches Hydrographisches Institut, Hamburg, West Germany) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Aug. 1986, p. 1001-1013. refs
(Contract DFG-SFB-94)

The applicability of an X-band (9.4 GHz) real aperture radar (RAR) and an infrared (IR) radiometer to discriminate between crude-oil spills and monomolecular sea slicks is investigated over the same sea area. The results from quasi-simultaneous overflights over a crude-oil sill and three different sea slicks [oleylalcohol,di-(ethylenglycol)-mono-isosterarylether and methyloleate] show that the advantage of an imaging radar is its uniequivocalpotential for surveying large sea surfaces and that the advantage of an IR sensor is its ability to determine quickly the thick centers of crude-oil spills. However, neither the RAR nor the IR radiometer can discriminate between crude-oil spills and sea slicks. Therefore, an airborne coastal patrol with the objective of monitoring oil pollution must comprise a package of additional sensors, e.g. a microwave radiometer and/or a lidar system. Author

A87-14419
MAPPING OF TIDAL CURRENTS IN THE VICINITY OF AN OFFSHORE SANDBANK, USING REMOTELY SENSED IMAGERY
C. B. PATTIARATCHI, T. M. HAMMOND, and M. B. COLLINS (Swansea, University College, Wales) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Aug. 1986, p. 1015-1029. refs
(Contract NERC-GR/3/4284; NSF INT-84-02232)

Localized flow patterns in the vicinity of a headland-associated linear sandbank (the Scarweather Sands, northern Bristol Channel), cannot be detected in temporally averaged observations using conventional oceanographic measuring techniques. Airborne Thematic Mapper (ATM) data has been used previously to identify such patterns at one particular stage of a tidal cycle, using suspended sediments in the surface waters as passive tracers. The present contribution describes tidally varying flow patterns around the sands, based upon the interpretation of ATM imagery of ATM imagery over a large proportion (8 hours) of a tidal cycle. Comparisons are made between flow patterns identified from the imagery and (1) surface vector current measurements using high frequency (HF) radar, (2) predicted tidal currents and (3) field observations made at the times of the aircraft over passes. There is shown to be good correlation beteen the results obtained using the different methods. The information derived enhances the understanding of the mechanisms of formation and maintenance of this and other similar linear sandbanks. During the latter stages of the tidal cycle (towards low water) over which data were collected, the airborne imagery was affected by Sun-glitter. The presence of such a feature introduces errors in the quantitative evaluation of suspended sediment and chlorophyll in surface waters, in this and other investigations elsewhere. Author

A87-14851* Massachusetts Univ., Amherst.
1985 INTERNATIONAL GEOSCIENCE AND REMOTE SENSING SYMPOSIUM (IGARSS '85), UNIVERSITY OF MASSACHUSETTS, AMHERST, OCTOBER 7-9, 1985, PROCEEDINGS
K. R. CARVER, ED. (Massachusetts, University, Amherst) Symposium sponsored by IEEE, NASA, U.S. Navy, et al. IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Nov. 1986, 247 p. For individual items see A87-14852 to A87-14862.

Papers are presented on an EM subsurface radar based on the transient field radiated by a wire antenna; the microwave dielectric, structural, and salinity properties of simulated sea ice; the extraction of sea-ice data from satellite SAR imagery, and the probing of thick vegetation canopies with a field microwave

scatterometer. Also discussed are the bidirectional reflectance modeling of a conifer forest canopy, a microwave dielectric model for aggregated soils, and the estimation of soil hydraulic parameters with passive microwave data. O.C.

A87-14853* Environmental Research Inst. of Michigan, Ann Arbor.
NUMERICAL SIMULATION OF SYNTHETIC APERTURE RADAR IMAGE SPECTRA FOR OCEAN WAVES
D. R. LYZENGA (Michigan, Environmental Research Institute, Ann Arbor) (1985 International Geoscience and Remote Sensing Symposium /IGARSS '85/, Amherst, MA, Oct. 7-9, 1985) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Nov. 1986, p. 863-872. NASA-supported research. refs
(Contract N00014-81-C-0692)

A numerical model for predicting the synthetic aperture radar (SAR) image of a moving ocean surface is described, and results are presented for two SIR-B data sets collected off the coast of Chile. Wave height spectra measured by the NASA radar ocean wave spectrometer (ROWS) were used as inputs to this model, and results are compared with actual SIR-B image spectra from orbits 91 and 106. Additional parametric variations are presented to illustrate the effects of nonlinearities in the imaging process. Author

A87-14854
ON THE RELATIVE IMPORTANCE OF MOTION-RELATED CONTRIBUTIONS TO THE SAR IMAGING MECHANISM OF OCEAN SURFACE WAVES
W. R. ALPERS (Bremen, Universitaet, West Germany) and C. BRUENING (Max-Planck-Institut fuer Meteorologie, Hamburg, West Germany) (1985 International Geoscience and Remote Sensing Symposium /IGARSS '85/, Amherst, MA, Oct. 7-9, 1985) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Nov. 1986, p. 873-885. BMFT-supported research. refs
(Contract DFG-SFB-94; N00014-83-G-0126)

The relative importance of the various motion-related contributions to the SAR imaging mechanism of ocean surface waves is studied by using two-dimensional Monte Carlo simulation techniques. It is shown that for wind waves the often-observed stretching of the peak wavelength and the rotation of the spectral peak toward the range direction is caused by both the degradation in azimuthal resolution and the nonlinearity of the velocity bunching mechanism. The distortion of the SAR image spectrum relative to the ocean wave spectrum due to the degradation in azimuthal resolution is mainly caused by the spread of the radial facet velocities within a SAR resolution cell. The effect of the radial orbital acceleration arising from the long waves of scales larger than a SAR resolution cell on the nonlinearity of the SAR imaging mechanism is small. Author

A87-14994*# General Software Corp., Landover, Md.
THE RELATIONSHIP BETWEEN SATELLITE MEASURED CONVECTIVE BURSTS AND TROPICAL CYCLONE INTENSIFICATION
J. STERANKA (General Software Corp., Landover, MD), E. B. RODGERS (NASA, Goddard Space Flight Center, Greenbelt, MD), and R. C. GENTRY (Clemson University, SC) Monthly Weather Review (ISSN 0027-0644), vol. 114, Aug. 1986, p. 1539-1546. NASA-supported research. refs

High temporal resolution satellite IR measurements are used to analyze the relationship between the mean temperature of cloud canopy tops and the future maximum winds of Atlantic Ocean tropical cyclones. The measurements showed that prolonged surges of intense convection developed in the rear region surrounding cyclone depression centers before the maximum winds initially increased. When surges lasted for 9 hr or more, and the cloud-top temperature within 222 km of the cyclone centers was 238 K or less, then 71 percent of the time the maximum winds increased by 5 m/s or more within 24 hr. When intense convection was not present, similar maximum wind increases occurred only 37 percent of the time. C.D.

A87-15140* Scripps Institution of Oceanography, La Jolla, Calif.
OCEANIC CLOUD FEEDBACKS ON EARTH RADIATION BUDGET PARAMETERS
B. CHERTOCK and R. C. J. SOMERVILLE (California, University, Scripps Institution of Oceanography, La Jolla) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 255-258. Research supported by the University of California. refs
(Contract NSF ATM-84-13953; NAG5-236)

Oceanic cloud variability and sensitivity to sea surface temperature (SST) were examined using radiometer data gathered with instrumentation on the Nimbus-7 satellite. The study area was a region of the Pacific Ocean north of Hawaii. SST and albedo data for the period 1978-1983 were compared and similar trends were found for minimal values of the albedo and SST. M.S.K.

A87-15144
VARIABILITY OF THE DAILY NET (SHORTWAVE AND LONGWAVE) RADIATIVE FLUX AT THE OCEAN SURFACE DURING MILDEX
C. GAUTIER and R. FROUIN (California, University, La Jolla) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 268-271. refs

Results are reported from calculations of the net radiation field over the surface of the ocean based on ship and satellite sounder data collected during the MILDEX campaign. Expressions were defined for estimating the net shortwave radiation and the bulk radiative properties at the surface as functions of satellite data. The estimates, which were based on GOES-6 VISSR/VAS images for the shortwave radiance and TOVS data for longwave radiance, were compared with ship data. M.S.K.

A87-15616#
ICE SHEET TOPOGRAPHY AND INTERNAL CHARACTERISTICS FROM MICROWAVE AND RADAR MEASUREMENTS
S. M. HODGE (USGS, Tacoma, WA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 237-255. refs

Satellite radar altimetry and very-high-frequency (VHF) radar sounding are very important remote sensing techniqeus for the study of the Antarctic and Greenland ice sheets. This paper describes the major scientific results which have been found by using them, as well as their scientific limitations and relevance to ice sheet dynamics. Radar sounding, in particular, is indispensible to polar glaciology, not only because it provides the most crucial data of all, the ice thickness, but also because it has yielded a wealth of unexpected information, such as flow tracers, presence or absence of liquid water at the bed, and evidence of past volcanism. Author

A87-15617#
FUTURE SATELLITE SYSTEMS FOR OCEANIC AND CRYOSPHERIC OBSERVATIONS
J. W. SHERMAN, III (NOAA, National Environmental Satellite, Data and Information Service, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 257-267. refs

NOAA planning to increase the availability of satellite-based global ocean wind, wave, and temperature data is reviewed. The present system, combining shipboard measurements and limited satellite data, is briefly characterized; a data-integration and distribution network for 1989-1990 is presented in a block diagram and described; and the sensors and capabilities of the satellites to be included (Geosat, ERS-1, N-Ross, JERS-1, DMSP, MOS-1,

and NOAA) are listed in tables and discussed. Increases in the number of daily wind and wave data points from the present 2,000-4,000 to up to 4 million and about 120,000, respectively, are predicted. T.K.

A87-15644#
WATER-DEPTH MEASUREMENT AND BOTTOM TYPE ANALYSIS USING A TWO-DIMENSIONAL ARRAY IMAGER
A. B. HOLLINGER, N. T. ONEILL, J. D. DUNLOP (MONITEQ, Ltd., Concord, Canada), M. T. COOPER (U.S. Navy, Naval Coastal Systems Center, Panama City, FL), H. EDEL (Department of Fisheries and Oceans, Ottawa, Canada) et al. IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 553-563.

Shallow-water digital mapping and bottom-type-classification experiments have been carried out with an airborne imaging spectrometer. A detailed characterization of the water mass depends on accurate spectroradiometry of the low-level intensities that are inherent in water scenes. The imaging spectrometer used is a prototype sensor capable of providing both high spectral resolution (about 2.6 nm) and high angular resolution (about 1 mrad). Author

A87-15678*# Environmental Research Inst. of Michigan, Ann Arbor.
OPTIMIZATION OF MULTISPECTRAL SENSORS FOR BATHYMETRY APPLICATIONS
F. J. TANIS (Michigan, Environmental Research Institute, Ann Arbor) and H. J. BYRNES (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 865-874. refs

The Naval Oceanographic office has proposed to augment current capabilities with an airborne MSS system capable of conducting hydrographic surveys of shallow and clear oceanic waters for purposes of determining ocean depth and identifying marine hazards. Recent efforts have concentrated on development of an active/passive system, where the active system will be used to calibrate a passive multispectral sensor. In this paper, parameters which influence collection-system design and depth-extraction techniques have been used to describe the practical bounds to which MSS technology can support coastal bathymetric surveying. Performance is estimated in terms of expected S/N and depth-extraction errors. Author

A87-15685#
ANALYSIS OF DIFFERENT ALGORITHMS FOR SEA SURFACE TEMPERATURE RETRIEVAL FROM AVHRR DATA
G. CANNIZZARO, M. RICOTTILLI (Telespazio S.p.A., Rome, Italy), and C. ULIVIERI (Telespazio S.p.A.; Roma, Universita, Rome, Italy) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 929-938. refs

A critical review of a great number of split-window algorithms capable of correcting NOAA/AVHRR 11-micron (channel-4) data for atmospheric attenuation by the use of the differential absorption properties of the two AVHRR adjacent channels (channels 4 and 5) in the 11-micron window region has been performed. A literature review of the algorithms is undertaken with the aim of singling out the algorithm structure (spectral bands considered, number of free parameters, etc.) and type (simulation and/or regression); the environmental conditions of validity of the algorithm (geometric, geographic, meteo-climatological, oceanographic, etc.); and the reported accuracy figures. Also included are an analysis of the difference of the algorithm outputs as a function of input data and conclusions on their applicability to sea-surface temperature determination. Author

A87-15686#
A NEAR REAL-TIME DATA SYSTEM FOR SATELLITE PASSIVE MICROWAVE ICE MAPS
F. W. THIRKETTLE (Ph.D. Associates, Inc., Toronto, Canada) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 939-945. Sponsorship: Department of the Environment. refs (Contract DE-KM14-73-0014; DE-KM14-73-3065)

The Scanning Multifrequency Microwave Radiometer (SMMR) operating on an alternate day basis onboard the U.S. NASA Nimbus-7 satellite has been utilized for the all weather, day and night remote sensing of sea ice. A near real-time data collection, analysis, display and distribution system functioning in an operational mode was developed by Ph.D. Associates Inc. for the sea ice product (under contract to the Ice Research and Development Branch of the Atmospheric Environment Service, Ottawa). The system begins with the selective retrieval of the previous day SMMR brightness temperature data from the NODDS (National Oceanic Data Distribution System) computer system in Monterey, CA, and terminates four hours later with the transmission, by facsimile, of 8 by 10 in. submaps containing geographically located and computer generated ice concentration contours. This operational system allows the user flexibility in the display of the final product and has been successfully employed in the support of a number of campaigns. Author

A87-15687#
COMPUTER-ASSISTED TECHNIQUES FOR GEOPHYSICAL ANALYSIS OF SAR SEA-ICE IMAGERY
B. A. BURNS, R. R. JENTZ, C. G. CARUTHERS, J. D. LYDEN, and P. L. JACKSON (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 947-959.

Computer-assisted techniques have been developed to obtain geophysical parameters from synthetic aperture radar (SAR) image data of sea ice. The algorithms developed to produce estimates of ice field motion, floe size distribution and ice concentration utilize varying degrees of manual interpretation integrated with minicomputer and microcomputer computations. These techniques are illustrated with applications to data obtained during the 1983 and 1984 Marginal Ice Zone Experiments. Author

A87-15688#
NIMBUS-7 MICROWAVE RADIOMETRY OF OCEAN SURFACE WINDS AND SEA ICE
I. G. RUBINSTEIN, F. E. BUNN (Ph.D. Associates, Inc., Toronto, Canada), and R. O. RAMSEIER (Department of the Environment, Atmospheric Environment Service, Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 961-970. Research supported by the Department of the Environment. refs

Passive microwave imagery from satellite sensors first became available with the 19 GHz horizontal polarization radiometer carried on the Nimbus-5 satellite launched in 1972. Continuity has been provided with the 1978 launch of five frequency dual polarization radiometers (6, 10, 18, 21, and 37 GHz) on the Seasat and the Nimbus-7 satellites. Still operational, Nimbus-7 will be replaced with the launch of a DMSP satellite in 1986 carrying a four frequency dual polarization radiometer (19, 22 single polarized, 37 and 85 GHz). This paper describes the development and validation of algorithms used to obtain wind speed over open oceans, and sea-ice concentration/ice age. This work primarily involves the Nimbus-7 Scanning Multichannel Microwave Radiometer - SMMR (Nimbus-5, Seasat, and simulated DMSP radiometer data also have been studied). Author

A87-15689#
EFFECTS OF SPATIAL VARIABILITY ON REMOTELY-SENSED SEA SURFACE TEMPERATURE
R. F. GASPAROVIC (Johns Hopkins University, Laurel) and J. C. WILKERSON (NOAA, National Environmental Satellite and Data Information Services, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 981-990.

Validating satellite measurements of sea surface temperature (SST) rarely involves comparing precisely coincident in situ and remote observations. Consequently, spatial variations in SST can result in measurement differences being attributed incorrectly to instrument errors. The effects of SST spatial variability are quantified using the SST structure function to estimate the expected rms temperature difference as a function of measurement separation distance. Aircraft and satellite infrared measurements are used to illustrate the magnitude and geographical dependence of these effects. Differences between in situ, point observations and remote, area-averaged measurements are also examined using satellite infrared imagery from regions surrounding moored oceanographic buoys. Author

A87-15690#
THE USE OF SATELLITE OBSERVATIONS OF OCEAN COLOR IN COMMERCIAL FISHING OPERATIONS
R. E. WITTENBERG-FAY (NOAA, National Ocean Service, La Jolla, CA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 991-998. refs

A87-15691*# Environmental Research Inst. of Michigan, Ann Arbor.
CALIBRATION OF DUAL-FREQUENCY SAR OCEAN IMAGERY
E. S. KASISCHKE, R. W. LARSON, and D. R. LYZENGA (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 999-1012. refs
(Contract N00014-81-C-0692; N00014-83-C-0513; NAS9-17205; F19628-84-C-0081)

A calibration procedure for digital aircraft SAR imagery is presented. Techniques to utilize internal and external calibration references are discussed. Examples of calibrated intensity scans from an oceanographic test site are presented. The relationship of the aircraft SAR calibration procedure to future spaceborne SAR systems is discussed. Author

A87-15692#
TEMPORAL AND SPATIAL ANALYSES OF CIVIL MARINE SATELLITE REQUIREMENTS
N. J. HOOPER (Metrics, Inc., Atlanta, GA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 1015-1033.

In mid-1989, two similar oceanic measuring satellite systems are planned for launch. Both systems are designed to provide oceanic data and information, but the instrumentation approaches are different. Civil users within the U.S. will be able to participate in either of these two satellite programs only by means of a proposed NOAA-led activity. This paper reports on data analysis conducted in support of that activity. The results of this analysis indicate that the combination of sensors would satisfy 70 percent of the marine users of surface wind data and products, the highest priority ocean parameter. Author

A87-15693#
REMOTE SENSING - IMAGE PROCESSING FOR MONITORING SURFACE EFFECTS OF DEEP SEABED MINING
J. B. ZAITZEFF and P. CLEMENTE-COLON (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 1035-1044. refs

A pilot study was initiated in June 1982 continuing to the present to evaluate the capabilities of remote sensing as an independent tool for observing the potential surface and near-surface environmental effects of ocean mining. The effort involved the acquisition and analysis of limited data sets from the NOAA Polar-Orbiter AVHRR and the NASA Nimbus-7 CZCS. Because the mining sites are in the Intertropical Convergence Zone, extensive cloud cover through the seasons severely limits satellite visible and IR sensor monitoring capabilities. However, sufficient cloud-free areas were found, and analyses of a small sample of both AVHRR and CZCS scenes demonstrate that deep-seabed mining-surface-parameter indices are within present satellites capabilities. Author

A87-15787
ESTIMATION OF SEA SURFACE TEMPERATURE FROM AVHRR DATA - REPLY TO SOME COMMENTS BY J. R. EYRE
S. M. SINGH (Reading, University, England), A. P. CRACKNELL (Dundee, University, Scotland), and A. F. G. FIUZA (Lisboa, Universidade, Lisbon, Portugal) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Sept. 1986, p. 1191-1196. refs
(Contract NERC-F60/G6/12)

A87-15861#
MONITORING OF MARINE ENVIRONMENT BY MULTI STAGE REMOTE SENSING
H. OCHIAI (Toba Merchant Marine College, Japan) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 11 p.
(IAF PAPER 86-87)

The results of multistage remote sensing (using Landsat, NOAA AVHRR, Space Shuttle SIR-B, and GMS VISSR imagery) of the marine environment in three test site areas around Japan are presented. Special attention is given to the comparison of the effectiveness of the imageries obtained by particular satellite instruments for investigating the various water characteristics (river effluents, coastal currents, and hot effluxes from power stations), for studying oil and red tide pollution, and for monitoring the sea ice in the Sea of Okhotsk. I.S.

A87-15863*# National Aeronautics and Space Administration, Washington, D.C.
TOPEX/POSEIDON - AN INTERNATIONAL SATELLITE OCEANOGRAPHY MISSION
W. F. TOWNSEND (NASA, Washington, DC) and J.-L. FELLOUS (CNES, Paris, France) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 9 p. refs
(IAF PAPER 86-89)

The TOPEX/Poseidon mission, a joint NASA-CNES effort, strives to provide highly accurate global ocean topography measurements over a three year period utilizing highly advanced satellite radar altimetry techniques. Scheduled for launch in late 1991, the TOPEX/Poseidon satellite, together with ESA's first European remote sensing satellite and NASA's scatterometer, promises to provide a fundamental breakthrough in the present knowledge of how the oceans work as a global system. As part of the World Ocean Circulation Experiment, TOPEX/Poseidon measurements will aid in the determination of the three-dimensional current structure of the global oceans. K.K.

A87-15864#
EXPERIMENTS ON REMOTE SENSING SEA SURFACE TEMPERATURE
G. K. KOROTAEV, V. S. SUETIN, IU. B. RATNER, and S. N. KOROLEV (AN USSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 18 p. refs
(IAF PAPER 86-91)

The algorithms for calculating sea surface temperature (SST) from remotely sensed data are analyzed. The multivariate character problem that occurs when evaluating the SST from satellite data is examined. Examples in which the SST is calculated from two-channel microwave and IR data are presented. The data reveal that instruments with operating wavelengths of 5-6 cm are capable of sensing SST with an accuracy of about 1 K. I.F.

A87-16078#
FRENCH PROJECTS IN SPACE OCEANOGRAPHY AND ASSOCIATED DATA PROCESSING ACTIVITIES
M. AVIGNON (CNES, Toulouse, France) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 18 p.
(IAF PAPER 86-413)

An outline of planned French projects in space-based oceanography is presented. The missions, orbits, and sensors of the Topex-Poseidon, ERS 1, and Ocean Color on SPOT 4 projects are summarized, and data on the sensors are presented. The general organization of the data processing is shown, and the data processing involved in each of the three projects is outlined. The thematic processing is presented, using the sea surface topography center as an example. C.D.

A87-16371
AIRBORNE MEASUREMENTS OF THE OCEAN RADAR CROSS SECTION AT 5.3 GHZ AS A FUNCTION OF WIND SPEED
F. FEINDT (Hamburg, Universitaet, West Germany), V. WISMANN (Max-Planck-Institut fuer Meteorologie, Hamburg, West Germany), W. ALPERS (Bremen, Universitaet, West Germany), and W. C. KELLER (U.S. Navy, Naval Research Laboratory, Washington, DC) Radio Science (ISSN 0048-6604), vol. 21, Sept.-Oct. 1986, p. 845-856. ESA-BMFT-supported research. refs

Measurements of the normalized radar cross section (NRCS) at 5.3 GHz (C band) of the sea surface as a function of wind speed and direction are presented. The data were obtained by a coherent scatterometer mounted on a small two-engine airplane performing circle flights over the Atlantic. The data show that the wind speed exponent at 5.3 GHz is typically 20 percent smaller than at 13.9 GHz (Ku band). Furthermore, the upwind/crosswind ratio of the NRCSs at C band is typically 20 percent smaller, and the upwind/downwind ratio typically 30 percent smaller than at Ku band. Author

A87-16457#
ANALYSIS AND INTERPRETATION OF SIR-A IMAGE OF LARGE INTERNAL WAVES IN THE ANDAMAN SEA
S. M. BHANDARI, N. K. VYAS, and H. I. ANDHARIA (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 195-200. refs

This paper presents the results of a fresh analysis of a system of large internal waves in the Andaman Sea imaged during the SIR-A flight in November 1981. Both visual and digital analysis techniques have been used. Different radar backscatter features observed on the image are explained in terms of the interaction of these large amplitude internal waves with the major features of sea-floor topography. An attempt was also made to model the observed transformation of wave properties based on a linear wave-bathymetric interaction theory. The observed changes in wavelength across the internal wave packet of a factor of more than 4 require steep variations in subsurface topography. Author

A87-16459#
A MONTE CARLO SIMULATION OF RADIATION TRANSFER IN THE SEA
P. V. SATHE and S. SATHYENDRANATH (National Institute of Oceanography, Goa, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 207-214. refs

A Monte Carlo simulation of radiation transfer (radiation covering wavelengths from 410-690 nm) from the atmosphere to the sea, within the sea, and then back to the atmosphere is described. The optical parameters of chlorophyll, suspended sediments, and yellow dissolved matter related to remote sensing are studied. It is observed that the absorption increases with solar elevation while the percentage of light reaching the surface upwards from within the water body has decreased, and that there is good correlation between the theoretical and simulated reflectance data. I.F.

A87-16481#
CHLOROPHYLL CONCENTRATION AS AN INDEX OF MAXIMUM SUSTAINABLE YIELD - A CASE STUDY IN REMOTE SENSING
P. V. R. NAIR, V. K. PILLAI, V. K. BALACHANDRAN, K. N. KURUP, and G. SUBBARAJU (Central Marine Fisheries Research Institute, Cochin, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 354-358.

A87-16482#
SATELLITE OBSERVATIONS OF CIRCULATION PATTERNS IN THE ARABIAN SEA
M. M. ALI and P. S. DESAI (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 359-363. refs

A87-16500#
SEA SURFACE TEMPERATURE VARIABILITY OVER NORTH INDIAN OCEAN DURING SOUTHWEST MONSOON - A STUDY OF TWO CONTRASTING SEASONS
M. R. RAMESH KUMAR, S. SATHYENDRANATH, N. K. VISWAMBHARAN, and L. V. GANGADHARA RAO (National Institute of Oceanography, Goa, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 469-474. refs

Using the satellite derived Sea Surface Temperature (SST) data for the years 1979 (bad monsoon) and 1983 (good monsoon), the SST variability for two contrasting monsoon seasons is studied. The study indicates that large negative anomalies off Somali and Arabian coasts are associated with good monsoon rainfall over India. The strong monsoonal cooling in these regions can be attributed to the strong low level winds and intense upwelling. The reappearance of the 27 C isotherm off Somali coast in the month of May/June coincides with the onset of southwest monsoon. The study also brings out the influence of the Central Indian Ocean SST anomalies on the monsoon activity. The positive anomalies in this region are associated with good monsoon rainfall and vice versa. Author

A87-16501#
OCEAN COLOUR MAPPING USING LANDSAT MSS DATA
N. CHATURVEDI, M. CHAKRABORTY, A. NARAIN (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), G. SUBBARAJU, P. V. R. NAIR (Central Marine Fisheries Research Institute, Cochin, India) et al. IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 475-480. refs

To evaluate the applicability of Landsat MSS data in ocean color mapping, an attempt was made to look into the relationship between the gray values and oceanic parameters like chlorophyll and particulate matter. Landsat MSS data of Nov. 10, 1981, was analyzed and compared with the sea truth data of Nov. 27, 1981. MSS bands 4 and 5 showed the maximum gray value range as compared to MSS bands 6 and 7. A density sliced image of band

4 was generated in the form of a color coded map showing the sliced levels corresponding to various pigment levels using linear correlation with band 4 gray values. A multiple linear regression analysis was carried out for both chlorophyll and particulate matter. A color coded chlorophyll map was also generated using all four band data. Author

A87-16522#
A COMPARATIVE STUDY OF SPECTRAL SIGNATURES OF ANTARCTICA
I. V. MURALIKRISHNA (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 605-607. refs

Antarctica and Himalayas have obvious climatic differences that lead to the different types of ice and snow being sensed by Landsat. A comparative study of reflectances of Dakshina Gangotri and Himalayan region suggest that the ice pack in the remote continent is less dense, with higher radiances recorded by Landsat MSS. However, the regions with crests formed by wind erosion criss-crossed with flow in glacier on the ice-shelf have a different spectral signature, with increased absorption in the NIR channel when compared to reflectance in the low density. Author

A87-16523#
DEVELOPMENT OF K ALGORITHM FOR OCEAN COLOUR MAPPING USING NIMBUS-7 CZCS DATA - STUDIES IN THE ARABIAN SEA
B. KUMARI, R. M. DWIVEDI, A. NARAIN (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), G. SUBBARAJU, P. V. R. NAIR (Central Marine Fisheries Research Institute, Cochin, India) et al. IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 608-613. refs

An estimation of diffuse attenuation coefficient (K) is useful in understanding the optical properties of ocean water types. Since K covaries with pigment concentration present in oceanic waters, it can be therefore used as an indirect measure of chlorophyll concentration. With the help of sea truth data an attempt has been made to develop an algorithm for estimating K at 490 and 520 nm from the ratio of inherent upwelling radiances at 443 nm and 550 nm. A least-squares regression analysis was performed for K (490), K (520), and chlorophyll concentration. The coefficient of determination and standard error of estimate for this analysis are presented. A color-coded K map was generated by applying the K algorithm to water-leaving radiance from Nimbus-7 CZCS after atmospheric correction. Author

A87-16524#
INTERPRETATION AND ANALYSIS OF OCEANIC FEATURES OBSERVED ON TERRA IMAGERY OVER LAKSHADWEEP SEA
H. I. ANDHARIA, S. M. BHANDARI, and N. K. VYAS (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 614-619. refs

Study of the oceanic features observed on the TERRA Imagery collected during Salyut-7 Mission in April 1984 is presented. The selected image is over Lakshadweep Sea and contains a large sun-glint area at the center. At the periphery of the sun-glint region, a number of important oceanic features are clearly visible. The paper describes in detail the observed phenomena and attempts to provide a physical explanation for them in terms of atmospheric and oceanic processes. The paper also describes the physical parameters that can be derived from such features. Author

A87-16746
OIL SLICK DETECTION WITH AN AIRBORNE SLAR
F. WITTE (DFVLR, Institut fuer Hochfrequenztechnik, Wessling, West Germany) IN: NAECON 1986; Proceedings of the National Aerospace and Electronics Conference, Dayton, OH, May 19-23, 1986. Volume 1 . New York, Institute of Electrical and Electronics Engineers, 1986, p. 234-239.

In the field of remote sensing and reconnaissance research the German Aerospace Research Establishment (DFVLR) carries out different experiments with different sensors or sensor packages. One of these is the DFVLR-SLAR, an experimental inexpensive side-looking airborne radar operating in X-band. It is used for generation of radar imagery from land and sea surfaces with spatial resolution similar to that of future satellite systems. Depending on the application, the SLAR is flown in different aircraft such as the Cessna 207, Do28, or Do 228. The DFVLR-SLAR was employed during the Archimedes II project (oil slick detection, qualification and classification in the North Sea) on October 1 and 2, 1985. The data collected show the good ability of the SLAR to detect thin oil slicks, of the order of 1 micron or less, on the water's surface. The observed shapes of the slicks are similar to those obtained from an UV and an IR sensor. Author

A87-16859* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NIMBUS 7 SATELLITE MEASUREMENTS OF THE SPRINGTIME ANTARCTIC OZONE DECREASE
R. S. STOLARSKI, A. J. KRUEGER, M. R. SCHOEBERL, R. D. MCPETERS, P. A. NEWMAN, and J. C. ALPERT (NASA, Goddard Space Flight Center, Greenbelt, MD) Nature (ISSN 0028-0836), vol. 322, Aug. 28, 1986, p. 808-811. refs

Measurements from the Solar Backscatter Ultraviolet instrument and the Total Ozone Mapping Spectrometer aboard the Nimbus 7 satellite, a sun-synchronous polar-orbiting satellite which passes any given point on the dayside near local noon, are reported. These provide global measurements of ozone from November 1978 to the present which confirm the reported decline in total ozone in the Antarctic region and show the phenomenon to be regional in extent. The decrease occurs during September as the sun rises, reaching a minimum in mid-October. Seven years (1979-1985) of October monthly means show a 40 percent decrease in the ozone minimum and a 20 percent decrease in the surrounding ozone maximum. C.D.

A87-16944
OCEAN RESEARCH FROM SPACE IN A VISIBLE SPECTRAL BAND
B. A. NELEPO, G. A. GRISHIN, and V. S. SUETIN (AN USSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR) Acta Astronautica (ISSN 0094-5765), vol. 13, May 1986, p. 241-245. refs

This paper discusses some results of optical monitoring of the World Ocean acquired over recent years. From the methodical viewpoint, two trends can be mentioned. One is associated with the studies of ocean dynamics in reflected light. The other aims at the reconstruction of the optical characteristics of the ocean and its biproductivity in analyzing inherent radiation. Internal waves, internal soliton, and hydrological, hydrooptical and optical-biological state monitoring are discussed. Author

A87-17438
CHARACTERISTICS OF L-BAND MULTIPATH FADING DUE TO SEA SURFACE REFLECTION IN AERONAUTICAL SATELLITE COMMUNICATIONS
M. YASUNAGA, Y. KARASAWA, T. SHIOKAWA, and M. YAMADA (Kokusai Denshin Denwa Co., Ltd., Research and Development Laboratories, Tokyo, Japan) Institute of Electronics and Communication Engineers of Japan, Transactions, Section E (English) (ISSN 0387-236X), vol. E69, Oct. 1986, p. 1060-1063. refs

A87-17663
INFLUENCE OF THE ADEQUACY OF THE ALLOWANCE FOR THE ATMOSPHERE AND SPECTRAL-MEASUREMENT ERRORS ON THE RELIABILITY OF IDENTIFYING THE STATE OF NATURAL OBJECTS [VLIIANIE ADEKVATNOSTI UCHETA ATMOSFERY I POGRESHNOSTEI SPEKTRAL'NYKH IZMERENII NA DOSTOVERNOST' IDENTIFIKATSII SOSTOIANIIA PRIRODNYKH OB'EKTOV]
V. A. GOLOVKO IN: Remote sensing of the earth from the Meteor-Priroda satellite: The Bulgaria-1300-II Soviet-Bulgarian experiment . Leningrad, Gidrometeoizdat, 1985, p. 120-127. In Russian. refs

Numerical modeling is used to perform a comparative analysis of estimates of the reliability of the identification of chlorophyll content in sea water depending on the adequacy of the allowance for the atmosphere and errors in satellite spectral measurements for different optical conditions of the atmosphere. Measurements with two instruments are compared: the CZCS and the SMP-32 multichannel spectrometer (part of the Bulgaria-1300-II instrumentation on the Meteor-Priroda satellite). B.J.

A87-17863
SNOW MELT AND SURFACE ALBEDO IN THE ARCTIC BASIN
D. A. ROBINSON, M. C. SERREZE, G. KUKLA (Lamont-Doherty Geological Observatory, Palisades, NY), G. SCHARFEN, and R. G. BARRY (Cooperative Institute for Research in Environmental Sciences, Boulder, CO) Geophysical Research Letters (ISSN 0094-8276), vol. 13, Sept. 1986, p. 945-948. refs
(Contract NSF ATM-83-18676; AF-AFOSR-86-0053)

Meteorological satellite imagery has been used to map the changes of surface brightness and texture associated with the seasonal progression of snow melt on the arctic pack ice in 1977 and 1979, and, using an image processor, surface albedo has been estimated. This is the first basin-wide information on the temporal and spatial change of the ice surface and its albedo. In both years studied, melt progressed poleward from the Barents and Kara Seas and from the Southern Hemisphere and Chukchi Seas. Average surface albedo of the Arctic Basin fell to 0.40, and in the central Arctic to about 0.50, in late July of each year, but the melt occurred approximately 3 weeks later in 1979 than in 1977. Results suggest a significant year-to-year variability in the arctic energy and mass balance. Author

A87-18362
SOME RESULTS ON FIELD EXPERIMENTS IN MOS-1 - MARINE OBSERVATION SATELLITE-1, VERIFICATION PROGRAM
K. ARAI, T. IGARASHI (National Space Development Agency of Japan, Tokyo), and C. ISHIDA (National Space Development Agency of Japan, Hiki) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1253-1261.

In order to develop the MOS-1 microwave scanning radiometer data processing algorithms for the derivation of various geophysical parameters, field experiments by ground-based radiometry with in-situ data and analysis on these data have been carried out. Some results presented in this paper provide inherent microwave emission and scattering characteristics. On the atmospheric water vapor and cloud liquid, computer simulation shows a good correlation between these parameters and the brightness temperature or the zenith attenuation; thus, these algorithms are methodologically reasonable. However, the measured antenna temperature is apparently greater than theoretical ones, and the antenna pattern correction is important to correct these sidelobe affects. Author

A87-18363
REAL TIME REPORTING SYSTEM ON OCEANIC CONDITIONS BY SPACE STATION
H. KOSHIISHI, M. NAKA, H. YAMAMOTO, K. MATSUMOTO, K. HOMMA (National Aerospace Laboratory, Chofu, Japan) et al. IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1263-1270. Research supported by the Fujitsu, Ltd., Hitachi, Ltd., Mitsubishi Electronic Corp., NEC Corp., and Toshiba Corp.

This paper presents some results of conceptual design studies of the Real Time Reporting System on Oceanic Conditions (RTRSOC). By using a Space Station this system can acquire, process, and report world-wide information on oceanic conditions in real time. The sensor system of the RTRSOC is composed mainly of optical and microwave large aperture sensors which are realized only in the Space Station. A high speed onboard data processing system is indispensable for real time image processing and analysis. The RTRSOC mission has great significance for industrial activities, and will also be able to meet many of the future requirements for remote sensing. Author

A87-18377
DIFFUSION PATTERN OF THE COLD WATER OFF VLADIVOSTOK BY NOAA/AVHRR
Y. HATAKEYAMA (Asia Air Survey Co., Ltd., Atsugi, Japan), S. TANAKA, and T. SUGIMURA (Remote Sensing Technology Center of Japan, Tokyo) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1375-1380.

A87-18588
GEOMORPHOLOGY OF A ROCKY COASTAL PLATFORM IN COLD REGIONS (ANTICOSTI ISLAND, GULF OF SAINT LAWRENCE, CANADA) [GEOMORPHOLOGIE D'UNE PLATE-FORME LITTORALE ROCHEUSE DE REGIONS FROIDES /ILE D'ANTICOSTI, GOLFE DU SAINT-LAURENT, CANADA/]
L. NADEAU, J.-M. M. DUBOIS, G. LESSARD, and D. COTE (Sherbrooke, Universite, Canada) Photo Interpretation (ISSN 0031-8523), vol. 24, Mar.-Apr. 1985, p. 1-5, 7, 9, 11-14. In French, English, and Spanish.

A87-18641
ESTIMATION OF OCEANIC EDDY TRANSPORTS FROM SATELLITE ALTIMETRY
G. HOLLOWAY (Institute of Ocean Sciences, Sidney, Canada) Nature (ISSN 0028-0836), vol. 323, Sept. 18, 1986, p. 243, 244. refs
(Contract N00014-85-C-0440)

Attention is given to a novel approach for ocean eddy observation which employs sea-surface elevation fluctuations determined from Seasat altimetry to obtain a simple estimate of eddy transports. The method is presently applied to heat and salt transport in the North Pacific; the 5 million kg/sec eddy salt transport value obtained for 35 deg N is consistent with observed salinity, given the wide uncertainty in net fresh water supply. O.C.

A87-19416
RADAR BACKSCATTER FROM SEA ICE
S. P. GOGINENI (Kansas, University, Lawrence) IN: National Radar Conference, Los Angeles, CA, March 12, 13, 1986, Proceedings . New York, Institute of Electrical and Electronics Engineers, Inc., 1986, p. 107-114. refs

Mapping of sea ice is important to Arctic operations and to meteorology and oceanography. Experiments have been conducted since 1977 aiming at determining the optimum parameters for both satellite and aircraft imaging radars that can be used for ice mapping. The radar backscatter from summer ice is very different from that during the rest of the year. Strong contrasts between multiyear and first-year ice at C-band and higher frequencies in the winter disappear during the summer. L band provides almost

no contrast in winter, but some contrast during summer. Distinguishing ice types at any frequency during summer may depend on recognition of shapes rather than amplitude contrasts because of the rapid variability of conditions as the melting proceeds. Author

N87-10300*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CONVECTIVE STRUCTURE OF THE PLANETARY BOUNDARY LAYER OF THE OCEAN DURING GALE
S. H. MELFI and R. BOERS *In* NASA. Langley Research Center 13th International Laser Radar Conference 1 p Aug. 1986
Avail: NTIS HC A15/MF A01 CSCL 04A

The structure of the Planetary Boundary Layer (PBL) was measured, using an airborne lidar, over the Atlantic Ocean during several intefisive observation periods of the Genesis of Atlantic Lows Experiment (GALE). Primary emphasis is on the understanding of the convective structure within the PBL during cold air outbreaks. Cold outbreaks generally occur in between the development of coastal storms; and behind a cold front sweeping down from Canada out across the Atlantic. As the cold dry air moves over the relatively warm ocean, it is heated and moistened. The transfer of latent and sensible heat during these events accounts for most of the heat transfer between the ocean and atmosphere during winter. Moistening of the PBL during these eventsis believed to be an important factor in determining the strength of development of the storm system which follows. In general, the more PBL moisture available as latent heat the higher the probability the storm will intensify. The major mechanism for vertical mixing of heat and mositure within the PBL is cellular convection. Knowlede of the organization and structure of the convection is important for understanding the process. Author

N87-10484*# National Oceanic and Atmospheric Administration, Boulder, Colo. Aeronomy Lab.
CONTINUOUS WIND MEASUREMENT IN THE TROPICAL PACIFIC USING VHF RADARS
B. B. BALSLEY, W. L. ECKLUND, and D. A. CARTER *In* International Council of Scientific Unions, Middle Atmosphere Program. Handbook for MAP, Vol. 20 1 p Jun. 1986
Avail: NTIS HC A22/MF A01; also available from SCOSTEP Secretariat, Illinois Univ., 1406 West Green Street, Urbana, Ill. 61801 CSCL 04B

Very High Frequency (VHF) Radar Wind Profilers are being installed on Ponape, East Caroline Islands and Christmas Island, Republic of Kiribati to continuously monitor winds aloft. The purpose of this experiment is to study wind fluctuations on time scales between minutes and days, to determine the longitudinal character of these fluctuations, and to examine their relationship to climate variability. Six-hourly wind profiles will be provided via satellite to the scientific community for Project TOGA (Tropical Ocean Global Atmosphere). B.G.

N87-10635 Colorado State Univ., Fort Collins.
ENVIRONMENTAL INFLUENCES ON HURRICANE INTENSIFICATION Ph.D. Thesis
R. T. MERRILL 1985 158 p
Avail: Univ. Microfilms Order No. DA8607660

Though qualitatively similar in structure, different hurricanes can attain different peak intensities during their lifetimes. Forecasters and empiricists relate the intensity to the sea surface temperature and the effectiveness of the upper tropospheric outflow, but offer no clear explanation of how the latter operates. The observed upper tropospheric environment flow differences between hurricanes which intensify and those which fail to do so are examined and then combined with previously published empirical and modeling results into a general conceptual mode of environmental influences on hurricane intensification. Several observational and numerical tests for this conceptual model are then proposed. Dissert. Abstr.

N87-10671*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SCIENCE OPPORTUNITIES FROM THE TOPEX/POSEIDON MISSION
R. STEWART, L. L. FU, and M. LEFEBVRE 15 Jul. 1986 68 p (Contract NAS7-918)
(NASA-CR-179752; JPL-PUB-86-18; NAS 1.26:179752) Avail: NTIS HC A04/MF A01 CSCL 08C

The U.S. National Aeronautics and Space Administration (NASA) and the French Centre National d'Etudes Spatiales (CNES) propose to conduct a Topex/Poseidon Mission for studying the global ocean circulation from space. The mission will use the techniques of satellite altimetry to make precise and accurate measurements of sea level for several years. The measurements will then be used by Principal Investigators (selected by NASA and CNES) and by the wider oceanographic community working closely with large international programs for observing the Earth, on studies leading to an improved understanding of global ocean dynamics and the interaction of the ocean with other processes influencing life on Earth. The major elements of the mission include a satellite carrrying an altimetric system for measuring the height of the satellite above the sea surface; a precision orbit determination system for referring the altimetric measurements to geodetic coordinates; a data analysis and distribution system for processing the satellite data, verifying their accuracy, and making them available to the scientific community; and a principal investigator program for scientific studies based on the satellite observations. This document describes the satellite, its sensors, its orbit, the data analysis system, and plans for verifying and distributing the data. It then discusses the expected accuracy of the satellite's measurements and their usefulness to oceanographic, geophysical, and other scientific studies. Finally, it outlines the relationship of the Topex/Poseidon mission to other large programs, including the World Climate Research Program, the U.S. Navy's Remote Ocean Sensing System satellite program and the European Space Agency's ERS-1 satellite program. Author

N87-10672# Scripps Institution of Oceanography, La Jolla, Calif. Marine Physical Lab.
THE INTERNAL TIDE OFF SOUTHERN CALIFORNIA Summary Report
R. G. WILLIAMS Jan. 1986 176 p
(Contract N00014-79-C-0472)
(AD-A167722; MPL-U-34/85; S10-REF-86-1) Avail: NTIS HC A09/MF A01 CSCL 08J

The internal tide may well form an important link in the chain of events between the forcing of the surface tide and the eventual dissipation of internal waves by viscous forces. Two issues related to this chain of events are addressed. One is the directionality of the internal tide off the coast of California and the other is the widespread occurrence of semi-diurnal tidal harmonics in internal wave spectra. It is commonly accepted that the internal tide derives its energy from the forcing of isopycnal surfaces over topographic features by the surface tide. Accordingly, steep continental slopes like the Patton escarpment should be important generation regions. The directionality of the internal tide off California and hence the importance of the Patton escarpment as a source are assessed by analyzing data collected by the R/P FLIP. The results indicate that the direction of propagation of the internal tide is variable and that the majority of its energy does not appear to originate at the escarpment. GRA

N87-10955# Centre National d'Etudes Spatiales, Toulouse (France). Groupe de Recherche de Geodesie Spatiale.
STUDY OF THE PERFORMANCES OF SEASAT SATELLITE OVER ICE AND SEA ICE [ETUDE DU FONCTIONNEMENT DU SATELLITE SEASAT SUR LES GLACES ET GLACES DE MER]
C. SCHGOUNN Paris ESA Nov. 1982 39 p In FRENCH
(Contract ESA-4751/81-F-DD-(SC))
(CNES-CS/MM/82/117/CT/GRGS; ESA-CR(P)-2248; ETN-86-98125) Avail: NTIS HC A03/MF A01

The conditions of utilization of an altimetric radar included in SEASAT satellite to study sea ice and the topography of the

polar caps are studied. The Oakhanger raw data, produced at a rate of 10 points/sec are analyzed and the specific responses of ice and snow regions are compared. The physical properties of water, snow, ice, and sea ice are studied to determine the parameters affecting the return signal and to estimate the contribution of the volume echo of each to the signal power. It is shown that the SEASAT altimeter differentiates the snow of the polar caps and the sea ice. It allows the determination of the limits of the evolution of the sea ice, but it is not adapted to follow the variations of the surface of the snowpack. ESA

N87-11239# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
AN EXPERIMENTAL CAMPAIGN FOR THE DETERMINATION OF RADAR STRUCTURE OF THE OCEAN AT C BAND
E. ATTEMA *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 3-10 Dec. 1985
Avail: NTIS HC A25/MF A01

The determination of the directional wave spectrum and the surface wind field over the ocean, using the instruments of the ERS-1 satellite is discussed. This requires accurate knowledge of the radar signature of the ocean expressed by the radar cross section per unit area, sigma zero. The wave spectrum determination requires a suitable modulation transfer function, and an empirical model for sigma zero and its dependence on wind speed, wind direction and incidence angle forms the basis for the wind retrieval algorithm. An international experimental campaign was conducted to validate the empirical models and determine model parameters. It is shown how instruments were deployed to ensure a coherent and reliable experimental data set. Instruments included airborne scatterometers, airborne synthetic aperture radar, tower-based scatterometers, wave buoys and meteorological instruments on board aircraft, a research ship, and a research platform. ESA

N87-11240# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
AIRBORNE AND TOWER-BASED SCATTEROMETRY DURING THE PROMESS AND TOSCANE-T CAMPAIGNS
E. ATTEMA *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 11-15 Dec. 1985
Avail: NTIS HC A25/MF A01

During the PROMESS and TOSCANE-T campaigns, scatterometers were used from aircraft and a research platform to measure ocean backscattering as a function of wind speed and direction. The principle of operation of each scatterometer is described. Internal and external calibration procedures are discussed. Absolute accuracy within 1dB is achieved. Flight patterns are outlined and samples of output data are presented. ESA

N87-11242# Toulouse Univ. (France). Lab. d'Aerologie.
AIRBORNE MEASUREMENT METHODS APPLIED TO THE DETERMINATION OF BOUNDARY CONDITIONS AT THE SEA SURFACE: THE TOSCANE EXPERIMENT [METHODES DE MESURES AEROPORTEES APPLIQUEES A LA DETERMINATION DES CONDITIONS AUX LIMITES SUR LA MER: EXPERIENCE TOSCANE]
P. DURAND, F. SAID, and A. DRUILHET *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 23-28 Dec. 1985 In FRENCH Sponsored by Inst. National d'Astronomie et de Geophysique
Avail: NTIS HC A25/MF A01

Two light aircraft were used to collect data on average boundary layer conditions at the sea surface and on turbulent air flow over the sea. The method for calculating turbulent flow is presented. Advantages and disadvantages of the aircraft for this type of data collection are discussed, particularly problems related to perturbations of information on the absolute speed of the aircraft. Consequences for the calculation of wind parameters and motion transfer are outlined. A solution which allows the turbulent horizontal kinetic energy global vertical motion transfer to be reconstructed is given. The relation between parameters calculated at the average flight altitude of 50 m and the conditions at the real boundary layer is considered. ESA

N87-11243# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
TOWARDS A C-BAND RADAR SEA ECHO MODEL FOR THE ERS-1 SCATTEROMETER
A. E. LONG *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 29-34 Dec. 1985
Avail: NTIS HC A25/MF A01

Specification of a vertical polarization radar echo model, CMOD1, based on airborne circle-flight, and radar scattering cross section measurements from three C-band scatterometer systems to relate normalized surface scattering cross-sections to radar beam incidence angle, wind speed and direction is described. The analyzed circle flight records are used to suggest the model form and to find its parameters by least squares fitting methods. The CMOD1 Specification is expected to be used in design and performance assessment of the ERS-1 scatterometer. ESA

N87-11244# Toulouse Univ. (France). Lab. d'Aerologie.
DYNAMICS OF THE MARINE BOUNDARY LAYER. DETERMINATION OF BOUNDARY CONDITIONS [DYNAMIQUE DE LA COUCHE LIMITE MARINE. DETERMINATION DES CONDITIONS AUX LIMITES]
A. DRUILHET, F. SAID, and P. DURAND *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 35-41 Dec. 1985 In FRENCH
Avail: NTIS HC A25/MF A01

The dynamics of the atmospheric boundary layer are analyzed in order to determine boundary conditions over the ocean surface. Flow, temperature, and evaporation analysis methods based on average profile measurements and those requiring the measurement of turbulent functions are distinguished. The latter can be used in aircraft campaigns. They make possible the study of the spatial homogeneity of the boundary conditions and thus the integration of scales, a problem specific to satellite-borne remote sensing. ESA

N87-11247# Institut Francais du Petrole, Rueil-Malmaison.
SAR IMAGING OF THE SEA SURFACE DURING THE ESA C-BAND WIND SCATTEROMETER CAMPAIGN
P. PIAU, C. BLANCHET, and L. GRAY (Canada Centre for Remote Sensing, Ottawa, Ontario) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 53-57 Dec. 1985
Avail: NTIS HC A25/MF A01

The SAR 580 was used during the PROMESS experiment study of wind and wave measurements on the sea surface with C-band radars as will be made by the Active Microwave Instrument (AMI) aboard ERS-1. The meteorological conditions encountered during the experiment allowed a study with a good range of wave heights (1 to 7 m) and wind speeds. The SAR 580 performed measurements with different azimuth angles in C and X-band simultaneously. The wave length and direction of long waves are determined with a good accuracy. The determination of the additive noise level which degrades the determination of the amplitude of the image spectrum is discussed. It is shown that this SAR is very sensitive to range-traveling waves, and much less to the azimuth-traveling ones. ESA

N87-11250# Toulouse Univ. (France). Lab. d'Aerologie.
ANALYSIS OF AIRBORNE MEASUREMENTS OF THE MARINE BOUNDARY LAYER DURING THE TOSCANE EXPERIMENT [ANALYSE DES MESURES AEROPORTEES DANS LA COUCHE LIMITE MARINE AU COURS DE L'EXPERIENCE TOSCANE]
F. SAID, P. DURAND, B. KOEHLER, and A. DRUILHET *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 67-71 Dec. 1985 In FRENCH Sponsored by Inst. National d'Astronomie et de Geophysique
Avail: NTIS HC A25/MF A01

Determination of dynamic atmospheric parameters from the boundary layer above the ocean surface in order to analyze scatterometer data is described. Two aircraft measured friction velocity and wind in the marine boundary layer. Parameterization of data from an area 25 km by 40 km is described. The method used to investigate two dimensional fields is presented. The homogeneity of the field above the sea is illustrated using sea surface temperature data and thermodynamic variables. Surface heat flux, evaporation, and circulation are compared with the wind field, showing a strong correlation. ESA

N87-11252# Canada Centre for Remote Sensing, Ottawa (Ontario).
THE C AND KU BAND SCATTEROMETER RESULTS FROM CANADIAN PARTICIPATION IN THE ESA PROMESS OCEAN MEASUREMENT CAMPAIGN
A. L. GRAY and R. K. HAWKINS *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 77-82 Dec. 1985 Sponsored by ESA and Innotech Aviation
Avail: NTIS HC A25/MF A01

Multipolarized C and Ku-band fanbeam scatterometer and X(VV) and C(VV) SAR data were collected by aircraft during the ESA PROMESS ocean backscatter experiment. The C(VV) and Ku(HH) scatterometer data for incidence angles from 10 to 58 deg for straight flight lines and from 15 to 55 deg for circle flights is described. For light to moderate winds it is shown that there are significantly larger changes in Ku backscatter than at C band for the same change in wind speed. For the more important moderate to high speed wind regime however, the advantage Ku-band data has over C-band decreases and, on the basis of backscatter sensitivity, satisfactory performance can be expected from the ERS-AMI wind scatterometer. Results for C(VV) and Ku(HH) indicate that both frequencies respond in approximately the same way to a changing azimuth angle between the radar look and wind directions. ESA

N87-11275# Institute of Ocean Sciences, Sidney (British Columbia).
DEVELOPMENT OF AN IMAGING OPTICAL SPECTROMETER FOR OCEAN AND LAND REMOTE SENSING
J. F. R. GOWER, G. A. BORSTAD, and A. B. HOLLINGER (Moniteq Ltd., Concord (Ontario).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 219-225 Dec. 1985
Avail: NTIS HC A25/MF A01

To meet the requirements of improved optical land and sea imaging, particularly ocean and coastal chlorophyll fluorescence mapping, an airborne imaging spectrometer called Fluorescence Line Imager was designed and constructed. Results give insights into optical imaging of water color patterns. Examples of the image and spectral data are given. Technical problems and advantages associated with this type of instrument design, and benefits and opportunities for putting such an instrument into space are discussed. ESA

N87-11282# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
SPECTRAL SIGNATURES OF COASTAL OBJECTS
M. VIOLLIER, T. BELSCHER, and L. LOUBERSAC *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 253-256 Dec. 1985 In FRENCH; ENGLISH summary
Avail: NTIS HC A25/MF A01

Spectral signatures were measured in coastal areas using a high resolution spectroradiometer and a SPOT simulation radiometer. Optical indexes for characterization of seaweeds and strand facies are derived. ESA

N87-11284# Oldenburg Univ. (West Germany).
LASER REMOTE SENSING OF THE MARINE ENVIRONMENT: RECENT RESULTS OBTAINED WITH THE OCEANOGRAPHIC LIDAR SYSTEM
D. DIEBEL-LANGHOR, T. HENGSTERMANN, and R. REUTER *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 267-272 Dec. 1985 Sponsored by Commission of the European Communities, Ispra, Italy, Bundesministerium fuer Forschung und Technologie, Bonn, Deutsche Forschungsgemeinschaft, Bonn, and Niedersaechsisches Ministerium fuer Wissenschaft und Kunst, Hannover, West Germany
Avail: NTIS HC A25/MF A01

A lidar system for research in the coastal zone was developed. Based on spectroscopic methods, data relevant for oceanographic studies and for marine pollution monitoring are obtained. Operated from aircraft, a nearly synoptic investigation of extended areas is achieved. The system was utilized in experiments in the North Sea and the Adriatic. Data on the spectral light turbidity and on the concentration of dissolved organics (Gelbstoff) and chlorophyll-a are reported. By use of nanosec laser pulses and a fast signal receiver depth profiles of the attenuation coefficient down to 6 attenuation lengths were measured. Airborne measurements were performed over marine oil spills. They allow a determination of the oil type, and of the oil film thickness in the micrometer range. ESA

N87-11302# Universite de Bretagne Occidentale, Brest (France). Lab. d'Oceanographie Physique.
AVHRR DATA PROCESSING FOR UTILIZATION IN DYNAMICAL OCEANOGRAPHY
V. MARIETTE and V. VERBEQUE *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 365-369 Dec. 1985 Sponsored by CNRS and Inst. Francais de la Recherche pour l'Exploitation de la Mer
Avail: NTIS HC A25/MF A01

Infrared satellite imagery was compared with an oceanographic cruise in tidal seas. The AVHRR data of NOAA7 geometrically corrected and registered with regard to a Mercator projection were calibrated to obtain sea surface temperature (SST) using a combination of the 11 and 12 micron channels. Analyses of satellite data show that, during the night, the bias is small (0.2 C). In the day time, despite the same pattern for the dynamical structure, SST given by satellite is higher than measured in situ by 1.5 C. To explain these differences, the influence of the energy budget at the air-sea interface upon the upper layer of the ocean was studied. Rather than the use of SST images for the study of evolution of the frontal areas in tidal seas, thermal gradient image analysis is proposed. ESA

N87-11303# Scripps Institution of Oceanography, La Jolla, Calif.
DOWNWARD LONG-WAVE IRRADIANCE AT THE OCEAN SURFACE USING SATELLITE DATA
C. GAUTIER and R. FROUIN *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 371-374 Dec. 1985
Avail: NTIS HC A25/MF A01

Two methods to estimate the downward longwave irradiance at the ocean surface from a radiative transfer model and satellite observations were developed. Both are based on physical radiative modeling of the longwave radiation in the atmosphere and on satellite observations of atmospheric profiles and clouds. While the radiative effects of clouds are explicitly taken into account in method A, they are only parameterized in method B. The two methods were tested by comparing satellite estimates with surface mesurements made during MILDEX (Oct-Nov 1983). For method A, the correlation coefficient (r) and the standard error (se) are: 0.69 and 23 w/sqm for half-hourly averages and 0.73 and 18 w/sqm for daily averages. For method B, r = 0.58 and se = 24.9 w/sqm for half-hourly averages and 0.53 and 21.7 w/sqm for daily averages. ESA

N87-11372 Deutscher Wetterdienst, Offenbach am Main (West Germany). Inst. fuer Meereskunde.
DIAGNOSTIC INVESTIGATIONS OF THE INTERTROPICAL CONVERGENT ZONE [DIAGNOSTISCHE UNTERSUCHUNGEN DER INNERTROPISCHEN KONVERGENZZONE]
E. RUPRECHT, M. HANTEL, and P. SPETH *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment (date] p 13-14 1986 In GERMAN
Avail: Issuing Activity

The intertropical convergent zone (ITCZ) in the Atlantic-African domain was investigated as to position and structure of the ITCZ, waves connected with the ITCZ, and budgets relative to the ITCZ. Above the ocean ITCZ position can be determined from METEOSAT pictures in the IR domain. The transition between the two main positions (from January till May, and from June till November) is abrupt. Above the African continent the position of the ITCZ is very difficult to determine due to orographic effects. The periods during which the easterly waves partially responsible for the development of disturbances in the ITCZ occur were determined. It is confirmed that position and intensity of the ITCZ above the ocean are essentially determined by the easterly wave paths. ESA

N87-11406 Hamburg Univ. (West Germany). Inst. fuer Meteorologie.
THE RESPONSE OF THE TROPICAL ATMOSPHERE TO THE EXTRAORDINARY EL NINO SEA SURFACE TEMPERATURE ANOMALLY 1982-1983: OBSERVATION [DIE ANTWORT DER TROPISCHEN ATMOSPHAERE AUF DIE AUSSERGEWOEHNLICHE EL NINO MEERESOBERFLAECHENTEMPERATURANOMALIE 1982/83 - BEOBACHTUNG]
H. VONSTORCH and R. DOBERITZ *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment p 94-95 1986 In GERMAN
Avail: Issuing Activity

The El Nino events in 1982-1983 were observed. The outgoing long wave radiation (OLR) was routinely measured by satellites. The results show that sea surface temperature (SST), precipitation, and soil pressure oscillate in phase; the correlations between them can be as high as 80% to 90%. Cloud distributions consistent with OLR anomalies are observed. ESA

N87-11426 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE CORRELATION BETWEEN WIND AND THE TRAJECTORIES OF SATELLITE-POSITIONED DRIFT BUOYS [ZUR KORRELATION VON WIND UND DEN TRAJEKTORIEN SATELLITEN-GEORTETER TRIFTBOJEN]
J. STAHLMANN *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment p 145-146 1986 In GERMAN
Avail: Issuing Activity

Satellite-positioned drift buoys were used in the North Atlantic in order to examine the relation between wind and drift flow induced by wind. The parameters for the description of this relation are the deflection angle between wind direction and drift flow, and the relation between drift flow and wind shear. A correlation which is independent of the sea zone is obtained by choosing a suitable spectral window which only contains the frequency domain where wind is the only dominating excitation. The results agree with Ekman theory. It was possible to separate the energy maxima due to inertia oscillations and to tides. ESA

N87-11427 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
SATELLITE OBSERVATIONS OF ATMOSPHERICALLY DETERMINED CHANGES OF THE OCEAN SURFACE TEMPERATURE [SATELLITENBEOBACHTUNGEN ATMOSPHAERISCH BEDINGTER AENDERUNGEN DER OBERFLAECHENTEMPERATUR DES OZEANS]
L. STRAMMA *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment p 150-151 1986 In GERMAN
Avail: Issuing Activity

Satellite observations in the IR domain were performed in order to study the heating of the sea surface temperature and the cooling after the passage of hurricanes in the western North Atlantic Ocean. Data taken from the NOAA-7 satellite were corrected for atmospheric effects and for the angle of inclination during the measurement. Comparisons with a temperature sensor 0.6 m under the sea surface were made in order to examine diurnal variations. Large diurnal variations occur in case of strong solar radiation and simultaneous weak wind force. Hurricanes were observed to cause an irreversible mixing of the ocean's surface and transition layers leading to a cooling of the surface layer. The combination of satellite observations and in situ measurements in the ocean is shown to be useful for the study of the interaction between atmosphere and ocean. ESA

N87-11457 Kiel Univ. (West Germany). Inst. fuer Meereskunde.
ANALYSIS OF MESOSCALE TEMPERATURE AND TURBIDITY FIELD [ANALYSE VON MESOSKALIGEN TEMPERATUR- UND TRUEBUNGSFELDERN]
T. VIEHOFF *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment p 214-215 1986 In GERMAN
Avail: Issuing Activity

The kinematic structures in the ocean surface layer were analyzed using a remote temperature and turbidity measurements. This combination reduces the disadvantages of IR measurement with respect to the absorption of sea water. The data of the Advanced Very High Resolution Radiometer (AVHRR) on the NOAA 7 satellite and the Coastal Zone Color Scanner on the NIMBUS 7 satellite were analyzed for the North Atlantic. The sea surface temperature was determined using the IR channels of the AVHRR, the turbidity was determined by the blue/green ratio. The temperature distribution shows stepwise subpolar fronts with meanders of 140 km; the blue/green ratio shows a clear frontal structure. Regional negative correlations between temperature and blue/green ratio occur. ESA

N87-11471# World Climate Programme, Geneva (Switzerland).
REPORT OF THE COSPAR INTERNATIONAL WORKSHOP ON SATELLITE-DERIVED SEA SURFACE TEMPERATURES FOR GLOBAL CLIMATE APPLICATIONS
E. G. NJOKU, ed. and E. P. MCCLAIN, ed. Feb. 1986 61 p Workshop held at Camp Springs, Md., 28-31 May 1985
(WCP-110; WMO/TD-93; ETN-86-97805) Avail: NTIS HC A04/MF A01; print copy available at WMO, Geneva, Switzerland

The state of the art of sea surface temperature determinations from satellites was reviewed, and recommendations on the steps necessary to meet the accuracy requirements of the World Climate Research Program were made. The requirements are particularly demanding, especially those for the Tropical Ocean and Global Atmosphere project, for which accuracies of 0.3 C are needed in the warmest regions of the tropical oceans. ESA

N87-11477# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.
ADVANCED OCEAN COLOR MONITOR (OCM) FEASIBILITY STUDY, EXECUTIVE SUMMARY Final Report
G. CERUTTI-MAORI Paris ESA 13 Jul. 1983 36 p Partly in FRENCH and ENGLISH
(Contract ESA-5234/82-F-CF(SE))
(SNIAS-96-CA/LL/O; ESA-CR(P)-2253; ETN-86-98130) Avail: NTIS HC A03/MF A01

After a theoretical analysis of the radiometric and geometric performances of the ocean color monitor instrument and a comparative study of the different configurations, a choice is made to select the instrument characteristics better adjusted to the European Space Agency specifications. It is decided to limit the device to the measurement of the ocean color, abandoning the measurement of the ocean surface temperature. The detailed description of the selected configuration shows that it is compatible with the load of the ERS-2 satellite, having 62 kg mass, 90 W power consumption and a reliability greater than 0.8. ESA

N87-12043# Coastal Engineering Research Center, Vicksburg, Miss.
AN ANNOTATED BIBLIOGRAPHY OF THE ATLANTIC REMOTE SENSING LAND-OCEAN EXPERIMENT (ARSLOE) Final Report
S. E. WAGNER and A. R. SHERLOCK Mar. 1986 36 p
(AD-A168703; CERC-86-4) Avail: NTIS HC A03/MF A01 CSCL 08C

The Atlantic Remote Sensing Land-Ocean Experiment (ARSLOE) was conducted during October and November 1980 at the US Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility located at Duck, North Carolina. ARSLOE consisted of experiments which were related to ocean waves, remote sensing of ocean fronts, and remote sensing of land cover. This annotated bibliography presents a compilation of published literature which describes the experiment, the measurements made, and the analyses conducted since termination of the experiment. GRA

N87-12093# National Oceanographic Data Center, Washington, D. C.
MARINERS WEATHER LOG, VOLUME 30, NUMBER 2, SPRING 1986
1986 65 p
(PB86-213360) Avail: NTIS HC A04/MF A01 CSCL 04B

Topics addressed include: El Nino/Southern Oscillation Diagnostic Advisory; Eastern north pacific tropical cyclones, 1985; and central north pacific tropical cyclones, 1985. GRA

N87-12100# Royal Australian Navy Research Lab., Edgecliff.
REAL TIME OCEANOGRAPHIC ANALYSIS FOR THE SOUTH WESTERN AUSTRALIAN AREA FOR JULY 1984 TO AUGUST 1985
L. J. HAMILTON Dec. 1985 50 p
(AD-A168741; RANRL-TM-(EXT)-21/85) Avail: NTIS HC A03/MF A01 CSCL 08J

Attempts made at real time oceanographic analyses for the south-western Australian area are shown diagrammatically in the form of contour maps. Results for the period July 1984 to August 1985 are discussed. It is concluded that with present data sources useful sea surface temperature analyses should be possible in late spring, summer, and perhaps early autumn, but not in winter, when cloud coverage severely hinders satellite data acquisition. Subsurface analyses were not possible; almost all data used were for the sea surface. GRA

N87-13048*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ESTIMATION OF PRECIPITATION FROM GOES IR IMAGERY DURING FGGE: APPLICATION TO DIAGNOSTIC STUDIES
F. R. ROBERTSON *In its* NASA/MSFC FY-85 Atmospheric Processes Research Review 5 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

The objectives were to (1) develop a method of estimating open-ocean rainfall and associated latent heat release via GOES IR satellite imagery; (2) to use remote precipitation estimates to investigate the role of diabatic forcing in the maintenance of the South Pacific Convergence Zone (SPCZ) during FGGE SOP-1/; and (3) to assess the significance of non-quasigeostrophic transports of energy in several cyclogenetic events preceding the development of a North Atlantic blocking episode during FGGE SOP-1. The bulk of the early FY-85 work was directed toward development of the single pixel indexing technique (SPI) which assigns a rain rate to GOES IR black-body temperatures, T sub b, via a non-linear statistical relationship developed with raingauge measurements. The method was tested against radar-derived rainfall during GATE raingauge measurements over coastal North Carolina and island stations in the South Pacific Ocean. Skill was found comparable to Arkin's method (1979 MWR) in convective situations. The results suggest that transferring a rain algorithm from one oceanic regime to another may not require substantial modification of coefficients or tunable parameters. Twelve H mean rainfall amounts were produced for the region bounded by 10 deg. N, 50 deg. S, 120 deg W and 170 deg. E during the period January 10 to 16, 1979. These estimates constitute a basic input to diagnostic calculations of diabatic heating over the SPCZ region. ECMWF level III-b data analyses was used to compute several components of the APE balance in the South Pacific during the period January 10 to 18, 1979. Author

N87-13052*# Purdue Univ., West Lafayette, Ind. Dept. of Geosciences.
DYNAMICS AND ENERGETICS OF THE SOUTH PACIFIC CONVERGENCE ZONE DURING FGGE SOP-1
D. G. VINCENT *In* NASA. Marshall Space Flight Center NASA/MSFC FY-85 Atmospheric Processes Research Review 3 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

The major research objectives are to diagnose the physical processes responsible for the maintenance of the South Pacific Convergence Zone (SPCZ) and to examine the role of the SPCZ in the large-scale circulation patterns of the Southern Hemisphere. To accomplish these objectives researchers used several data sources which include: a modified set of Level III-b upper air analyses, originally produced by ECMWF (Vincent, 1982); subjectively analyzed surface analyses for the South Pacific based on island station reports (Vincent, 1985); outgoing longwave radiation values supplied to us by NOAA/NESDIS; and equivalent black body temperatures and precipitation rates derived by Robertson. In the past year researchers found that wave number four plays an inportant role in the Southern Hemisphere tropics during the 15-day period when the sPCZ was a dominant feature, particularly with regard to the baroclinic conversion of potential to kinetic energy (Huang and Vincent, 1985). The convectively-active SPCZ area was found to make a significant contribution to this conversion process; thus, it appears that baroclinic effects and latent heating are important in maintaining the SPCZ. Recently efforts concentrated on two research tasks, an examination of cyclone activity within the SPCZ (Kann, 1985; Vincent, 1985; Vincent and Kann, 1985) and a study of the heat and moisture budgets in the South Pacific (Miller, et al., 1985). It was found

that cyclonic disturbances occurred with regularity in the Zone from 10 to 17 January. Author

N87-13066*# California Univ., Davis. Dept. of Land, Air and Water Resources.
AIRBORNE DOPPLER MEASUREMENTS OF THE CENTRAL CALIFORNIA EXTENDED SEA BREEZE
J. J. CARROLL *In* NASA. Marshall Space Flight Center NASA/MSFC FY-85 Atmospheric Processes Research Review 2 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

One data acquisition flight was executed in the late summer of 1984. The flight paths were designed to obtain measurements of the extended sea breeze penetration into the central valley of California over several hours. Data from this flight are being processed at Marshall Space Flight Center prior to release for analysis. Author

N87-13119# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
MIZEX: A PROGRAM FOR MESOSCALE AIR-ICE-OCEAN INTERACTION EXPERIMENTS IN ARCTIC MARGINAL ICE ZONES. 8: A SCIENCE PLAN FOR A WINTER MARGINAL ICE ZONE EXPERIMENT IN THE FRAM STRAIT/GREENLAND SEA, 1987/89
K. DAVIDSON, I. DYER, D. HORN, O. JOHANNESSEN, and P. MIKHALEVSKY Apr. 1986 58 p
(AD-A169070; CRREL-SR-86-9) Avail: NTIS HC A04/MF A01 CSCL 20A

The present plan is motivated by the need to improve our understanding of the fundamentals of acoustic propagation, noise, and electromagnetic remote sensing in the winter marginal ice zone (MIZ). The plan strongly emphasizes oceanography, ice dynamics, and meteorology. In fact, the latter disciplines must be deeply enough researched to resolve fundamental questions entailing air/ice/ocean interaction, heat and mass exchanges and balances, growth and decay of ice-edge eddies, etc. Detailed scientific objectives are examined for oceanography, meteorology, ice physics, remote sensing, and acoustics together with detailed experimental plans, and a discussion of logistics for these experiments. GRA

N87-13839*# Oregon State Univ., Corvallis. Coll. of Oceanography.
TIME DEPENDENT WIND FIELDS Final Report
D. B. CHELTON 27 Jan. 1986 67 p
(Contract NAS7-100)
(NASA-CR-179959; NAS 1.26:179959) Avail: NTIS HC A04/MF A01 CSCL 08C

Two tasks were performed: (1) determination of the accuracy of Seasat scatterometer, altimeter, and scanning multichannel microwave radiometer measurements of wind speed; and (2) application of Seasat altimeter measurements of sea level to study the spatial and temporal variability of geostrophic flow in the Antarctic Circumpolar Current. The results of the first task have identified systematic errors in wind speeds estimated by all three satellite sensors. However, in all cases the errors are correctable and corrected wind speeds agree between the three sensors to better than 1 ms sup -1 in 96-day 2 deg. latitude by 6 deg. longitude averages. The second task has resulted in development of a new technique for using altimeter sea level measurements to study the temporal variability of large scale sea level variations. Application of the technique to the Antarctic Circumpolar Current yielded new information about the ocean circulation in this region of the ocean that is poorly sampled by conventional ship-based measurements. Author

N87-13841# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOWARD 84/86 FIELD EXPERIMENT. INVESTIGATION OF PHYSICS OF SYNTHETIC APERTURE RADAR IN OCEAN REMOTE SENSING. VOLUME 1: DATA SUMMARY AND EARLY RESULTS Interim Technical Report, Sep. 1984 - May 1985
O. H. SHEMDIN May 1986 164 p
(AD-A171037) Avail: NTIS HC A08/MF A01 CSCL 17I

The mechanisms responsible for SAR imaging of the ocean surface are not adequately understood at present. Conflicting hypotheses have been proposed that remain without valid proof, because of lack of adequate data sets to test these hypotheses. The influence of environmental parameters has prevented extending relationships that were demonstrated under one set of conditions to another beyond the range used in formulating the relationships. The TOWARD experiment was conceived to overcome the difficulties. The single most significant achievement to date is the determination that none of the available theories on SAR imagining of long surface waves has been demonstrated to explain the SAR observations obtained in TOWARD. Work is presently in progress to amend existing models and to develop new ones. GRA

N87-13842# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOWARD 84/86 FIELD EXPERIMENT. INVESTIGATION OF PHYSICS OF SYNTHETIC APERTURE RADAR IN OCEAN REMOTE SENSING. VOLUME 2: CONTRIBUTIONS OF INDIVIDUAL INVESTIGATORS Interim Report
O. H. SHEMDIN May 1986 198 p
(AD-A171038) Avail: NTIS HC A09/MF A01 CSCL 17I

Some areas of discussion are: Surface Gravity Wave Measurements, Development and Utilization of a Surface Energy Measurements System in Toward 84/85, Wave Follower Measurements During Toward 84/85, The Propagation of Short Surface Waves on Longer Gravity Waves, Toward Meteorology Measurements. Other areas of discussion are: Processing of JPL SAR Frame: Azimuthal Waves on 31 October 1984, SAR Imagery Simulated From Two-Scale Radar Wave Probe Return, and Sample Predictions and Simulations of SAR Ocean Imagery. GRA

N87-13846# MATRA Espace, Toulouse (France). Instrumentation Div.
ADVANCED OCEAN COLOR MONITOR (OCM) FEASIBILITY STUDY
A. PERALDI, G. EICHEN, DAGRAS, TULET, BOKHOVE, SMORENBURG, and MAISONNEUVE Paris, France ESA 12 Dec. 1983 54 p
(Contract ESA-5236/82-F-GG(SC))
(MATRA-NO/748/OCM; ESA-CR(P)-2250; ETN-86-98127) Avail: NTIS HC A04/MF A01

A modular pushbroom design for the ERS-2 Ocean Color Monitor (OCM) was assessed. Signal analyses evaluated the radiance at the entrance of the instrument, taking into account the sunglint contribution, instrument performances and interfaces, and instrument subsystems. A development plan and assembly, integration, and tests are outlined. The feasibility of a pushbroom OCM is demonstrated, and the usefulness of the concept is clearly assessed for the visible channels. A design which meets most of the essential objectives of the mission and, in particular, those which can only be achieved through the basic feature of the pushbroom, namely the dwell-time, was developed. ESA

N87-13851# Stockholm Univ. (Sweden). Central Planning and Administration.
REMOTE SENSING, THE ARCTIC AND ANTARCTICA, SCIENTIFIC POLAR RESEARCH, NATURAL RESOURCES, HYDROLOGY, EXPLORATION AND TRANSPORTATION TECHNIQUES
R. THOREN Apr. 1986 49 p Paper presented at the ISPRS International Symposium on Remote Sensing, Resources Development and Environmental Management, Enschede, Netherlands, 25-29 Aug. 1986
(FOA-B-60005-M7; ISSN-0281-0263; ETN-86-98337) Avail: NTIS HC A03/MF A01; National Research Institute of National Defence, Stockholm, Sweden KR 50

Polar climate, oceanography, natural resources, and working environments; ocean technology; hydroacoustics and optics; sea ice; diving medicine; and offshore platforms are discussed. ESA

N87-13900*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
ANALYSIS OF THE INFLOW AND AIR-SEA INTERACTIONS IN HURRICANE FREDERIC (1979) Final Report
J. KAPLAN and W. M. FRANK Dec. 1986 119 p
(Contract NAG5-398)
(NASA-CR-180014; NAS 1.26:180014) Avail: NTIS HC A06/MF A01 CSCL 55C

An unusually large amount of aircraft, rawinsonde, satellite, ship and buoy data from hurricane Frederic (1979) are composited over a 40 hr period. These are combined with Frank's (1984) analysis of Frederic's core and Powell's (1982) surface wind analysis to analyze Frederic's three dimensional low level structure between the storm center and a radius of 10 deg. latitude. The analysis is improved significantly by determining the levels at which low level cloud motion winds (CMW's) are in the best agreement with verification wind data and then adjusting the winds to uniform analysis levels. Due to the unusually good low level wind resolution afforded by this data set, it is possible to obtain kinematically derived fields of vorticity, divergence and vertical velocity. These analyses are observed to be internally consistent and should prove useful for future analysis. Analysis of Frederic's surface to 560 m angular momentum budget beyond 2 deg. radius indicates that surface drag coefficients increase slightly with increasing radius and decreasing wind speed. Estimates of storm rainfall obtained by performing a moisture budget between the surface and the top of the inflow layer show that most storm rainfall falls inside about 4 deg. radius and that substantial underestimation of storm rainfall occurs when all low level CMW's are assigned to 560 m. Author

N87-14765# SACLANT ASW Research Center, La Spezia (Italy).
A DIRECTORY OF GROUND CONTROL POINTS FOR MAPPING SATELLITE IMAGES OVER THE NORTHEASTERN ATLANTIC OCEAN AND ADJACENT SEAS
B. WANNAMAKER, E. NACINI, and P. MINNET Feb. 1986 131 p
(AD-A170290; SACLANTCEN-SR-93) Avail: NTIS HC A07/MF A01 CSCL 08B

The precise geographical location and height of a set of 638 'ground control points' are listed for use in remapping satellite imagery to standard map projections. The area covered includes the NE Atlantic Ocean and the Mediterranean, Baltic, North, Greenland, Iceland and Norwegian Seas. Author (GRA)

N87-14769# Mullard Space Science Lab., Dorking (England).
ANALYSIS OF ALTIMETRY DATA FROM THE MARGINAL ICE ZONE EXPERIMENT, EXECUTIVE SUMMARY
N. F. MCINTYRE, H. D. GRIFFITHS, A. R. BIRKS, A. M. COWAN (Cambridge Univ. (England).), M. R. DRINKWATER, E. NOVOTNY, R. J. POWELL, V. A. SQUIRE, L. M. H. ULANDER, and C. L. WRENCH Paris, France ESA Jan. 1986 18 p Prepared in cooperation with University Coll., London, England, Science Research Council, Chilton, England, and Cambridge Univ., England
(Contract ESTEC-5948/84-NL-BI)
(ESA-CR(P)-2215; ETN-86-98097) Avail: NTIS HC A02/MF A01

Data collected by an airborne radar altimeter in the Greenland and Norwegian Seas and in northern Norway, Svalbard, and Greenland were analyzed. The detection of radar retroreflectors from an airborne platform are demonstrated, and accuracies and optimal experimental set-up are assessed. The feasibility of locating the position of ERS-1 with this technique is discussed. Data overflights of a range of ice sheet and sea ice surfaces are analyzed and, in the light of complementary data sources, the extraction of information other than that conventionally derived from altimetry is investigated. Simulations indicate which of these products can be extracted from satellite data. The accuracy of altimetric measurements over the ocean, and the extent to which such data may be relied upon for the verification of satellite investigations are considered. ESA

N87-14824 Defence Research Information Centre, Orpington (England).
METHODS OF REMOTE EVALUATION OF CHLOROPHYLL CONCENTRATION IN THE SEA
K. MALACHOWSKI Jan. 1986 30 p
(DRIC-T-7652; BR100206; ETN-87-98617) Avail: Issuing Activity

Passive methods of determining the depth of light penetration and the effective chlorophyll concentration, the connection between the concentration of phytopigments and sea color, atmospheric correction, and determining chlorophyll concentration using passively-induced fluorescence (including an active laser method) are discussed. A passive satellite method of analyzing sea color is recommended. ESA

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.

A87-10371
MODELLING WATER QUALITY USING THEMATIC MAPPER DATA - CASE OF LAKE MICHIGAN
K.-Y. HUANG and K. LULLA (Indiana State University, Terre Haute) Geocarto International, no. 2, 1986, p. 3-16. refs

Analysis of water quality based upon prediction models that use discretely monitored data is affected by the locations of sampling stations and may not represent dominant water conditions. These models are also affected by the time lapse, sampling error, and atmospheric influences on the spectral data. This research investigated the impact of these three factors upon the predictive capability of water quality models using archived TM and archived ground-based water quality data. Coordinate transformation was implemented to locate and identify ground sampling stations on the TM data products. Chavez's (1975) regression method was used to reduce haze effects. The impact of time lapse, sampling error, and haze effects on the reliability of water quality predictive modelling is significant and, thus, it is unlikely that reliable water quality predictive models can be generated using archived TM and ground-truth data. Attempts to reduce atmospheric effects using Chavez's method were unsuccessful. Limitations intrinsic

within ground-truth data and remotely sensed data (especially time lapse) have profound effect on quantitative water quality assessment. Author

A87-10374
APPLICATION OF AERIAL TECHNIQUES IN PLANNING GROUNDWATER PROSPECTING IN NUBIA, EGYPT
E. M. EL SHAZLY, M. A. ABDEL HADY, and F. A. EL NASHARTY (Academy of Scientific Research and Technology, Remote Sensing Center, Cairo, Egypt) Geocarto International, no. 2, 1986, p. 45-54. refs

Black and white, vertical aerial photographs of seven areas in Nubia located in the southern part of the Eastern Desert of Egypt are examined stereoscopically in order to delineate lithologic units and plan ground-water prospecting. Eight geologic and ten lithologic units were detected in the areas studied; the lithologic units consist of igneous and metamorphic rock units and detrital sediments. The photogeologic characteristics of the lithologic units are described. The lithologic units are studied to determine the types of ground-water aquifers and aquicludes within the units and their extensions. Drainage patterns and structural elements (lineaments and photolineation) are analyzed. The drainage lines are utilized to follow the course of the rainfall accumulation and the final destination of the runoff and the delineation of lineaments, and photolineations help in the location of lineaments intersections applicable for ground-water prospecting. It is noted that the lineaments are the most useful for planning ground-water prospecting. Photogeologic maps and drainage and sediment charts of the areas are presented. I.F.

A87-12199
GENERALIZATION OF LANDSAT MSS INTERPRETATIONS OF AQUATIC AREAS IN SOUTHWESTERN FINLAND
J. RAITALA and J. LAMPINEN (Oulu, University, Finland) Earth, Moon, and Planets (ISSN 0167-9295), vol. 36, Sept. 1986, p. 63-88. Research supported by the Finnish Cultural Foundation. refs

The digital remote sensing classification procedure applied to the lakes Pyhajarvi (near Sakyla), Koskeljarvi and Koylionjarvi in southwestern Finland is based on spectral reflectances. The aquatic surfaces were divided into five categories consisting of eleven classes connected with water depth, water turbidity, nature of the bottom and the aquatic vegetation. Generalization of this classification over other water areas of different types allowed the authors to evaluate the usefulness, value and accuracy of the classification. All water areas, although representing different types, were rationally categorized into five main types, although some pairs among the eleven classes were slightly confused, or became ambiguous. Hydrolittoral and aquatic Landsat MSS remote sensing seems to be useful for parametric mapping under circumstances in which field data collected from a small number of reference areas are to be extrapolated to apply to other areas within a single MSS frame. Some suplementary test field inspections and background information would be required, however, in order to guarantee that the primary reference areas were representative enough, or if not, to indicate the variety of aquatic areas classified together. With these restrictions, the machine-processed remote sensing would result in a practical and economical mapping procedure which should, as a next step, be developed for temporal studies in view of the long-term nature of the Landsat project. Author

A87-13520
LAKE MICHIGAN WATER QUALITY ANALYSIS USING THEMATIC MAPPER DATA
K.-Y. HUANG and K. LULLA (Indiana State University, Terre Haute) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 737-747. refs

The effects of time lapse, sampling errors, and atmospheric phenomena on the predictive capability of water quality models developed using archived TM and archived ground-based water quality data are investigated. The southwestern portion of Lake Michigan was studied. The uses of coordinate transformations to locate and identify group sampling stations on the TM data, and of Chavez's (1975) regression technique to reduce haze effects are discussed. It is observed that the water quality predictive models constructed from archived TM and ground-truth data are unreliable for water quality assessment; the dynamic nature of the aquatic environment and complex water interactions affect the intrinsic signal measured by a remote sensor. I.F.

A87-14858* Johns Hopkins Univ., Laurel, Md.
RAIN CELL SIZE STATISTICS DERIVED FROM RADAR OBSERVATIONS AT WALLOPS ISLAND, VIRGINIA
J. GOLDHIRSH and B. MUSIANI (Johns Hopkins University, Laurel, MD) (1985 International Geoscience and Remote Sensing Symposium /IGARSS '85/, Amherst, MA, Oct. 7-9, 1985) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Nov. 1986, p. 947-954. NASA-supported research. refs
(Contract N00024-85-C-5301)

An investigation of two-dimensional rain cell size statistics has analyzed regression relations relating radar-determined rain rates to disdrometer data. This has yielded least-squares fits of radar reflectivity factors, and the application of a contouring program has generated 22,000 contours in which each isopleth belongs to predefined rain-rate intervals. An abundance of total and cell contours were observed belonging to all rain-rate categories. Both the computed number distributions and the conditional cumulative distributions as a function of contour diameter were found to be represented with good approximation by given exponential functions. O.C.

A87-15184
MULTISTAGE GROUNDWATER EXPLORATION AND SATELLITE REMOTE SENSING TEST AREA - THE KASSERINE BASIN (TUNISIA)
C. VOUTE (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) Photogrammetria (ISSN 0031-8663), vol. 40, Aug. 1986, p. 317-326. refs

Speed, accuracy, and economy of groundwater exploration can be improved by survey optimization based on a systematic integration of satellite remote sensing, airphoto interpretation, field data collection, geophysical surveys, and drilling in a multistage approach with feedback loops. The methodology has been tested in 1983 using Landsat MSS and aerial photographs in an area in Tunisia, where extensive fieldwork, geoelectrical prospection, and drilling were carried out between 1940 and 1981. Author

A87-15615#
ADAPTATION OF MULTISOURCE REMOTELY SENSED DATA FOR HYDROLOGIC MODELING
E. R. JOHNSON, W. F. KRAJEWSKI (NOAA, Hydrologic Research Laboratory, Silver Spring, MD), and E. L. PECK (HYDEX Corp., Fairfax, VA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 227-236. Research supported by the Agricultural and Resources Inventory Surveys. refs

A summary of a long-term study on the suitability of remote sensing capabilities for use in hydrologic models is reported. Seven hydrologic models used by government agencies were investigated. Particular attention is given to the problem of updating the states of the models using remotely sensed information. The results indicate remote sensing information has only limited value for use with the hydrologic models in their present form. The usefulness of the remote sensing information would be greatly enhanced with minor modification of the models. Author

A87-15646#
ESTIMATION OF SURFACE WATER POTENTIAL THROUGH REMOTE SENSING AND OTHER LAND BASE INFORMATION SYSTEM
T. K. GHOSH (Indian Institute of Technology, Bombay, India) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 573-580.

Remotely sensed data (mainly derived through the analysis of the Landsat-1 data from two dates in 1975 and 1981 and further combined with air-photo interpretation along with the relevant hydrological parameters) have been successfully utilized to assess the surface water availability of parts of the Gadchiroli district, Maharashtra, India. In this investigation, a runoff model was constructed to determine the actual components involved.
Author

A87-15650#
COMPUTER-AIDED DRAINAGE NETWORK ANALYSIS FROM LANDSAT IMAGERY AND ITS APPLICATION TO ROCK TYPE RECOGNITION
J. F. WANG, S. M. SHI, and X. D. ZHANG (Beijing University, People's Republic of China) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 617, 618.

A87-15656*# Sigma Data Services Corp., New York, N.Y.
THE ROLE OF GIS AND REMOTE SENSING IN MASTER PLANNING FOR RESOURCES MANAGEMENT OF THE BERLIN LAKE, OHIO RESERVOIR PROJECT
H. A. EDWARDO, M. KORYAK (U.S. Army, Engineer District, Pittsburgh, PA), M. S. MILLER (Sigma Data Services Corp., New York), H. WILSON (NASA, Goddard Institute for Space Studies; Columbia University, New York), C. J. MERRY (U.S. Army, Cold Regions Research and Engineering Laboratory, Hanover, NH) et al. IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 659-669.

A87-15659#
AN APPROACH TO THE USE OF REMOTE SENSING FOR THE DETECTION OF ACID LAKES IN THE CANADIAN SHIELD
J. A. C. FORTESCUE (Ontario Geological Survey, Toronto, Canada) and V. H. SINGHROY (Ontario Centre for Remote Sensing, Toronto, Canada) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 689-696. refs

Data from a Landsat-4 TM image, airborne simulated MSS and CZCS images, helicopter-mounted programmable-radiometer readings, and helicopter-gathered limnological measurements (all obtained in August 1984 over an area of the Canadian Shield containing 114 lakes) are combined to investigate the feasibility of remote identification of acid lakes. Although the remotely sensed images did not successfully discriminate acid lakes, several of the approaches discussed (especially the use of TM band 3) are considered promising.
T.K.

A87-15665#
STORAGE ANALYSIS OF MALAPRABHA RESERVOIR USING REMOTELY SENSED DATA
M. K. MANAGOND, M. A. ALASINGRACHAR, and M. G. SRINIVAS (Indian Institute of Technology, Bombay, India) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 749-756.

The case study illustrates the usefulness and limitations of present-day remotely sensed data in the storage analysis of the reservoir created by a straight gravity masonry dam on the Malaprabha river, a tributary to the Krishna basin in Karnataka State of India. Topographic maps of scales 1:50,000 published in 1976, aerial photographs of average scale 1:50,000 taken between Feb. 8, 1979 and Mar. 2, 1979, and Landsat data from Mar. 19, 1975 and Apr. 10, 1981, were used. Applying visual and digital analysis techniques, the land-water interface was determined for different periods. The surface area of the reservoir watershed was then computed. The reservoir volume and level fluctuations were then found from the elevation-area capacity curves. The study also demonstrates a rational method of estimating the inflow into the reservoir by making the assessment of precipitation and losses using various thematic maps (such as isohyetal, slope, land-use and drainage) generated from the available data.
Author

A87-15669#
USE OF REMOTE SENSING FOR WETLANDS ASSESSMENT IN HAZARDOUS WASTE SITES
D. J. NORTON (Bionetics Corp., Warrenton, VA) and J. PRINCE (EPA, Boston, MA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 781-790. refs

The identification of wetland boundaries, ground-cover types, and physical parameters from aerial photography (AP) for evaluation of wetland sites with hazardous wastes by EPA is discussed and demonstrated. The goals of the identification and inventory phase (dimensional measurements, vegetation, hydrology, and cultural factors) and the evaluation phase (ecological significance, socioeconomic value, and degradation) of wetlands assessment are listed; and the feasibility of using current and archival AP to meet these goals is investigated in a trial assessment of the Acushnet River estuary in Massachusetts. The results show that AP is of significant value in the identification phase but must be combined with ground measurements in the evaluation phase.
T.K.

A87-15674#
DETECTING HYDROBIOLOGICAL PARAMETERS WITH LANDSAT 3 - SUMMER 1981 DATA
P. RUIZ-AZUARA (Universidad Nacional Autonoma de Mexico, Alvaro Obregon, Mexico) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 829-838.

A87-15681#
SOME ASPECTS OF FLOOD STUDIES OF SAHIBI RIVER BASIN USING REMOTELY SENSED DATA
M. A. ALASINGRACHAR (Indian Institute of Technology, Bombay, India) and M. B. KUMTHEKAR IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 891-896.

The study illustrates the use of Landsat preflood and postflood coverages of Sahibi river basin in Rajasthan, India, during the year 1977, when there was unprecedented flooding in parts of Rajasthan, Haryana, and the territory of Delhi. Flood-boundary delineation was accomplished by adopting digital techniques to classify areas of deep water, shallow water, wet lands, and land with some moisture. Superimposing the preflood data on the postflood data, the flood areas were demarcated. Temporal composite techniques were also attempted, using an optronics colormation system to delineate the flood areas. The best result was obtained by band 7 of preflood coverage, projected with a red filter on band 7 of postflood coverage with a green filter. The land use in flooded areas was determined using the stretched and unstretched data to generate the color composites on the colormation system.
Author

A87-15683*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EFFECT OF THEMATIC MAPPER SPECTRAL PROPERTIES ON LAND COVER MAPPING FOR HYDROLOGIC MODELING
J. C. GERVIN, Y. C. LU (NASA, Goddard Space Flight Center, Greenbelt, MD), R. L. GAUTHIER, J. R. MILLER (U.S. Army, Engineer District, Detroit, MI), and R. R. IRISH (Science Applications Research, Lanham, MD) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 909-918. refs

The accuracy of unsupervised land-cover classification from all seven Landsat TM bands and from six combinations of three or four bands is evaluated using images of the Clinton River Basin, a suburban watershed near Detroit. Data from aerial TMS photography, USGS topographic maps, and ground surveys are employed to determine the classification accuracy. The mapping accuracy of all seven bands is found to be significantly better (6 percent overall, 12 percent for residential areas, and 13 percent for commercial districts) than that with bands 2, 3, and 4; but almost the same accuracy is obtained by including at least one band from each major spectral region (visible, NIR, and mid-IR). T.K.

A87-15694#
INTEGRATION OF SNOTEL DATA AND REMOTELY SENSED SNOW COVERED AREA IN WATER SUPPLY FORECASTING
B. A. SHAFER (USDA, Soil Conservation Service, Portland, OR) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 1045-1056. refs

Snowmelt runoff is the major constituent of annual streamflow in the Western U.S. Accurate forecasts of this runoff are vital to many sectors of the region's economy. Remotely sensed snow covered area (SCA) and telemetered data from the U.S. Soil Conservation Service's SNOTEL network are being integrated into water supply forecast procedures along with other conventional point data. Several methods are discussed for incorporating SCA and SNOTEL data into statistical and physical process models in cooperation with other federal agencies. Impediments to greater utilization of remotely sensed SCA are identified. Analysis of a 1983 flood event on the Colorado River underscores the necessity of integrating point and areal measurements in order to more fully comprehend the three dimensional nature of operational water supply forecasting. Author

A87-15695*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FLOODPLAIN LAND COVER MAPPING USING THEMATIC MAPPER DATA
A. G. KERBER, J. C. GERVIN, Y.-C. LU (NASA, Goddard Space Flight Center, Greenbelt, MD), R. MARCELL (Science Applications Research, Lanham, MD), and H. A. EDWARDO (U.S. Army, Engineer District, Pittsburgh, PA) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 1057-1064.

The accuracy of land-cover classifications based on Landsat-4 TM and MSS images (obtained in August 1982) and airborne TMS images (obtained in September 1981) of the New Martinsville, West Virginia area is evaluated by comparison with ground-truth data. TM, TMS, and MSS are found to have overall mapping accuracies 80.1, 78.5, and 75.6 percent; agriculture/grass accuracies 62.0, 29.7, and 46.6 percent; and developed-area accuracies 67.2, 77.8, and 59.4 percent, respectively. T.K.

A87-15696#
INTERACTIVE SNOWCOVER MAPPING WITH GEOSTATIONARY SATELLITE DATA OVER THE WESTERN UNITED STATES
M. W. ALLEN and F. R. MOSHER (NOAA, National Severe Storms Forecast Center, Kansas City, MO) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 1065-1074.

The interactive process used by the Satellite Field Service Station of the U.S. National Severe Storms Forecast Center to construct snow-cover maps from real-time 1-km-resolution visible GOES data is described. Snow-free reference masks of the regions to be covered are created from late-summer data; the GOES data are remapped into the mask projection and made cloud-free if necessary; the images are aligned with the reference masks; and a snow/no-snow image is created by pixel-by-pixel digital comparison. It is found that the advantage of the every-half-hour availability of GOES imagery outweighs the disadvantage of its low resolution (compared with Landsat TM). T.K.

A87-15782
SATELLITE REMOTE SENSING OF ATMOSPHERIC WATER VAPOUR
G. DALU (CNR, Istituto di Fisica dell' Atmosfera, Rome, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Sept. 1986, p. 1089-1097. CNR-supported research. refs

On the basis of a radiative transfer model, the radiative response of the atmosphere at the 11- and 12-micron AVHRR channels used for remote sensing of the sea surface temperature was simulated for a wide variety of atmospheric conditions. The brightness temperature differences between the channels is directly related to the atmospheric absorption due to water vapor. The retrieved water vapor has an error of + or - 5 kg/sq m when compared to ship data. It is possible to use the remotely sensed water vapor data to infer the boundary layer structure, although this information would be limited in the case of water vapor contained near the surface. O.C.

A87-15865#
SATELLITE REMOTE SENSING OF INLAND WATERS - LAKE BALATON AND RESERVOIR KISKORE
GY. BUTTNER, M. KORANDI (FOMI Remote Sensing Centre, Budapest, Hungary), A. GYOMOREI, ZS. KOTE, and GY. SZABO (Research Centre for Water Resources Development, Budapest, Hungary) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 9 p. refs
(IAF PAPER 86-93)

A87-16446#
IDENTIFICATION OF EROSION-PRONE AREAS IN A PART OF THE UKAI CATCHMENT
R. SHARMA, B. SAHAI (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India), and R. L. KARALE (Department of Agriculture and Cooperation, All India Soil and Land Use Survey, New Delhi) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 121-126. refs

For the formulation of proper watershed management programs, the information on the existing or the potential erosion-prone areas and understanding of the contribution of various watershed elements to the quantitative rate of soil erosion is required. For the implementation of these programs, the priority classification of watersheds and their periodic updating along with the status of erosion-prone areas in the watershed is essential. The present paper illustrates the utility of remote sensing techniques in providing information on the above-mentioned aspects through a case study of a part of the Ukai catchment. An Erosion Index (EI) has been defined for priority classification of watersheds which should have a wider applicability. Author

A87-16448#
AN APPROACH TO SOLVE MADRAS METROWATER SUPPLY PROGRAM - A REMOTE SENSING BASED STUDY
R. SATYANARAYANA RAO, P. RAMAKRISHNA REDDY, and S. K. BHAN (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 133-137.

Multispectral Landsat data of the Madras city area are analyzed in order to derive the various lithologic, structural, geomorphic, and hydrological properties of the terrain. It is observed that the water yield prospect for the palaeochannels and flood plain areas is 50-150 cu m/hour, 20-50-cu m/hour for the fluvial plains and coastal sand dune areas, 5-20 cu m/hour for the fractured zones in hard rock/semiconsolidated formation, and negligible for hard, massive rock areas and along the coastal saline effected areas. Various recommendations for the proper development and management of ground water resources are discussed. I.F.

A87-16476#
USE OF REMOTE SENSING TECHNIQUES FOR TARGETING GROUND WATER IN FRACTURED CRYSTALLINE ROCKS - TWO CASE STUDIES FROM KARNATAKA
M. BASAPPA REDDY (Karnataka Urban Water Supply and Drainage Board, Bangalore, India) and R. L. GAIKWAD (Department of Mines and Geology, Bangalore, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 322-327.

A87-16479#
A STUDY OF CHANGING DRAINAGE PATTERNS AND THEIR TECTONIC IMPLICATIONS IN PARTS OF NORTH INDIA, USING REMOTE SENSING TECHNIQUES
A. K. TANGRI (Remote Sensing Applications Centre, Lucknow, India) and R. P. SHARMA (Geological Survey of India, Lucknow) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 342-347.

A87-16480#
MONITORING OF WETLAND AND SHORELINE ON THE PART OF GUJARAT COAST USING LANDSAT DATA
S. R. NAYAK, M. C. GUPTA, and H. B. CHAUHAN (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 348-353.

A87-16490#
EVALUATION OF SEDIMENT YIELD INDEX USING LANDSAT DATA AND GEOGRAPHIC INFORMATION SYSTEM
D. D. DOHARE, P. G. SHANWARE (Department of Agriculture and Cooperation, All India Soil and Land Use Survey, New Delhi), and S. ALI IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 412-417.

A87-16494#
APPLICATION OF REMOTE SENSING TECHNIQUES IN THE STUDY OF WATER LOGGING IN PARTS OF THE NAGARJUNA SAGAR CANAL COMMAND AREA
K. C. B. RAJU and N. H. REDDY (Central Ground Water Board, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 434-441.

A87-16495#
DIGITAL MAPPING OF FLOODPLAIN LANDUSE
A. K. CHAKRABORTI (National Remote Sensing Agency, Water Resources Div., Dehra Dun, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 442-447.

An attempt is made in this study to map floodplain landuse by digital analysis of Landsat MSS data of pre-flood scene using a maximum likelihood classifier. The landuse classification categories and their area estimates are then used to broadly identify the flood prone and floodfree areas. A comparison with the published record however shows some disagreement with the remote sensing study. The possible explanation for this has been given. Author

A87-16515#
APPLICATION OF REMOTE SENSING FOR MINOR WATERSHED MANAGEMENT
G. BHANU MASTHAN and P. C. RAJU (Institute for Coastal and Offshore Research, Visakhapatnam, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 564-570. refs

A small river basin located north of Visakhapatnam (India) was selected to ascertain the viability of remote sensing for watershed management. The remote-sensing studies involved satellite-imagery interpretation, aerial photointerpretation, and ground reflectance measurements. Provided an interdisciplinary and multistage approach is adopted, it is believed that remote sensing can be instrumental in minor watershed management. K.K.

A87-16516#
UTILITY OF LANDSAT-MSS DATA FOR FLOOD STUDIES
A. S. RAMAMOORTHI, D. V. ROHINIKUMAR, and P. MANAVALAN (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 571-576.

It is proposed that Landsat-MSS data are highly useful for the regional appraisal of flood-related problems. The following areas were selected for the present study: (1) part of the Ganga basin including the Ganga River and its major tributaries, and (2) part of the Brahmaputra River and its confluences with Subansiri and Kameng. It is noted that multidate Landsat imageries could be used advantageously for flood mapping and river behavior studies. K.K.

A87-16518#
AN OVERVIEW OF APPLICATIONS OF AERIAL AND SATELLITE REMOTE SENSING TO GROUND WATER SURVEYS AND EXPLORATION IN INDIA
B. P. C. SINHA (Central Ground Water Board, New Delhi, India) and S. K. SHARMA (Central Ground Water Board, Faridabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 582-587.

A87-16939
A FURTHER DEVELOPMENT OF THE CHROMATICITY TECHNIQUE FOR SATELLITE MAPPING OF SUSPENDED SEDIMENT LOAD
T. LINDELL, B. KARLSSON (Statens Naturvardsverk, Uppsala, Sweden), M. ROSENGREN (Svenska Rymdaktiebogalet, Solna, Sweden), and T. ALFOLDI (Canada Centre for Remote Sensing, Ottawa) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Sept. 1986, p. 1521-1529. refs

A further development of the technique for mapping suspended sediment load using the chromaticity method is presented. The calibration is based on several Landsat scenes from Sweden and Canada covering different atmospheric conditions and different solar angles. The method is continuously used for water quality surveillance of Swedish lakes. Author

A87-16940
VISUAL ANALYSIS OF LANDSAT THEMATIC MAPPER IMAGES FOR HYDROLOGIC LAND USE AND COVER
L. J. TROLIER and W. R. PHILIPSON (Cornell University, Ithaca, NY) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Sept. 1986, p. 1531-1538. USGS-supported research. refs

Two Landsat TM scenes of upstate New York were examined by experienced and novice image interpreters to determine the ease of identifying 22 land-use or cover classes that have a major

effect on the quality and quantity of watershed runoff. Individual bands and selected composites of one scene were analyzed at a scale of 1:35,000, with the aid of topographic maps, to familiarize the interpreters with the appearance of the classes. Bands and composites of the second scene were then interpreted at a scale of 1:70,000 with no aids. With this preparation, even novice interpreters could identify most classes at 1:70,000. Best results were obtained with bands, 3, 4, and 5 or a composite of these three bands. Overall, visual analysis of enlarged TM images can provide an accurate and cost-effective inventory of hydrologically important land use and cover. Author

A87-18585
MORAINAL DAMMING AND SUPERIMPOSED DRAINAGE - THE EXAMPLE OF THE COATICOOK RIVER VALLEY (SOUTHERN QUEBEC, CANADA) [BARRAGE MORAINIQUE ET SURIMPOSITION - EXEMPLE DANS LA VALLEE DE LA RIVIERE COATICOOK /SUD DU QUEBEC, CANADA/]
G. LAROCQUE, A. LAROCQUE, P. BAIL (Montreal, Universite, Montreal, Canada), A. MORISSETTE, and J.-M. M. DUBOIS (Sherbrooke, Universite, Canada) Photo Interpretation (ISSN 0031-8523), vol. 24, May-June 1985, p. 1-4, 5, 7, 9. In French, English, and Spanish.

A87-19539
AIRCRAFT OBSERVATIONS OF LARGE RAINDROPS IN WARM, SHALLOW, CONVECTIVE CLOUDS
K. V. BEARD (Illinois State Water Survey, Climate and Meteorology Section, Champaign), D. B. JOHNSON (USBR, Div. of Atmospheric Resources Research, Denver, CO), and D. BAUMGARDNER (National Center for Atmospheric Research, Boulder, CO) Geophysical Research Letters (ISSN 0094-8276), vol. 13, Oct. 1986, p. 991-994. refs
(Contract NSF ATM-83-18669)

Raindrop size distributions have been obtained using airborne optical array probes during the 1985 Joint Hawaiian Warm Rain Project near Hilo. Drops often extended to 4 or 5 mm diameter, and on one occasion even reached 8 mm - much larger than had been previously reported. Large raindrops were detected frequently enough to indicate that they may be a regular feature of tropic clouds which are rather shallow but convectively active. The preliminary analysis of the data, involving some simple cloud physics calculations, indicates that the conditions in these clouds are well suited for the growth and survival of large raindrops. The presence of large raindrops suggests that a number of wide-spread views on the formation and evolution of warm rain should be altered, and that earlier data obtained in the orographic clouds of Hawaii should not be extrapolated uncritically to all types of warm rain. Author

N87-11280# National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.
AIRBORNE MEASUREMENTS OF THE SPECTRAL REFLECTANCE OF FRESHWATER ICE
G. A. LESHKEVICH *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 245-248 Dec. 1985
Avail: NTIS HC A25/MF A01

Spectral radiance from open water, old snow, and four freshwater ice types was measured over Saginaw Bay (Lake Huron) from an altitude of 300 m under clear skies. Simultaneous radiance and irradiance measurements were made at (or near) the surface over a reference panel and over the old snow and water. Three measurements were made over each surface type and averaged. After determining the spectral reflectance of the snow and water, an algorithm was applied to calculate the spectral reflectance of the ice types measured from 300 m, corrected for atmospheric attenuation and path radiance. ESA

N87-11283# Ecole Normale Superieure, Paris (France). Lab. de Geographie.
REFLECTANCE OF STRAND SEDIMENTS: RESULTS OF IN SITU MEASUREMENTS AND A SPOT SIMULATION IN MONT SAINT MICHEL BAY [LES REFLECTANCES DE SEDIMENTS D'ESTRAN: RESULTATS DE MESURE IN-SITU ET D'UNE SIMULATION SPOT EN BAIE DU MONT SAINT-MICHEL]
R. M. ZBINDEN *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 257-263 Dec. 1985 In FRENCH
Avail: NTIS HC A25/MF A01

The reflectance spectra of sands, dunes, and sediments forming morphosedimentary units typical of strands, identifiable by a SPOT satellite 20 m by 20 m pixel was studied by spectroradiometry. The relations between reflectance, granulometry, surface water content, and sediment calcimetry are shown. Regions where the activity of microalgae mask the signature of fine sediments are revealed. ESA

N87-11286# Bern Univ. (Switzerland). Inst. of Applied Physics.
CAN MICROWAVE SIGNATURES BE USED TO RETRIEVE THE WATER EQUIVALENT OF A DRY SNOW PACK?
C. MAETZLER *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 277-284 Dec. 1985
Avail: NTIS HC A25/MF A01

Based on a long-term program of measuring the interaction of microwaves with the seasonal snow cover at an alpine test site, the potential of microwave remote sensing to retrieve the water equivalent (WE) of the snowpack was tested. For dry winter snow a reasonable estimate is possible for WE less than 80 cm. However, a number of natural disturbances limit this potential. Some changes of the microwave observables can be corrected, others have effects which cannot be determined. It is found that a combination of microwave brightness temperatures tends to enhance the discriminability of dry snow and, simultaneously, cancels effects of the disturbances. This parameter should be used in tests with airborne and satellite data. ESA

N87-11288# Helsinki Univ. of Technology, Espoo (Finland). Radio Lab.
MICROWAVE SCATTERING LOSS OF DRY SNOW
M. T. HALLIKAINEN *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 289-292 Dec. 1985
Avail: NTIS HC A25/MF A01

The extinction coefficient of several snow types at 5 frequencies between 10 GHz and 90 GHz was determined. The temperature of the samples was minus 15 C. Since the dielectric loss of dry snow is low, the extinction coefficient is, in practice, equal to the scattering coefficient. The experimental loss behavior of the samples does not follow the theoretical behavior predicted by Mie theory (assuming spherical snow particles). The measured loss varies substantially depending on the snow type. At 90 GHz maximum and minimum values are 300 dB/m and 15 dB/m, respectively. At 10 GHz the loss is negligible for all snow types. The loss due to surface scattering effects is substantial for refrozen snow at 60 and 90 GHz. ESA

N87-11316# California Univ., Santa Barbara.
SPECTRAL SIGNATURE OF SNOW IN VISIBLE AND NEAR-INFRARED WAVELENGTHS
J. DOZIER *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 437-442 Dec. 1985
Avail: NTIS HC A25/MF A01

Snow reflectance measurements in the near-infrared (Landsat Thematic Mapper band 4) estimated an effective radiative grain radius, while a measurement in the visible (TM band 2) estimated the extent to which snow albedo is degraded by contamination. The combination of these parameters can be used to calculate snow albedo throughout the solar spectrum. The effective grain radius is approximately the spherical radius that corresponds to

the volume/surface ratio of the actual grains. Snow can be distinguished from water and ice clouds in TM band 5, because water is less absorptive than ice in this band and the small crystals in cirrus clouds are more reflective than the larger snow grains.
ESA

N87-11340# Instituut voor Culturrtechniek en Waterhuishouding, Wageningen (Netherlands).
REMOTE SENSING IN HYDROLOGY [DE HYDROLOGIE OP AFSTAND IN BEELD GEBRACHT]
G. J. A. NIEUWENHUIS Jan. 1986 18 p In DUTCH
(ICW-1687; ETN-86-98062) Avail: NTIS HC A02/MF A01

Applications of remote sensing techniques are presented. Aerial remote sensing systems are surveyed. The difference between aircraft and satellite remote sensing is discussed. In order to illustrate that electronic aerial sensing techniques lend themselves well to quantitative analysis, results showing the mapping of evaporation using digital reflection and heat images are quoted. Applications of remote sensing in hydrology and agricultural water economy are described. ESA

N87-11920# Massachusetts Technological Lab., Bethesda, Md. Washington Div.
RAIN EFFECTS ON RADIO FREQUENCY PROPAGATION Final Report, 31 Sep. 1985 - 31 Mar. 1986
D. J. FANG and C. S. LO 31 Mar. 1986 108 p
(Contract F04704-85-C-0144)
(AD-A168342; MTL-WD-8604-T; BMO-TR-86-23) Avail: NTIS HC A06/MF A01 CSCL 20N

Rain is a principal cause of signal degradation in a terrestrial or satellite transmission in a frequency range from UHF to EHF. This study proceeded with a format for compiling and editing the relevant data, and for making engineering inferences to supplement relevant yet inadequate data, as required for practical applications on a terrestrial or a slant path link. The format was to model the rain-induced attenuation by an empirical relationship on a = aRb L type of power law equation. Five well recognized models (CCIR, Fedi, French, Lin and SAM) were chosen for comparison with database. As for immediate applications, the Lin model is recommended for percentage of time over 0.35 of a year; and for percentage of time less than 0.3%, the French model is considered to be applicable. For more specific applications, such as for cases of low rain-rate regions to high rain-rate regions, low elevation angle paths to high elevation angle paths, etc., best performance models are identified. GRA

N87-12033*# Minnesota Univ., Minneapolis.
AN ECOLOGIC STUDY OF PEAT LANDFORMS IN CANADA AND ALASKA Progress Report
P. H. GLASER 1986 9 p
(Contract NAS5-28740)
(NASA-CR-179740; NAS 1.26:179740) Avail: NTIS HC A02/MF A01 CSCL 08B

The role of groundwater and surface runoff in controlling the water chemistry and development of peat landforms in northern Minnesota are described. The LANDSAT imagery taken duing spring break-up are particularly valuable in identifying potential zones of groundwater discharge. The vascular floras of raised bogs in eastern North Americas demonstrating the remarkabe uniformity of the ombrotrophic flora over broad geographic regions are described. The evolution of peat landforms in the major boreal peatlands of eastern America is examined. The LANDSAT imagery is used to determine the area of patterned to featureless peatlands, the area of ombrotrophic bog relative to minerotrophic fen, and the relative size and degree of streamlining of island landforms entirely composed of peat. Such measurements can be used to assess the role of climate, time, and hydrology in controlling the formation of peatland patterns across broad geographic regions.
B.G.

N87-12960# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF REMOTE SENSING TECHNIQUES TO THE DETECTION OF CHANGES IN A FLUVIAL SYSTEM DUE TO HUMAN INFLUENCE: THE EXAMPLE OF CANAS RIVER BASIN (SAO PAULO STATE, BRAZIL)
E. M. L. M. NOVO and A. A. DEABREU (Sao Paulo Univ. (Brazil).) Aug. 1986 36 p Submitted for publication
(INPE-3970-PRE/983) Avail: NTIS HC A03/MF A01

The main objective of this study is to exemplify the use of remote sensing data to evaluate human interference in fluvial systems. River Canas Basin was selected as a test site since it belongs to the Paraiba River basin where human action has disrupted natural equilibrium. Multitemporal aerial photography was analyzed so as to detect changes in fluvial morphology. The rate of environmental change was checked against remote sensing data available by using field work information. Results permitted identification river channel changes over time as well as local factors which explain the variability of change rates. Author

N87-13074*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SATELLITE PASSIVE MICROWAVE RAIN MEASUREMENT TECHNIQUES FOR LAND AND OCEAN
R. W. SPENCER *In its* NASA/MSFC FY-85 Atmospheric Processes Research Review 3 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

Multiseasonal rainfall was found to be measurable over land with satellite passive microwave data, based upon comparisons between Nimbus 7 Scanning Multichannel Microwave Radiometer (SMME) brightness temperatures (T sub B) and operational WSR-57 radar rain rates. All of the SMMR channels (bipolarized 37, 21, 18, 10.7, and 6.6. GHz T sub B) were compared to radar reflectivities for 25 SMMR passes and 234 radar scans over the U.S. during the spring, summer, and fall of 1979. It was found that the radar rain rates were closely related to the difference between 37 and 21 GHz T sub B. This result is due to the volume scattering effects of precipitation which cause emissivity decreases with frequency, as opposed to emissive surfaces (e.g., water) whose emissivities increase with frequency. Two frequencies also act to reduce the effects of thermometric temperature variations on T sub B to a miminum. During summer and fall, multiple correlation coefficients of 0.80 and 0.75 were obtained. These approach the limit of correlation that can be expected to exist between two very different data sources, especially in light of the errors attributable to manual digitization of PPI photographs of variable quality from various operational weather radar not calibrated for research purposes. During the spring, a significantly lower (0.63) correlation was found. This poorer performance was traced to cases of wet, unvegetated soil being sensed at the lower frequencies through light rain, partly negating the rain scattering signal. Author

N87-13075*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REMOTE SENSING OF SEVERE CONVECTIVE STORMS
R. J. HUNG (Alabama Univ., Huntsville.), R. E. SMITH, and G. S. WEST *In its* NASA/MSFC FY-85 Atmospheric Processes Research Review 3 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

The Tibet Plateau significantly affects the initiation and development of heavy rainfall and severe storms in China, just as the Rocky Mountains influence local severe storms in the United States. The study shows that the heavy rainfall in the Plateau area is usually preceded by a high growth rate of the convective clouds, followed by a rapid collapse of the cloud top. The study also shows that the tops of the convective clouds associated with heavy rainfall over the Plateau usually lie between the altitude of the two tropopauses which exist over the Plateau. There is good agreement between the collapsing of the cloud as observed from the satellite imagery, and the beginning of the rainfall observed by the ground stations and also between the dissipation of the cloud observed from the satellite infrared imagery, and the ending

of the rainfall, observed by the ground stations. Comparison of the volumetric dissipation of clouds per unit area over the location of the ground station with the rainfall recorded at that station shows a linear relationship for rainfall mounts exceeding 8 mm. The ratio of observed rainfall at the ground station over the satellite observed cloud volume dissipation per unit area was also computed. The result shows that the ratio is almost constant with the value of 9.55 mm/(pixel . km/pixel) for rainfall amounts exceeding 15 mm; and the variation is less then 10 percent for rainfall mounts between 8 and 15 mm. Needless to say, further investigation is required to verify this ratio. Author

N87-13096*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FIRST MEETING OF THE WORKING GROUP ON THE SHUTTLE MICROWAVE PRECIPITATION RADIOMETER (SMPR)
In its NASA/MSFC FY-85 Atmospheric Processes Research Review 2 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

The working group agreed that the first (primary) objective should be the determination of methods for the accurate measurement of total rain water and total cloud water with passive microwave methods. There was no argument on the points concerning nonlinear relationships between T sub B and rain rate (R) over the range of important rain rates (half of oceanic rainfall occurs at rates greater than 15 mm h-1), such that variations in rain rate within a footprint lead to an incorrect measurement of the average rate for that footprint, and one cannot determine the characteristics of the sensed rain area. This is especially true near 18 GHz, where the dynamic range above 15 mm h-1 is very small because this frequency does not clearly fall in either a scattering regime or emissive regime at these wavelengths. It is also not clear whether very low frequency (emissive) techniques will be the best at measuring rain processes, or high frequency (scattering) techniques, where precipitation-size ice plays a major role in the signal attenuation. It is still not known what signal of rain is at certain rates on an observational basis because of the many different conditions that can exist within a single satellite observed footprint.

N87-13833# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THERMAL AND NEAR INFRARED REMOTE SENSING IN THE STUDY OF PEAT DEPOSITS ON THE PARAIBA DO SUL RIVER FLOOD PLAIN (SP) M.S. Thesis [SENSORIAMENTO REMOTO NO TERMAL E INFRAVERMELHO PROXIMO NO ESTUDO DE DEPOSITOS DE TURFA NO VALE DO RIO PARAIBA DO SUL (SP)]
A. C. BERNARDI Jul. 1986 134 p In PORTUGUESE; ENGLISH summary Original document contains color illustrations
(INPE-3961-TDL/230) Avail: NTIS HC A07/MF A01

The purpose of this study was to evaluate the use of thermal and photographic remote sensing in the discrimination of peats with different organic matter and moisture contents, depth of occurrence, calorific value and thickness. To achieve this objective, the first step was to analyze the thermometric and radiometric temperatures obtained in the field and laboratory over peats from several regions. This was followed by the analysis of radiometric temperature aerial profiles and color and black and white aerial photographs taken simultaneously over peat deposits on the Paraiba do Sul river floodplain near Sao Jose dos Campos (SP). The collected data were submitted to linear regression analyses and statistical tests. The results show that radiometric aerial temperatures are sensitive to some peat characteristics and vegetative cover changes. However, since vegetation and land use, in general, changed with differences in peat moisture and organic matter contents, a series of both quantitative and qualitative information of the deposits was obtained by thermal aerial data and infrared photographs analyses. In view of the fact that LANDSAT TM images are obtained in the same spectral interval as that adopted in this study, and that there are other bands useful in soil moisture and composition change detection, this study indicates the potentiality of TM images in studies related to the identification and evaluation of peat deposit. Author

N87-13910# World Climate Programme, Geneva (Switzerland).
REVIEW OF REQUIREMENTS FOR AREA-AVERAGED PRECIPITATION DATA, SURFACE-BASED AND SPACE-BASED ESTIMATION TECHNIQUES, SPACE AND TIME SAMPLING, ACCURACY AND ERROR, DATA EXCHANGE
1985 71 p Presented at Workshop on Precipitation Data Requirements, Boulder, Colo., 17-19 Oct. 1985
(WCP-100; WMO/TD-115; ETN-86-98306) Avail: NTIS MF A01; print copy available at WMO, Geneva, Switzerland

Measuring techniques that take into account the high spatial variability of precipitation over land, and methods to estimate precipitation over oceanic areas; precipitation observing systems; and space/time sampling, error, and accuracy are discussed. Experiments conducted with high density rain gage networks; intercalibration and intercomparison studies related to deriving space based (satellite) estimates of precipitation; and techniques which use satellite radiance fields to estimate precipitation are described. ESA

N87-14813# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
OBSERVING THE SYNOPTIC STRUCTURE OF TWO MOISTURE BURSTS M.S. Thesis
J. R. SCHAEFER Dec. 1985 158 p
(AD-A170670; AFIT/CI/NR-86-70T) Avail: NTIS HC A08/MF A01 CSCL 04B

The moisture burst is characterized by large amounts of cloudiness emanating from tropical regions and often affecting middle latitude regions. Due to data scarcity, the study of moisture bursts near their origin is difficult. Supplementary data available during the First GARP Global Experiment make such a study feasible. Through the use of in situ observations and computer-generated model analyses, this thesis presents results of a synoptic case study of two moisture bursts. Satellite-derived data are shown to be useful in this region, although lack of certain satellite radiance channels during the time period precludes their use. The FGGE IIIb model analyses are first proven to be reliable by comparison with satellite observations and are then used extensively. GRA

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A87-11051
APPLICATIONS OF DIGITAL IMAGE PROCESSING VIII; PROCEEDINGS OF THE MEETING, SAN DIEGO, CA, AUGUST 20-22, 1985
A. G. TESCHER, ED. (Aerospace Corp., Los Angeles, CA) Meeting sponsored by SPIE. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 575), 1985, 298 p. For individual items see A87-11052 to A87-11063.
(SPIE-575)

Papers are presented on an evaluation of selected three-dimensional imaging and three-dimensional image processing techniques, the Fast Hartley transform, algorithms for mathematical morphological operations with flat top structuring elements, progressive transmission of digital diagnostic images, and a 10-MHz data compression system for real time image storage and transmission. Also considered are the model based matching of line segments in aerial images, the detection of maneuvering target tracks, pattern recognition through dynamic programming, knowledge-based tactical terrain analysis, and color coding medical

ultrasound tissue images with frequency information. Other topics include a CCD for a two-dimensional transform, an interactive digital image processing workstation for the earth sciences, image processing on photon-counting images, and material stress inspection by digital thermographic image processing. Papers are also presented on digital image processing for instantaneous frequency mapping, an object-pass filter for image processing, entropy-constant image enhancement for instantaneous frequency mapping, and a perimetric sampling technique applied to biological images. R.R.

A87-13518
A COMPARISON OF CLASSIFICATION TECHNIQUES USING THEMATIC MAPPER AND MULTI-SPECTRAL SCANNER DATA, FOR LAND COVER CLASSIFICATION
L. T. SCHMIDT and B. I. NAUGLE (Murray State University, KY) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 683-695. refs

A87-13521
THE WISCONSIN EXPERIMENTAL PROGRAM FOR SATELLITE IMAGE MAPPING USING THEMATIC MAPPER DATA
T. M. LILLESAND and T. H. C. LO (Wisconsin, University, Madison) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 757-769. Research supported by the William and Flora Hewlett Foundation. refs
(Contract NOAA-NA-800AD00086; NOAA PROJECT 144-U824)

A87-13523
CREATING AN OPTIMIZED COLOR BALANCE FOR TM AND MSS IMAGERY
B. P. CLARK (Computer Sciences Corp., Silver Spring, MD) and A. JOHNSON IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 821-831. refs

The use of transformed TM image data to create a hard copy TM color composite image containing MSS-like color balance is examined. The initial use of Landsat 4 data to develop TM color balanced images is discussed; the procedure was not successful due to dissimilarities between the TM black and white transparencies. Regression analysis is performed on Landsat 5 data which consists of a portion of a late June 1984 agricultural scene acquired simultaneously by MSS and TM sensors. Regression coefficients are calculated and utilized for operational image generation. The linear relationship between MSS spectral bands 1, 2, and 4 and TM bands 2, 3, and 4 is studied. The final image is produced from computer compatible tape regenerated using transformations derived from TM images. It is observed that the TM color composite images produced using the coefficients are identical to corresponding MSS images in tone and color balance. I.F.

A87-13524
APPLICATIONS OF LANDSAT MSS IMAGERY WITH VERY LOW SUN-ANGLES
J. M. MILLER and G. J. BURGER (Alaska, University, Fairbanks) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 832-841. refs

The usefulness of MSS images with low sun elevation-angles is evaluated. Images with sun elevation-angles between - 4 deg and + 10 deg during the winter of 1984-1985 are studied. The contrast-stretch enhancement of the data is described. It is observed that the presence or absence of leads in sea ice with a sun angle of -3 deg can be determined by stretching the 0-7 range of digital numbers to the full constrast of a photographic image; land features can be imaged down to 0 deg; and dune deposits and snow cover and ice characteristic on large lakes can be detected. I.F.

A87-13528* General Electric Co., Lanham, Md.
THEMATIC MAPPER IMAGE PROCESSING SYSTEM - GEOMETRIC CORRECTION PERFORMANCE FOR LANDSAT-5
J. BROOKS (General Electric Co., Space Div., Lanham, MD) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 925-928.
(Contract NAS5-25300)

Geometric correction performance data are presented for the Landsat-5 Thematic Mapper and the Thematic Mapper Image Processing System. Temporal registration and geodetic rectification results are displayed in the form of 90 percent errors. Both error estimation and direct measurements demonstrate that the instrument and system meet performance requirements. Author

A87-13529
GEOMETRIC QUALITY OF A THEMATIC MAPPER IMAGE OF THE UNITED KINGDOM
J. R. HARDY (Reading, University, England) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 937-948. refs
(Contract NERC-F60/G6/03)

A87-13530* International Business Machines Corp., Palo Alto, Calif.
ANALYSIS AND CORRECTION OF LANDSAT 4 AND 5 THEMATIC MAPPER SENSOR DATA
R. BERNSTEIN and W. A. HANSON (IBM Palo Alto Scientific Center, CA) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 960-974. refs
(Contract NAS5-27355)

Procedures for the correction and registration and registration of Landsat TM image data are examined. The registration of Landsat-4 TM images of San Francisco to Landsat-5 TM images of the San Francisco using the interactive geometric correction program and the cross-correlation technique is described. The geometric correction program and cross-correlation results are presented. The corrections of the TM data to a map reference and to a cartographic database are discussed; geometric and cartographic analyses are applied to the registration results. I.F.

A87-13531
SPOT SATELLITE DATA PROCESSING AND DISTRIBUTION IN THE UNITED STATES
E. S. MEREDITH (SPOT Image Corp., Washington, DC) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 988-995.

The processing and distribution of the SPOT 1 satellite data are described. The satellite is composed of a standard multipurpose bus and a mission specific payload. The functions of the bus subsystem are discussed. The payload consists of two identical high resolution visible instruments, two tape recorders, and the image telemetry transmission equipment. The operation of the high resolution visible instruments in the multiband and photochromatic channels is studied. The development of the SPOT reference grid which reveals a correlation between the grid nodal points and the centers of scenes is considered. The information available from

the SPOT Image catalog that contains all archived scenes is examined. I.F.

A87-15122
ARCTIC SUMMER CLOUDINESS
D. A. ROBINSON, G. J. KUKLA, and M. C. SERREZE (Lamont-Doherty Geological Observatory, Palisades, NY) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 176-179. refs
(Contract DE-AC02-81EV-10665)

DMSP imagery was used to perform an arctic-wide analysis of late spring and summer cloudiness using shortwave (0.4-1.1 micron) and IR (8.0-13.0 microns) data with a resolution of 2.7 km. Interactive analysis with a digital image processor led to identification of four cloud cover classes: cloud-free, thin, moderate and thick clouds. Clouds were most abundant in the outer Arctic Ocean and most frequent, with moderately thick clouds, in the second half of May and early-June. Cloud-free periods up to weeks in extent were observed and are concluded to have a significant impact on the surface radiation budget and the dissipation of snow and ice. M.S.K.

A87-15177#
LAND-COVER MAPPING FROM SYNTHETIC APERTURE RADAR - THE IMPORTANCE OF RADIOMETRIC CORRECTION
G. M. FOODY and P. J. CURRAN (Sheffield, University, England) Canadian Journal of Remote Sensing (ISSN 0008-2821), vol. 12, July 1986, p. 39-46. refs

The accuracy with which SAR data can be used to map land cover is increased if the data are radiometrically corrected. To evaluate this assertion, SAR data, collected as part of the European Space Agency's SAR-580 project, were radiometrically corrected, and both the corrected and uncorrected data were used to map land cover in the Thames Valley, UK. This correction was required to remove the tonal imbalance present in the SAR-580 data. Radiometric correction of the SAR data almost doubled the accuracy with which land cover could be mapped, to 52-73 percent at the 95-percent confidence level. It was concluded that for land cover mapping, other factors, such as the effect of incidence angle, must also be considered. Author

A87-15178#
THEMATIC MAPPING FROM LANDSAT AND COLLATERAL DATA - A REVIEW OF ONE COMPANY'S EXPERIENCE AND A FORECAST OF FUTURE POTENTIAL
A. F. GREGORY and H. D. MOORE (Gregory Geoscience, Ltd., Ottawa, Canada) (CASI, Canadian Conference on Astronautics, 3rd, Ottawa, Canada, Apr. 23, 24, 1985) Canadian Journal of Remote Sensing (ISSN 0008-2821), vol. 12, July 1986, p. 55-63. refs

A87-15498
DIGITAL PROCESSING OF REMOTELY SENSED DATA
A. D. KULKARNI (National Remote Sensing Agency, Hyderabad, India) IN: Advances in electronics and electron physics. Volume 66 . Orlando, FL, Academic Press, Inc., 1986, p. 309-368. refs

The principles governing multispectral remote sensing are reviewed, and digital techniques used in the processing of these remotely sensed images are described. Consideration is also given to applications and system design. Enhancement techniques such as gray-scale manipulation, edge-enhancement, spatial smoothing and filtering are discussed, as well as interpolation and registration techniques. K.K.

A87-15606#
USER REQUIREMENTS FOR GEOMETRIC TRANSFORMS
D. S. LOWE (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 79-85. refs

The kinds of geometric corrections (GCs) needed by various users of satellite multispectral-scanner data and the procedures used to provide them are compiled in tables and discussed. The problems encountered when the satellite operator applies generalized GCs to all data (as in the case of Landsat MSS data) are outlined, and it is recommended that the GC needs of different users can best be met by offering both single-projection corrected image tapes with an easily achieved degree of accuracy and uncorrected tapes. It is suggested that more sophisticated resampling for precision mapping, large-area mosaics, spatial and spectral enhancement, or information extraction is best left to the user or to value-added organizations. T.K.

A87-15607#
SPECTRORADIOMETRIC TRANSFORMS AND DATA COMPRESSION
W. A. MALILA and E. P. CRIST (Michigan, Environmental Research Institute, Ann Arbor) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 87-94. refs

The process by which raw signals from space-borne sensors are converted to radiometrically calibrated, stable, and useable data includes many different and important elements. This paper discusses the overall goals of such pre-processing, as well as discussing, in general terms, the specific steps in the overall process. In particular, techniques aimed at correction of instrument effects, or of effects related to observation conditions, are considered. In addition, techniques by which sensor data can be transformed and/or compressed, for purposes of enhanced interpretability or reduced data volume are discussed. References are provided from which more detailed information pertaining to these topics can be obtained. Author

A87-15608#
PREPROCESSING FOR MULTI-SOURCE DATA INTEGRATION
F. J. AHERN (Canada Centre for Remote Sensing, Ottawa) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 95-103. refs

Techniques for the preprocesisng (PP) of data from spaceborne and airborne remote sensing to facilitate their integration with each other and with in situ measurements are discussed, with reference to recent Canadian experience in the PP of Landsat MSS and TM images. Consideration is given to radiometric PP, geometric correction, spatial PP (linear and nonlinear/adaptive filtering and image segmentation), and the provision of external data. It is recommended that future users be offered a wide selection of PP options to reduce the effort and expertise required to make intelligent use of remote-sensing data. T.K.

A87-15609#
APPLICATIONS OF GEOCODED IMAGERY
I. LAVERTY, J. MACDONALD (MacDonald Dettwiler and Associates, Ltd., Richmond, Canada), and J. CIHLAR (Canada Centre for Remote Sensing, Ottawa) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 105-119.

Geocoded imagery has been available on a limited basis for several years now, providing an opportunity to evaluate it in a variety of applications. New systems currently being developed will soon make geocoded imagery more widely available. In this paper the place of geocoding in image processing is examined, with examples of how it is being used to advantage in general

and in a number of specific applications. The cost, benefits, and availability of geocoded data compared with lesser levels of geometric correction are assessed to help users evaluate its potential. Trends in remote sensing which will affect these trade-offs in the future are also discussed. Author

A87-15619#
FAST CLASSIFICATION OF IMAGE DATA WITH LARGE SPECTRAL DIMENSION
N. PENDOCK (Image Processing Consultants, Sandton, Republic of South Africa) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 281-285. Research supported by the Anglo-American Corp.

A classifier is presented which discriminates image-feature classes on the basis of local spectral minima and maxima. For a Landsat TM image (spectral dimension 7), several hundred distinct spectral shape classes may be identified, while for a Daedalus scene (spectral dimension 11) many thousands of classes may be produced. The spectral shape class for each image element may be mapped continuously onto an RGB color cube using a space-filling (fractal) curve. Alternatively, each pixel may be assigned a hue determined by its spectral shape class, an intensity equal to its spectral mean (or maximum), and a saturation equal to its spectral variance (or range). This JHS representation may then be rotated into an RGB color space for display and interpretation. Author

A87-15620#
OPERATIONAL QUALITY CONTROL AT EARTHNET LANDSAT STATIONS.
E. ORIOL-PIBERNAT (ESA, Frascati, Italy) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 289-298.

An operational quality-control system has been implemented at ESA Landsat stations and the Earthnet Program Office to check in an automatic way the main characteristics of every single product before distribution to the users. At the same time, a record is kept in the form of a database, in order to be able to trace back any identified problem or define statistically the performance of the sensors (TM and MSS). The algorithms used are described together with a definition of the thresholds set for every parameter. Examples of the behavior of such parameters are presented, and some consideration is given to the usefulness of the approach, to justify its implementation. Author

A87-15632#
GEOMETRIC SHAPE DETECTION IN DAEDALUS ATM DATA
H. E. STRUTHERS and N. E. PENDOCK (Anglo-American Corp., Marshalltown, Republic of South Africa) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 423-431. refs

A remotely sensed scene usually contains one or more geometric shapes. This paper examines techniques that can be applied to digital remotely sensed data to facilitate shape detection. In particular, consideration is given to pyramidal reduction, segmentation, the Hough Transform, and template matching. The time constraints involved in applying these techniques to a Daedalus Airborne Thematica Mapper (ATM) scene are also examined. Author

A87-15633#
EVALUATION OF CLASSIFICATION ALGORITHMS
J. WASRUD (Indiana State University, Terre Haute) and K. LULLA (Rutgers University, New Brunswick) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 433-441. refs

The features and effectivenesss of the nonparametric per-point parallellipiped classification algorithm LEVELSCLASSIFY (LVC) and the maximum-likelihood algorithms CLASSIFYPOINTS (CP), LAYEREDCLASSIFIER (LC), and ECHO are investigated by applying them to Landsat-MSS and ground-truth data on a test site near Baraboo, Wisconsin. The results are presented in tables and discussed. The total accuracy values at classification level 1 (Anderson et al., 1972) are given (in percent) as 86.8 for ECHO, 82.6 for LC, 80.5 for CP, and 84.9 for LVC; at level 2 the values are 70.4, 63.6, 62.6, and 60.8, respectively. ECHO and LC are shown to require more analyst time than LVC and CP, and the CPU times for a typical test procedure are found to be 53.24 s for ECHO, 34.70 s for LC, 48.79 s for CP, and 12.84 s for LVC. Since all four methods are considered suitable for this type of analysis, it is suggested that the accuracy/efficiency tradeoffs be evaluated for each application. T.K.

A87-15634#
VECRAU - A COMPUTERIZED SYSTEM FOR INTEGRATING VECTOR AND LANDSAT SATELLITE DATA
E. J. VAN VUUREN, P. A. J. VAN RENSBURG, and S. H. VON SOLMS (Rand Afrikaans University, Johannesburg, Republic of South Africa) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 443-452. refs

A computerized method of preparing vector-type geocoded geographical data to be overlaid onto a Landsat-4 MSS image is described. The geographical data sets consisted of silo-range boundaries digitized from 1:250,000 maps and soil-potential contours generated by computer-aided modeling procedures. These geocoded geographical data were initially in vector format; i.e., line segments represented by their coordinates. After rasterizing the geocoded data sets they were overlaid onto classification maps generated from the Landsat data, with the purpose of calculating potential grain production per silo range. Author

A87-15642#
OPTIMUM CLASSIFICATION OF LANDSAT THEMATIC MAPPER DATA FOR ECOLOGICAL STUDY
S. UENO, Y. KAWATA, and T. KUSAKA (Kanazawa Institute of Technology, Japan) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 533-544. refs
(Contract MOE-60129032)

The classification of full-scene Landsat-5 TM data on an 800-pixel-square test site in Japan to identify ground-cover types is reported. The TM/CCT data are corrected radiometrically and geometrically, matched to the 25-m grid size of the ground-truth data, and subjected to either supervised or unsupervised classification procedures, which are described in detail. Both classification methods are found to give satisfactory results. Comparison of classifications with different combinations of Landsat bands shows that the addition of band 5 to bands 1-3 improves the discrimination of rural, urban, and ecological ground-cover types. T.K.

A87-15645#
DIMENSION REDUCTION AND INTERPRETATION OF MULTI-SPECTRAL IMAGERY USING CHEBYSHEV POLYNOMIALS
N. PENDOCK (Image Processing Consultants, Sandton, Republic of South Africa) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 565-571. Research supported by the Council for Scientific and Industrial Research.

Principal components analysis is the optimal transformation for reducing the spectral dimension of remotely sensed data by minimizing the mean-square (average) error between the original and transformed spectral bands. This technique is, however, computationally expensive for data with high spectral dimension, and minimizing the maximum error of representation, rather than the average error, may be a better strategy for the detection of certain spectral features. Such a computationally efficient uniform transformation may be achieved by fitting a polynomial to each spectral vector and then reducing its degree through the use of Chebyshev polynomials. These two dimension reduction techniques are applied to Daedalus ATM 11 band spectral data and are compared. Author

A87-15653#
MAPPING LAND COVER TYPES IN ENGLAND AND WALES USING LANDSAT THEMATIC MAPPER IMAGERY
G. C. DEANE, P. N. CHURCHILL, and G. H. GRIFFITHS (Hunting Technical Services, Ltd., Borehamwood, England) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 633-641. refs

Landsat TM imagery for the whole of England and Wales is being interpreted, using computer-aided analysis techniques, to provide statistical information on the distribution of major land cover types. Existing aerial photographs for a number of randomly located sites, together with current ground data, are being used to provide training information for use in supervised spectral classifications of these TM data. Aerial photography and ground data for other areas are being used to establish the accuracy of the TM classifications. Author

A87-15655#
A DATA STRUCTURE WITH APPLICATIONS TO REMOTE DETECTION OF ENVIRONMENTAL CHANGE
P. P. SANCHEZ (Michigan, Environmental Research Institute, Ann Arbor) and S. A. TAHERI (Eastern Michigan University, Ypsilanti) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 655-658.

This paper describes a data structure intended to support an unsupervised clustering approach to spatial preprocessing of imagery. The data structure utilizes the operating system concept of a bit map to group together, in clusters called 'blobs', spatially and spectrally similar pixel vectors. This clustering technique is useful as a preprocessing step for categorizing terrain features as units larger than the individual pixels, and also for characterizing spectral/spatial/temporal features for change detection. Author

A87-15657#
SIMULATION SOFTWARE OF SYNTHETIC APERTURE RADAR
I. KOHNO, O. TAKANO (Earth Resources Data Analysis Center, Tokyo, Japan), M. ONO, and H. TANAKA (Mitsubishi Electric Corp., Kamakura, Japan) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 671-677.

Research and development for data use of SAR images is in progress in Japan, and SAR simulation software has been developed. This simulation software consists of eight major blocks and possesses high simulation capability for various kinds of simulation parameters. The simulated SAR images have shown good coincidence with real SAR images. Author

A87-15668#
VARIABILITY OF CLASSIFICATION WITH MAXIMUM LIKELIHOOD BASED DISCRIMINANT FUNCTIONS
C. LAC PRUGENT, S. FERNANDEZ, C. GARGANTINI, and A. POLJANEC (Comision Nacional de Investigaciones Espaciales, Centro de Sensores Remotos, Buenos Aires, Argentina) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 773-780. Research supported by the Comision Nacional de Investigaciones Espaciales. refs
(Contract UN-ARG-81/002)

In this paper the authors tried to show the variability in the classification of Landsat images by means of the very well known maximum likelihood discriminant function as well as the Bayesian classifiers. Several images obtained using the bootstrap statistical method show graphically such variability. Some suggestions for multitemporal analysis are made, specially for the Bahwar's model which use the Kauth-Thomas transform of Landsat multitemporal data. In fact, the K-T transform implies a concept very close to the principal components and then have the same problems on the variability which implies some doubts in the reliability of the results. Author

A87-15673#
REMOVAL OF ATMOSPHERIC AND TOPOGRAPHIC EFFECTS FROM LANDSAT MSS IMAGE
Y. KAWATA, S. UENO, and T. KUSAKA (Kanazawa Institute of Technology, Ishikawa, Japan) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 821-828. refs

It has been known that surface-reflectance data measured by Landsat include unwanted noise such as atmospheric and topographic effects. The correction of these effects is very important to increase the accuracy in the classification. Here a simple radiometric-correction method is proposed which removes both atmospheric and topographic effects from the remotely sensed data. The method is applied to a mountainous test site whose digital terrain data are available. The results show that the rejection of both effects is, to some extent, successful on the Landsat band-7 image over rugged terrain. The values of necessary atmospheric parameters in the evaluation of reflection and transmission functions, such as the optical thickness, the single-scattering albedo and the turbidity factor of the atmosphere, are computed from LOWTRAN 5 code. Lambert's law of reflection is assumed in this study. Author

A87-15858#
RESULTS OF SPOT 1 IMAGES - QUALITY ASSESSMENT PROGRAM
G. BEGNI, B. BOISSIN, and M. LEROY (CNES, Toulouse, France) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 6 p. refs
(IAF PAPER 86-84)

During the so-called 'postlaunch assessment period', the quality of SPOT images was tested and a characterization of geometric and radiometric performance was made. After a brief description of the methods used, the quantitative results are presented. Considering a series of typical images, the relation between these results and the major applications of SPOT data are discussed. Author

A87-15866#
HIGHER RESOLUTION SATELLITE REMOTE SENSING AND THE IMPACT ON IMAGE MAPPING
A. H. WATKINS and J. M. THORMODSGARD (USGS, EROS Data Center, Sioux Falls, SD) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 12 p. refs
(IAF PAPER 86-98)

The techniques designed to improve the resolution of remote sensing imagery are described. Special attention is given to the techniques used for digital image processing, such as noise suppression, contrast enhancement, edge enhancement, local area contrast adjustment, image restoration, geometric correction and mosaicking, terrain relief displacement correction, and data merging. The use of the IHS merging of Landsat TM and SPOT data for obtaining high-resolution images of the Chernobyl nuclear plant is described. I.S.

A87-16379#
CLASSIFICATION OF OPTICAL SURFACE PROPERTIES USING COLOR TRANSFORMATION TO SEPARATE HIGHLY CORRELATED BANDS
G. ENDERLEIN (DFVLR, Institut fuer Optoelektronik, Wessling, West Germany) (Meeting on Advanced Image Processing and Planetological Application, Vulcano, Italy, Sept. 16-18, 1985) Societa Astronomica Italiana, Memorie (ISSN 0037-8720), vol. 57, no. 2, 1986, p. 173-190.

A technique for the classification of multispectral digital images is described and demonstrated. The fundamental principles of principal-component analysis using n-dimensional probability-density functions are reviewed; conventional color transformations for display in the BGR system are explained; and a new technique based on transformation to the hue-saturation-intensity (HSI) system is presented. Applications to the 400-nm and 560-nm bands of a Mauna Kea CCD-camera image of lunar crater Tycho (to evaluate TiO2 absorption by the lunar surface) and to the 600-nm and 900-nm bands of a MOMS scene of the Big Island of Hawaii are shown. T.K.

A87-16380#
ADAPTIVE FILTERING USING SPATIAL FEATURES
J. H. T. STAKENBORG (CEC, Laboratory of Image Processing, Ispra, Italy) (Meeting on Advanced Image Processing and Planetological Application, Vulcano, Italy, Sept. 16-18, 1985) Societa Astronomica Italiana, Memorie (ISSN 0037-8720), vol. 57, no. 2, 1986, p. 191-211. refs

A semilinear edge-preserving image-smoothing algorithm to be used prior to field extraction and field-by-field classification is developed and demonstrated. The basic principles of the method and the reasons for selecting a 3 x 3 rotating mask for edge definition are explained, and the computer implementation is described in detail and illustrated with tables, diagrams, and sample printouts. The algorithm is applied to six-channel Landsat-5 TM images of the Mooswald-Mundenhof test site near Freiburg (FRG) and to simulated SPOT images of Les Vans (Ardeche, France), and the results of subsequent pixel-by-pixel classification are presented graphically and briefly characterized. T.K.

A87-16452#
SPATIAL CHARACTERISTICS OF REFLECTANCE IN MOUNTAINOUS AREA
K. TSUCHIYA, R. TATEISHI, and Y. SAKURAI (Chiba University, Japan) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 161-169.

Under the assumptions that a terrain surface corresponding to one pixel is a plane and uniform in terms of reflective characteristics, an approximation formula is derived, which can explain radiance characteristics obtained by a satellite from space as a function of directions of the sun, outward normal of the pixel surface and the sensor. It is found that the derived equation can better explain radiance values of Landsat MSS data than simple application of Lambertian law. The formula is also applicable to various purposes such as elimination of shadow effects, extraction of terrain features, etc. Author

A87-16462#
AUTOMATIC TRANSLATION CORRECTION
C. PEANVIJARNPONG, S. VIBULSRESTH (National Research Council, Thailand Remote Sensing Centre, Bangkok), F. CHEEVASUVIT, and K. PETCHSUWAN (King Mongkut's Institute of Technology, Ladkrabang, Thailand) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 230-234.

Generally, translation correction of satellite images is performed by manual operation of image superimposition. The translation is obtained from different coordinates of the specified bench marks. As a result, the precision depends on the operator. This paper presents a method of automatic translation correction by using contour correlation. The contour of an image is detected by comparing each pixel in the gradient image with the mean square of its neighbors. The auto-adaptive contour detection gives a thin contour line, therefore there is no ambiguity on the translation value. This method gives higher accuracy and can be implemented on a general purpose computer. It can be used not only to verify the accuracy of the geometric correction of satellite images but also to produce mosaic satellite imagery. Author

A87-16463#
A COMPARATIVE STUDY OF BAYES CLASSIFIER A DECISION TREE LEARNING ALGORITHM AND A MULTISTAGE CLASSIFIER FOR REMOTE SENSING APPLICATIONS
A. GESCHKE (VEB Robotron-Vertrieb, Berlin, East Germany) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 235-240.

A87-16465#
THE DECORRELATION OF SPECTRAL BANDS - A SIMPLE PREPROCESSING TECHNIQUE AIMING AT A BETTER DIFFUSION OF SATELLITE IMAGERY
D. BOREL (CNES, Paris, France) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 247-251.

The 2nd generation satellite instruments, by delivering on ground resolution of up to 10 meters, will provide for the first time an imagery similar to medium scale aerial photos. By orienting the delivery of such imagery toward the production of 3 spectral band color compositions, it would be possible to benefit from the widespread knowledge of color or IR color-aerial photo interpretation. This interpretability, in turn, will be greatly enhanced by a preprocessing focused on the decorrelation of spectral bands, which produces compositions with many more shades in the intermediate colors, and thus helps the discrimination of many more details. Author

A87-16484#
AN EXPERT SYSTEM FOR MULTITEMPORAL CLASSIFICATION
R. KRISHNAN (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 376-378.

In the remote sensing context an expert system will improve its classification accuracy by 'learning' about the relationships between classes. Multitemporal classification differs from single date classification, in that in addition to spectral information temporal relations between classes can also be used. The proposed expert system makes use of such temporal relations between classes and then refines old and discovers new temporal relations between classes. Author

A87-16503#
'RSDCATLG' AN INTERACTIVE QUERY AND REPORT SYSTEM FOR REMOTE SENSING DATA CATALOGUES
R. K. GOEL and A. R. DASGUPTA (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 487-492.

Attention is given to 'RSDCATLG', a system which facilitates automated, multisource, and interactive search on remotely sensed data catalogs. This system, which is based on the use of DATATRIEVE and FORTRAN, can respond to user queries for data from multiple sources involving a specific or nonspecific period and/or geographic area. It is noted that 'RSDCATLG' is currently operational for Landsat-MSS, Bhaskara-TV, and Bhaskara-SAMIR data, and that catalogs form new data sources can be linked to the system without disturbing the existing data base and the mainframe of the retrieval package. K.K.

A87-16505#
IMAGE PROCESSING SOFTWARE FOR REMOTE SENSING DATA
T. CH. MALLESWARA RAO (National Remote Sensing Agency, Hyderabad, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 498-506. refs

Attention is given to the image processing software developed by India's National Remote Sensing Agency (NRSA) for remote sensing data processing. The general categories of the command structure are: (1) utilities, (2) image display, (3) arithmetic operation, (4) geometric manipulation, (5) image transformation, (6) image measurement, and (7) decision theoretic. It is noted that, for the most part, NRSA developed software uses FORTRAN and MACRO ASSEMBLER subroutines. Present capabilities and future requirements of NRSA in image processing are discussed. K.K.

A87-16525#
REMOTE SENSING INPUTS TO RESOURCE DATA MANAGEMENT SYSTEMS FOR DEVELOPING COUNTRIES
Y. V. N. KRISHNA MURTHY and R. V. RAMA RAO (Institute for Coastal and Offshore Research, Visakhapatnam, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 620-626.

A87-17217* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
TEMPORAL CHANGE OF LANDSAT MSS ALBEDO ESTIMATES IN ARID RANGELAND
H. B. MUSICK (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Oct. 1986, p. 107-120. NASA-supported research. refs

Temporal variation in earth-atmosphere system reflectance in the 0.5-1.1 micron waveband was determined from Landsat MSS data for an area of arid rangeland in south-central New Mexico. Data were extracted from eight MSS scenes for the period 1973-1983, with four scenes from 1976. Maximum potential change between the extremes of rangeland degradation status was estimated to provide a benchmark for assessing the significance of the observed variations. Reflectance standardized for differences in sensor radiometric response by the Environmental Research Institute of Michigan coefficients increased significantly from 1973 to 1983, but standardization by Landsat Data Users Handbook coefficients resulted in little long-term change. Short-term (less than 1 year) variation was significant relative to maximum potential change. A sequence of three Landsat-2 scenes within one year showed a decrease in reflectance with increasing solar zenith angle. The effect of zenith angle on shading of the soil surface by plants was estimated and found to be about the same magnitude as the observed within-year variation in reflectance with solar zenith angle. Author

A87-17218* Hunter Coll., New York.
ON THE NATURE OF MODELS IN REMOTE SENSING
A. H. STRAHLER (Hunter College, New York), C. E. WOODCOCK (Boston University, MA), and J. A. SMITH (NASA, Goddard Space Flight Center, Greenbelt, MD) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Oct. 1986, p. 121-139. refs
(Contract NAG5-273; NAG5-276; NAS9-16664)

An explicit framework can provide a better understanding of remote sensing models and their interrelationships. This framework distinguishes between the scene, which is real and exists on the ground, and the image, which is a collection of spatially arranged masurements drawn from the scene. The scene model generalizes and parameterizes the essential qualities of the scene. Scene models may be discrete, in which the scene model consists of discrete elements with boundaries, or continuous, in which matter and energy flows are taken to be continuous and there are no clear or sharp boundaries in the scene. In the discrete case, there are two possibilities for models: H- and L-resolution. In the H-resolution case, the resolution cells of the image are smaller than the elements, and thus the elements may be individually resolved. In the L-resolution case, the resolution cells are larger than the elements and cannot be resolved. Most canopy models are L-resolution, deterministic, and noninvertible in nature; image processing models, however, tend to be H-resolution, empirical, and invertible. This taxonomy helps add insight to the development of remote sensing theory and point the way to new, productive areas of research. Author

A87-18370
STUDIES ON GROUND CONTROL POINTS MATCHING OF REMOTE SENSING IMAGE DATA
K. TSUCHIYA (Chiba University, Japan), K. ARAI (National Space Development Agency of Japan, Tokyo), and K. TANAKA (NEC Corp., Yokohama, Japan) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1321-1328. refs

The experiments on the effects of geometric and radiometric distortion on the success rate of ground control points (GCPs) matching was made using Landsat MSS data. The results indicate that the influence of geometric distortion on the success rate of GCP matching depends on the geometric shape feature of GCPs, and the influence of radiometric correction method on the success rate of GCP matching is small. It was also found that the success rate of GCP matching was improved by an averaging filter technique. The preliminary study on the data of CCD sensor indicate that the data without radiometric correction do not cause a serious problem in GCP matching. Author

A87-18418
CATEGORIZATION OF GROUND SURFACE BASED ON L4/TM DATA BY PRINCIPAL COMPONENT ANALYSIS
T. OSHIMA, M. MURATA, T. JINGUJI (Hosei University, Koganei, Japan), S. TANAKA, and T. SUGIURA (Remote Sensing Technology Center of Japan, Tokyo) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1685-1688.

A87-18463
EVALUATION OF RADIATION TEMPERATURE MEASURED BY LANDSAT-5 TM BAND 6
K. TACHI, S. YAMAMOTO, T. NAKAZAWA, K. AYABE (National Space Development Agency of Japan, Earth Observation Center, Hatoyama), Y. NAKAYAMA (Remote Sensing Technology Center of Japan, Tokyo) et al. IN: Space exploitation and utilization; Proceedings of the Symposium, Honolulu, HI, December 15-19, 1985 . San Diego, CA, Univelt, Inc., 1986, p. 185-198. refs
(AAS PAPER 85-621)

Landsat-5 TM band 6 data acquired and processed at the Earth Observation Center at Saitama-ken, Japan, were analyzed to evaluate the quality of temperature measurements. Radiation temperature measured in this way was compared with ground-truth

data and radiation temperature derived from NOAA-7 AVHRR channel 4. These comparisons indicated that the TM data were linearly correlated with the ground truth data over the temperature range 3.7-16.3 C, and the temperature pattern of the sea surface of the TM data was very similar to that of the AVHRR data except for clouds, despite a five-hour interval between the two satellite acquisition times. D.H.

A87-18587
TEST OF DIGITAL PROCESSING ON A SIMULATED SPOT IMAGE OF TOULOUSE (FRANCE) [ESSAI DE TRAITEMENT INFORMATIQUE SUR UNE IMAGE SIMULEE SPOT DE TOULOUSE /FRANCE/]
R. FERRAND and H. MARTY (Lycee Saint-Sernin, Toulouse, France) Photo Interpretation (ISSN 0031-8523), vol. 24, May-June 1985, p. 39-42, 43, 45. In French, English, and Spanish.

A87-18590
CLASSIFICATION AND STEEP-GRADIENT LINES FOR THE INTERPRETATION OF A TM IMAGE [CLASSIFICATION ET LIGNES DE FORT GRADIENT POUR L'INTERPRETATION D'UNE IMAGE THEMATIC MAPPER]
F. VERGER and L. WANG (Ecole Normale Superieure, Montrouge, France) Photo Interpretation (ISSN 0031-8523), vol. 24, Mar.-Apr. 1985, p. 25-27, 29. In French, English, and Chinese.

A87-18592
IDENTIFICATION OF LAND-USE TYPES BY TREATMENT OF DIGITAL SPOT-SIMULATION DATA (EMPORADA, SPAIN) [IDENTIFICATION DES TYPES D'UTILISATION DU SOL PAR TRAITEMENT DES DONNEES DIGITALES D'UNE SIMULATION SPOT /EMPORDA, ESPAGNE/]
R. ARBIOL, J. ROMEU, and O. VINAS (Catalunya, Institut Cartografic, Barcelona, Spain) Photo Interpretation (ISSN 0031-8523), vol. 24, Mar.-Apr. 1985, p. 39-43, 45, 47. In French, English, and Spanish.

N87-10526*# Lunar and Planetary Inst., Houston, Tex.
LANDSAT IMAGERY OF THE CENTRAL ANDES Progress Report, 22 Oct. 1986
C. A. KOMER and P. MORGAN 29 Aug. 1986 1 p
(Contract NASW-4066)
(NASA-CR-179852; NAS 1.26:179852) Avail: NTIS HC A02/MF A01 CSCL 08B

The central Andes of South America extend from approximately 14 deg. S to 28 deg. S as an unbroken chain of mountains and volcanoes over 2000 km long. It is here that the Nazca plate dives under the South American plate at angles varying from 10 deg to 30 deg. Very little is known about the volcanoes comprising this classic, subduction-type plate margin. A catalogue of the volcanoes in the central Andes is being prepared by Dr. P.W. Francis and Dr. C.A. Wood at the NASA Lunar and Planetary Institute. At present, more than 800 volcanoes of Cenozoic age have been recognized in the chain, with an estimated 75-80 major, active Quarternary volcanoes. Approximately one hundred 1536 x 1536 pixel color composite Optronics positives were produced from six full LANDSAT Thermatic Mapper scenes and three partial TM scenes. These positives cover a large portion of the central Andes. The positives were produced from LANDSAT data using the VAX imaging package, LIPS. The scenes were first transferred from magnetic tape to disk. The LIPS package was then used to select volcanically interesting areas which were then electronically enhanced. Finally, the selected areas were transferred back to tape and printed on the Optronics equipment. The pictures are color composites using LANDSAT TM bands 7,4, and 2 in the red, green, and blue filters, respectively. Author

N87-11238# European Space Agency, Paris (France).
PROCEEDINGS OF THE THIRD INTERNATIONAL COLLOQUIUM ON SPECTRAL SIGNATURES OF OBJECTS IN REMOTE SENSING
T. D. GUYENNE, ed. Dec. 1985 591 p In ENGLISH and FRENCH Colloquium held in Les Arcs, France, 16-20 Dec. 1985 (ESA-SP-247; ISSN-079-6566; ETN-86-97563) Avail: NTIS HC A25/MF A01

The PROMESS and TOSCANE T remote sensing simulation campaigns; modeling in the microwave region and over land; modeling in the optical domain (visible and infrared); passive spectral methods; active spectral methods; sensor and data calibration; and spectral characterization of objects were discussed. ESA

N87-11256# National Aerospace Lab., Amsterdam (Netherlands).
SIMULATION OF MULTITEMPORAL SAR IMAGES
G. J. L. NOOREN *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 111-116 Dec. 1985
(Contract ESA-5777/83-NL-MS)
Avail: NTIS HC A25/MF A01

A method to convert multitemporal real aperture images into SAR-like imagery by modifying side-looking airborne radar imagery through the introduction of more speckle is described. Such imagery was used in experiments in segmentation and classification. The experiments show that while single frequency monotemporal radar data are hardly adequate for these tasks, multitemporal images are useful. ESA

N87-11329# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
DIGITAL COMBINATION OF SAR AND (MSS) OPTICAL DATA FOR IDENTIFICATION OF SPECTRAL SIGNATURES
M. RAST and F. JASCOLLA (Technische Univ., Munich (West Germany).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 503-509 Dec. 1985
Avail: NTIS HC A25/MF A01

The intercorrelation between SIR-A SAR data and MSS optical data on the reflectance properties of different soil types and geological features in an arid test site was studied. Application of radar data necessitated the basic evaluation of its spectral information and the comparison with optical data because of the higher signature information content in the SAR data set in order to better understand surface reflectance in a shorter wavelength, and to assess the combination of different remote sensing information sources in operational application. Gray value profiles of SIR-A data in the area of Lake Nasser (Egypt) were set against Landsat MSS data and compared with field mapped ground truth data. Image merging of data sets with strongly different signature contents is shown to improve analysis. ESA

N87-11331# Institut Francais du Petrole, Rueil-Malmaison. Div. Geophysique et Instrumentation.
CONTRIBUTION OF INTERNAL WAVES TO SPECTRAL SIGNATURES [CONTRIBUTION A LA SIGNATURE SPECTRALE DES ONDES INTERNES]
A. WADSWORTH and P. PIAU *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 517-521 Dec. 1985 In FRENCH; ENGLISH summary
Avail: NTIS HC A25/MF A01

Examples of internal wave visualizations from different sensors of the visible and microwave spectrum are shown and their radiometric characteristics are assessed. It is demonstrated that detection is not enhanced with a better geometric resolution and that the real aperture mode of the side-looking imaging radar is well suited for detection and identification of internal wave packets. The high accessibility of a given zone, using SPOT data and the

good all-weather detection possibilities of ERS-1 are mentioned.
ESA

N87-11336*# California Univ., Davis. Dept. of Electrical and Computer Engineering.
LANDSAT D THEMATIC MAPPER IMAGE DIMENSIONALITY REDUCTION AND GEOMETRIC CORRECTION ACCURACY Final Report
G. E. FORD 1986 111 p
(Contract NAS5-27577)
(NASA-CR-179876; NAS 1.26:179876) Avail: NTIS HC A06/MF A01 CSCL 05B

To characterize and quantify the performance of the Landsat thematic mapper (TM), techniques for dimensionality reduction by linear transformation have been studied and evaluated and the accuracy of the correction of geometric errors in TM images analyzed. Theoretical evaluations and comparisons for existing methods for the design of linear transformation for dimensionality reduction are presented. These methods include the discrete Karhunen Loeve (KL) expansion, Multiple Discriminant Analysis (MDA), Thematic Mapper (TM)-Tasseled Cap Linear Transformation and Singular Value Decomposition (SVD). A unified approach to these design problems is presented in which each method involves optimizing an objective function with respect to the linear transformation matrix. From these studies, four modified methods are proposed. They are referred to as the Space Variant Linear Transformation, the KL Transform-MDA hybrid method, and the First and Second Version of the Weighted MDA method. The modifications involve the assignment of weights to classes to achieve improvements in the class conditional probability of error for classes with high weights. Experimental evaluations of the existing and proposed methods have been performed using the six reflective bands of the TM data. It is shown that in terms of probability of classification error and the percentage of the cumulative eigenvalues, the six reflective bands of the TM data require only a three dimensional feature space. It is shown experimentally as well that for the proposed methods, the classes with high weights have improvements in class conditional probability of error estimates as expected. Author

N87-11455 European Space Agency. European Space Operations Center, Darmstadt (West Germany).
OPERATIONAL EVALUATION OF METEOSAT DATA [OPERATIONELLE AUSWERTUNG VON METEOSAT-DATEN]
J. SCHMETZ, V. GAERTNER, B. MASON, and O. TURPEINEN *In* Deutscher Wetterdienst Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment p 210-211 1986 In GERMAN
Avail: Issuing Activity

Fully automatically deduced METEOSAT results and their utilization possibilities are presented. Consecutive rectified IR photographs are used to determine wind vectors; their is good agreement with rawinsonde observations in the lower troposphere. The water surface temperature is deduced from the IR radiation density for clear areas, and compared with ship observations for calibration. The cloud analysis is based on a histogram analysis of three channels and provides three cloud levels per segment; this analysis can be used to objectify and automate the estimation of vertical moisture profiles. The moisture of the upper troposphere is calculated from the radiation density measurement in the water vapor channel, and can be used for the initialization of numerical models. The climate data set is suited for climatological studies and for the calculation of the radiation budget at the upper atmosphere boundary. The precipitation index is also determined.
ESA

N87-12218# Canada Centre for Remote Sensing, Ottawa (Ontario).
MAP/IMAGE CONGRUENCY EVALUATION KNOWLEDGE BASED SYSTEM
G. W. PLUNKETT, D. G. GOODENOUGH, and M. GOLDBERG (Ottawa Univ. (Ontario).) *In* Canadian Information Processing Society Graphics Interface 1986: Proceedings 6 p 1986
Avail: Canadian Information Processing Society, 243 College Street, 5th Floor, Toronto, Ontario $30.00 Canada, $35.00 USA

A Knowledge Based System (KBS) for analyzing LANDSAT Multispectral Band Scanner (MSS) images and comparing this analysis to corresponding geocartogrphic data is presented. The preprocessing requirements for the LANDSAT and the geocartographic data are discussed for a uniform representation of the data. The segmentation of the LANDSAT data and the interpretation of the segments are presented. The preprocessed data are read into the Map/Image Congruency Evaluation (MICE) KBS where the image elements are classified and then compared with the map data, based on class, segment size, shape, and location. Results of the map/image congruency analysis are output and converted to image form. The MICE KBS is presented and the results generated for the LANDSAT MSS scene of the Prince George area of British Columbia are reviewed. Author

N87-12219# MacDonald, Dettwiler and Associates Ltd., Richmond (British Columbia).
A CONTEXT BASED TECHNIQUE FOR SMOOTHING OF DIGITAL THEMATIC MAPS
B. YEE, D. TURPIN, E. KENK (Ministry of Environment, Victoria (British Columbia).), and M. SONDHEIM *In* Canadian Information Processing Society Graphics Interface 1986: Proceedings 5 p 1986
Avail: Canadian Information Processing Society, 243 College Street, 5th Floor, Toronto, Ontario $30.00 Canada, $35.00 USA

A context based technique for smoothing digital thematic maps produced by multispectral classification of LANDSAT Thematic Mapper data is described. The output of this technique is a maplike product which can be directly used as input to a geographic information system. Author

N87-12220# Centre National d'Etudes Spatiales, Toulouse (France). Div. Traitement de l'Image.
PRINCIPLE OF VISUAL COLOR CODING APPLIED TO SATELLITE IMAGERY [PRINCIPE DE CODAGE VISUEL DE LA COULEUR APPLIQUE A DES IMAGES SATELLITAIRES]
M. J. LEFEVRE-FONOLLOSA and H. CRUCHANT *In* Canadian Information Processing Society Graphics Interface 1986: Proceedings 3 p 1986 In FRENCH; ENGLISH summary
Avail: Canadian Information Processing Society, 243 College Street, 5th Floor, Toronto, Ontario $30.00 Canada, $35.00 USA

In remote sensing, color is used essentially as a means of enhancing the results of image processing. In recent months, the use of color as a means of processing the spatial information content of image data was investigated. The characteristics of the human visual system were used in an approach to the processing of remote sensing imagery. Specifically, three channels of a spatial radiometer was used to simulate the sensor function of the human eye while the computer processing was used to simulate the function performed by the second segment of the system. When an image is subjected to this type of simulation-processing, the result is three new-images termed the color-coded image, the lighting-coded image, and the color-quantity-coded image. Comments on this approach and its prospects with suitable reference to examples based on the Thematic Mapper and (simulated) SPOT data are included.
Author

N87-12967*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPUTATIONAL METHOD TO MODEL RADAR RETURN RANGE IN A POLYGONALLY BASED, COMPUTER-GENERATED-IMAGERY SIMULATION
F. J. MORAN and J. D. PHILLIPS Jul. 1986 22 p
(NASA-TM-88324; A-86313; NAS 1.15:88324) Avail: NTIS HC A02/MF A01 CSCL 08B

Described is a method for modeling a ground-mapping radar system for use in simulations where the terrain is in a polygonal form commonly used with computer generated imagery (CGI). The method employs a unique approach for rapidly rejecting polygons not visible to the radar to facilitate the real-time simulation of the radar return. This rapid rejection of the nonvisible polygons requires the precalculation and storage of a set of parameters that do not vary during the simulation. The calculation of a radar range as a function of the radar forward-looking angle to the CGI terrain is carried out only for the visible polygons. This method was used as part of a simulation for terrain-following helicopter operations on the vertical motion simulator at the NASA Ames Research Center. It proved to be an efficient means for returning real-time simulated radar range data. Author

N87-12973*# Geological Survey, Lakewood, Colo. Geologic Div.
ATMOSPHERIC-WATER ABSORPTION FEATURES NEAR 2.2 MICROMETERS AND THEIR IMPORTANCE IN HIGH SPECTRAL RESOLUTION REMOTE SENSING
F. A. KRUSE and R. N. CLARK *In* JPL Proceedings of the Second Airborne Imaging Spectrometer Data Analysis Workshop p 63-73 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 05B

Selective absorption of electromagnetic radiation by atmospheric gases and water vapor is an accepted fact in terrestrial remote sensing. Until recently, only a general knowledge of atmospheric effects was required for analysis of remote sensing data; however, with the advent of high spectral resolution imaging devices, detailed knowledge of atmospheric absorption bands has become increasingly important for accurate analysis. Detailed study of high spectral resolution aircraft data at the U.S. Geological Survey has disclosed narrow absorption features centered at approximately 2.17 and 2.20 micrometers not caused by surface mineralogy. Published atmospheric transmission spectra and atmospheric spectra derived using the LOWTRAN-5 computer model indicate that these absorption features are probably water vapor. Spectral modeling indicates that the effects of atmospheric absorption in this region are most pronounced in spectrally flat materials with only weak absorption bands. Without correction and detailed knowledge of the atmospheric effects, accurate mapping of surface mineralogy (particularly at low mineral concentrations) is not possible. Author

N87-12990# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
GENERATION OF IMAGES WITH RECORDED AUXILLARY DATA FOR THE LANDSAT THEMATIC MAPPER (TM) IMAGERY M. S. Thesis, Mar. 1985 [GERACAO DE IMAGENS COM DADOS AUXILIARES REGISTRADOS A IMAGENS TM—LANDSAT]
J. B. ESCADA, JR. Sep. 1986 66 p In PORTUGUESE; ENGLISH summary
(INPE-3982-TDL/234) Avail: NTIS HC A04/MF A01

A system for storing and recovering auxiliary data is implemented so that the latter can be correlated with a given Thematic Mapper scene in a way that these auxiliary data can be treated as a Thematic Mapper image. The resources available at the Processing Subsystem of the Image Generation Department of INPE (Instituto de Pesquisas Espaciais - Institute for Space Research) for generating photographic or digital images will then allow the generation of geocoded artificial images with the same characteristics of a Thematic Mapper scene. The gray levels associated with each geocoded image pixel will represent not the terrain radiometry, but the corresponding auxiliary data. Author

N87-13049*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
THE USE OF SATELLITE DATA IN UNDERSTANDING AND PREDICTING CONVECTIVE AND LARGE-SCALE DYNAMICAL PROCESSES
J. A. DUTTON, J. H. E. CLARK, and H. N. SHIRER *In* NASA. Marshall Space Flight Center NASA/MSFC FY-85 Atmospheric Processes Research Review 2 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04A

A two-layer truncated baroclinic spectral model was developed to study the long-term evolution of disturbances to a baroclinically unstable mean flow. Topography and crudely-parameterized radiative processes were accounted for. As a result of Robert Schlaak's discovery of the underlying barotropic nature of the index oscillation as well as reviewers suggestions about the original manuscript, the model has been revised to allow for barotropic as well as baroclinic wave-mean flow interactions. The form-drag exerted by the topography on the barotropic part of the mean flow is larger than on the baroclinic part and thus researchers anticipate significant changes from the original calculations on the index oscillation when it is strongly modulated by topography. Researchers believe that since the index oscillation accounts for a significant portion of atmospheric temporal variance, the long term predictability could be improved if reliable forecasts of the index oscillation were available. Two spectral models of the index oscillation, one barotropic and the other baroclinic, have been developed. The latter allows for moisture, radiation, land-sea temperature countrasts, and energy exchanges with the underlying surface.

N87-13053*# Texas A&M Univ., College Station. Dept. of Meteorology.
APPLICATION OF SATELLITE DATA TO TROPIC/SUBTROPIC MOISTURE COUPLING
J. P. MCGUIRK and A. H. THOMPSON *In* NASA. Marshall Space Flight Center NASA/MSFC FY-85 Atmospheric Processes Research Review 3 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

The objective is to develop analysis tools for use of satellite data to interpret synoptic-scale systems in data-void regions. Interim goals are to: (1) quantify the synoptic information content of satellite data; and (2) utilize these data in the diagnosis of moisture bursts in the eastern tropical Pacific Ocean. Researchers developed and implemented a statistical procedure for using TIROS N microwave data to infer infrared channel data for overcast conditions; they used the same procedure for deducing full TIROS N channel radiance profiles from NOAA 5 VTPR channel data over regions where the TIROS N data are missing. An empirical orthogonal function analysis of twice-daily channel radiance fields over the tropical eastern Pacific was completed. The vertically oriented eigenfunctions were interpreted in terms of typical meteorological events. The horizontal distribution of the eigenfunction amplitudes relates these meteorological signals to moisture bursts. A pair of moisture burst climatologies is complete: one of four years using infrared imagery (including the highly anomalous 1982 to 83 cold season); the other implementing 850 to 200 mb wind analyses in conjunction with GOES imagery. A number of different evaluations of the synoptic evolution of moisture fields (enhanced infrared imagery, moisture channel data, FGGE humidity analysis, and in situ station and sounding observations) are compared. All have limitations; all can be utilized together; all together are still less than adequate in the tropical Pacific. Author

N87-13058*# Wisconsin Univ., Madison. Space Science and Engineering Center.
STUDIES OF LIGHTNING DATA IN CONJUNCTION WITH GEOSTATIONARY SATELLITE DATA
B. AUVINE and D. MARTIN *In* NASA. Marshall Space Flight Center NASA/MSFC FY-85 Atmospheric Processes Research Review 2 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

Since January, work has been proceeding on the first phase of this project: the creation of an extensive real-time lightning

data base accessible via the Space Science and Engineering Center Mcldas system. The purpose of this endeavor is two-fold: to enhance the availability and ease of access to lightning data among the various networks, governmental and research agencies; and to test the feasiblity and desirability of such efforts in succeeding years. The final steps in the creation of the necessary communications links, hardware, and software are in the process of being completed. Operations ground rules for access among the various users have been discussed and are being refined. While the research planned for the last year of the project will rely for the most part on archived, quality-controlled data from the various networks, the real-time data will provide a valuable first-look at potentially interesting case studies. For this purpose, tools are being developed on Mcldas for display and analysis of the data as they become available. In conjunction with concurrent GOES real-time imagery, strike locations can be plotted, gridded and contoured, or displayed in various statistical formats including frequency distributions, histograms, and scatter plots. The user may also perform these functions in relation to arbitrarily defined areas on the satellite image. By mid-May these preparations for the access and analysis of real-time lightning data are expected to be complete. Author

N87-14767# Forschungsinstitut fuer Informationsverarbeitung, Karlsruhe (West Germany).
INTEGRATION OF ARTIFICIAL INTELLIGENCE CONCEPTS INTO THE METHODS FOR EXTRACTING LINE OBJECTS FROM MONOCHROMATIC AERIAL IMAGERY Final Technical Report
R. NEU, W. HEISSLER, H. KAZMIERCZAK, and M. STIES Mar. 1986 83 p
(Contract DAJA45-84-C-0014; DA PROJ. 1T1-61102-BH-57)
(AD-A170884; ETL-0425) Avail: NTIS HC A05/MF A01 CSCL 14E

Procedures for automatic extraction of line shaped objects from aerial images have been improved and completed. A general model of road network has been used to complete road extraction from images. Digital elevation data has been used to guide the process of river and creek extraction from images. The methods have been implemented on a DEC VAX 11/780. The functions are described in detail. Test results and assessment are included in the report. Author (GRA)

N87-14768# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
MODIFICATION OF PARAMETERIZED LATENT HEAT RELEASE ESTIMATES USING UNENHANCED AND ENHANCED SATELLITE IMAGERY M.S. Thesis
W. F. SJOBERG May 1986 118 p
(AD-A170899; AFIT/CI/NR-86-67T) Avail: NTIS HC A06/MF A01 CSCL 04B

The objectives of this research are to compare the parameterized latent heat release estimates obtained from the SESAME I data set with observed precipitation values and radar fields; to test three procedures for utilizing satellite cloud images to modify these conventional latent heating estimates; and to propose a procedure which combines latent heat release calculations and satellite imagery whose results exhibit the best comparison with observational data forms. GRA

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A87-10047
GLOBAL POSITIONING SYSTEM APPLICATIONS
T. S. LOGSDON and J. D. ASHLEY (Rockwell International Corp., Satellite Systems Div., Seal Beach, CA) IN: Space Congress, 23rd, Cocoa Beach, FL, April 22-25, 1986, Proceedings . Cape Canaveral, FL, Canaveral Council of Technical Societies, 1986, p. 8-1 to 8-9. refs

The Navstar GPS is a space-based radio-navigation system that employs dual-frequency L-band transmissions to provide continuous, worldwide navigation coverage to an unlimited number of users. The configuration, capabilities, and operation of the GPS satellites are described. The Navstar system has been tested and the operating ranges and accuracy levels of the system are compared with those of other radio-navigation systems. It is observed that the Navstar system is as accurate or more accurate than other navigation systems currently in use. The uses of the GPS satellites in military, air traffic control, time synchronization, offshore oil exploration, and iceberg tracking are discussed. I.F.

A87-10449
MICROWAVE RADIOMETRY OF EARTH COVERS [MIKROVOLNOVAIA RADIOMETRIIA ZEMNYKH POKROVOV]
V. V. BOGORODSKII and A. I. KOZLOV Leningrad, Gidrometeoizdat, 1985, 272 p. In Russian. refs

The process governing microwave emission from complex geophysical structures is examined using polarization analysis for determining the geometrical and electrophysical characteristics of the earth's covers. The application of polarization analysis to better distinguish weakly contrasted structures is examined, and the subsurface probing of the earth covers is discussed. The principles behind the optimal reception of partially polarized short-wave emissions are described on the basis of linear, nonlinear, and adaptive filtering methods. K.K.

A87-10949
MANAGEMENT OF AIRBORNE RECONNAISSANCE IMAGES THROUGH REAL-TIME PROCESSING
N. H. ENDSLEY (Ball Corp., Ball Aerospace Systems Div., Boulder, CO) IN: Airborne reconnaissance IX; Proceedings of the Meeting, San Diego, CA, August 20, 21, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 157-164. USAF-sponsored research. refs

Digital airborne reconnaissance images generated by electrooptical sensors are able to furnish photographic film-competitive resolution, as well as better spectral selectivity, increased dynamic range, and better radiometric accuracy than conventional film; the primary advantage to which attention is presently given, however, is the efficient real-time processing of images for immediate transmission to users. Digital resampling, or 'image warping', is discussed as a necessary component of future digital reconnaissance, since it allows reduced fabrication and alignment costs for multisensor systems while providing precise geometric correction and alignment of images. The use of hardware to implement an efficient general-purpose resampling processor is presented. O.C.

A87-10976
A MULTISPECTRAL VIDEO IMAGING AND ANALYSIS SYSTEM
P. A. FROST (Xybion Electronic Systems Corp., Cedar Knolls, NJ) IN: High speed photography, videography, and photonics III; Proceedings of the Meeting, San Diego, CA, August 22, 23, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 96-106. refs

A versatile system for collecting and analyzing multispectral images is described. This innovative system uses state-of-the-art video and microprocessor technology to collect and digitize image data in real time; an IBM-PC compatible unit is used as the host computer. The solid-state video camera is designed to automatically collect sequential multispectral images, at the rate of 60 images per second, in six user-defined spectral bands. Data can be recorded and displayed using standard video equipment. The system is small, rugged, lightweight, and suitable for collecting field data for diagnostic or surveillance purposes, from ground level or from aircraft. An automatic, focal plane, shuttering system permits collection of blur-free images of rapidly changing scenes. The microprocessors-based digitizer has programmable resolution and digitizes complete spectral sequences in real time. Software is provided for collection and display of images and to facilitate histogram, ratio, and spectral time series analysis. Other software tools are provided for various image processing tasks including the construction of color composite spectral images. The elements of this system and their performance are described in this paper, and issues of resolution and calibration are discussed. Author

A87-11063
AN INTERACTIVE DIGITAL IMAGE PROCESSING WORKSTATION FOR THE EARTH SCIENCES
M. GUBEREK and S. BORDERS (Global Imaging, Inc., Solana Beach, CA) IN: Applications of digital image processing VIII; Proceedings of the Meeting, San Diego, CA, August 20-22, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 203-205. refs

An interactive digital image processing workstation has been developed for oceanographic, meteorological, geophysical applications. The turn-key system provides the capability to process imagery from commonly used ocean observation spacecraft in conjunction with in situ data sets. The system is based on the Hewlett-Packard 9000, a high-performance 32-bit processor (CPU) with a direct address range of 500 Megabytes. The Metheus Omega series of display controllers are used to drive the color CRT display. The controller memory may be configured to hold up to 1280x1024x32-bit images. The workstation provides the Global Applications Executive which standardizes the link between the user and applications programs under the UNIX operating system. The user can operate the system in three modes. In the menu mode, the user is asked to make a selection from a list of menus and applications. In the command mode, the user communicates with the system via simple English-like commands. Finally, in tutor mode, the user is prompted for all parameters which must be supplied to a program. The applications software includes programs to perform geometric correction, earth location, and registration of remotely sensed data. These programs handle imagery from the Advanced Very High Resolution Radiometer, the Coastal Zone Color Scanner, the Multispectral Scanner, the Scanning Multichannel Microwave Radiometer, and the Visual and Infrared Spin Scan radiometer. Other programs permit displaying monochrome and true-color images. Line graphics, such as contoured data, can be overlayed onto the displayed image in different colors. Interactive manipulation of these images is possible via a digital tablet provided. Interactive functions include panning, histogram normalization and pseudocolor manipulation. Author

A87-11676
CONFERENCE ON NUMERICAL WEATHER PREDICTION, 7TH, UNIVERSITE DU QUEBEC, MONTREAL, CANADA, JUNE 17-20, 1985, PREPRINTS
Conference sponsored by the American Meteorological Society, Canadian Meteorological and Oceanographic Society, ICAO, and WMO. Boston, MA, American Meteorological Society, 1985, 573 p. For individual items see A87-11677 to A87-11752.

An in-depth survey is presented of current developments in numerical weather processing. Attention is given to data assimilation techniques, objective analysis techniques and numerical algorithms, predictability and verification, initialization methods, observing system experiments, diagnostics, and methods of accounting for topography. Various numerical analyses which were carried out with global weather experiment and FGGE data are detailed. The effectiveness and applicability of satellite remote sensing data as input for weather models are evaluated. Numerical models of the planetary boundary layer, boundary conditions and convection are discussed, as are time-marching finite element and finite difference schemes for solving the numerical models. Numerous analyses of specific cyclonic events are summarized. M.S.K.

A87-11697* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SIMULATION STUDIES OF THE IMPACT OF FUTURE OBSERVING SYSTEMS ON WEATHER PREDICTION
R. ATLAS, E. KALNAY, W. E. BAKER, J. SUSSKIND, D. REUTER, and M. HALEM (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Conference on Numerical Weather Prediction, 7th, Montreal, Canada, June 17-20, 1985, Preprints . Boston, MA, American Meteorological Society, 1985, p. 145-151. refs

The features and preliminary results from a simulation system being implemented to develop realistic estimates of the impacts future data acquisition systems will have on large-scale numerical weather simulation are described. The new instruments may include advanced passive IR and microwave satellite sensors, as well as active scatterometer and lidar sounders. A main goal of the impact study is to identify those sensor systems which will provide the most benefit. The realism of the study is being enhanced by assimilating as much real-world data as possible and generating global weather maps for comparison with maps generated on the bases on the projected new, higher resolution data. Early results have indicated a preference for higher resolution wind data than for temperature data for making 1-5 day forecasts. The prime instrument candidate for collecting the data is lidar, provided the sensor resolution design goals are met. M.S.K.

A87-12396
EFFECT OF CHAOTIC SURFACE ROUGHNESS ON A REFLECTED PULSED MILLIMETER-WAVE SIGNAL [VLIIANIE KHAOTICHESKIKH NEROVNOSTEI POVERKHNOSTI NA OTRAZHENNYI IMPUL'SNYI SIGNAL MILLIMETROVYKH VOLN]
G. A. ANDREEV and A. A. POTAPOV Radiotekhnika i Elektronika (ISSN 0033-8494), vol. 31, July 1986, p. 1405-1414. In Russian. refs

A spectral approach in the plane tangent approximation is used to obtain an expression for the space-time frequency correlation function of millimeter waves scattered by chaotic irregularities of the earth surface. Helicopter measurements of surface irregularities were made at a wavelength of 8.6 mm; effective scattering powers and their angular and seasonal variations were determined for seven surface types. In addition, the duration of mm-wave pulses reflected by the chaotic surfaces are studied as a function of the roughness magnitude, the antenna orientation, and the radiation-pattern width. B.J.

A87-12671*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DOWNWARD LONGWAVE SURFACE RADIATION FROM SUN-SYNCHRONOUS SATELLITE DATA - VALIDATION OF METHODOLOGY
W. L. DARNELL, S. K. GUPTA, and W. F. STAYLOR (NASA, Langley Research Center, Hampton, VA) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 25, July 1986, p. 1012-1021. refs

An extensive study has been carried out to validate a satellite technique for estimating downward longwave radiation at the surface. The technique, mostly developed earlier, uses operational sun-synchronous satellite data and a radiative transfer model to provide the surface flux estimates. The satellite-derived fluxes were compared directly with corresponding ground-measured fluxes at four different sites in the United States for a common one-year period. This provided a study of seasonal variations as well as a diversity of meteorological conditions. Dome heating errors in the ground-measured fluxes were also investigated and were corrected prior to the comparisons. Comparison of the monthly averaged fluxes from the satellite and ground sources for all four sites for the entire year showed a correlation coefficient of 0.98 and a standard error of estimate of 10 W/sq m. A brief description of the technique is provided, and the results validating the technique are presented. Author

A87-12694
DATA PROCESSING AND CALIBRATION FOR AN AIRBORNE SCATTEROMETER
R. BERNARD, D. VIDAL-MADJAR, F. BAUDIN, and G. LAURENT (Centre de Recherches en Physique de l'Environnement Terrestre et Planetaire, Issy-les-Moulineaux, France) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, Sept. 1986, p. 709-716. CNES-ESA-supported research. refs

The ERASME-radar system has been designed to be easily mounted on small helicopters or aircraft. As it is used for research investigations on radar remote-sensing applications, it has to be well calibrated in every configuration, both absolutely and relatively for comparisons at different points of the swath. The data processing, which allows for antenna pattern correction and for flight parameters correction (pitch, roll, altitude), is described as an introduction to the calibration procedures: internal calibration, external calibration on corner reflectors for absolute calibration (within 1 dB), and a statistical approach which uses experimental data itself and analyzes the correlation between the processed data and recorded flight parameters. This method provides a way to check or adjust calibration for specific flight configurations, and allows a relative accuracy of better than 0.5 dB for data comparison within the radar swath. Such a method can be used to calibrate any airborne or spaceborne scatterometer when accurate antenna measurement is not feasible. Author

A87-13510
1985 ACSM-ASPRS FALL CONVENTION, INDIANAPOLIS, IN, SEPTEMBER 8-13, 1985, TECHNICAL PAPERS
Convention sponsored by ACSM and American Society for Photogrammetry and Remote Sensing. Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, 1025 p. For individual items see A87-13511 to A87-13531.

Papers are presented on Landsat image data quality analysis, primary data acquisition, cartography, geodesy, land surveying, and the applications of satellite remote sensing data. Topics discussed include optical scanning and interactive color graphics; the determination of astrolatitudes and astrolongitudes using x, y, z-coordinates on the celestial sphere; raster-based contour plotting from digital elevation models using minicomputers or microcomputers; the operational techniques of the GPS when utilized as a survey instrument; public land surveying and high technology; the use of multitemporal Landsat MSS data for studying forest cover types; interpretation of satellite and aircraft L-band synthetic aperture radar imagery; geological analysis of Landsat MSS data; and an interactive real time digital image processing system. Consideration is given to a large format reconnaissance camera; creating an optimized color balance for TM and MSS imagery; band combination selection for visual interpretation of thematic mapper data for resource management; the effect of spatial filtering on scene noise and boundary detail in thematic mapper imagery; the evaluation of the geometric quality of thematic mapper photographic data; and the analysis and correction of Landsat 4 and 5 thematic mapper sensor data. I.F.

A87-13517#
NASA'S HR-732 LARGE FORMAT RECONNAISSANCE CAMERA - A CASE STUDY FOR USFS MAPPING PURPOSES
L. D. WHITMILL, R. L. MILBURN, and D. B. GOREHAM (USDA, Geometronics Service Center, Salt Lake City, UT) IN: 1985 ACSM-ASPRS Fall Convention, Indianapolis, IN, September 8-13, 1985, Technical Papers . Falls Church, VA, American Congress on Surveying and Mapping and American Society for Photogrammetry and Remote Sensing, 1985, p. 652-658.

The design of the NASA's HR-732 format reconnaissance camera imagery is evaluated. The use of a 9 x 18 in. original film or a two time black and white reduction of the original in the large format camera (LFC) is analyzed in terms of number and sizes of models, lens distortion, orientation, and costs. It was determined that despite higher laboratory costs the reduced film would be more applicable in the LFC. The development of a camera calibration report which contains principal point and fiducial coordinate data for absolute model orientation setup and study is discussed. The procedures and ground control used for the modeling input are described. The absolute 4.5 x 9 in. model developed has a calibrated focal length of 303.3615 mm, a photo scale of 1:76,000, and a flight height of 66,000 feet. I.F.

A87-13751
SPECIALIZED IMAGE PROCESSING TECHNIQUE APPLIED TO HALLEY MULTICOLOUR CAMERA IMAGES OF THE EARTH
K. WILHELM, W. K. H. SCHMIDT, and G. K. HARTMANN (Max-Planck-Institut fuer Aeronomie, Katlenburg-Lindau, West Germany) Geophysical Research Letters (ISSN 0094-8276), vol. 13, Aug. 1986, p. 813-815. Research supported by the Max-Planck-Gesellschaft zur Foerderung der Wissenschaften and DFVLR. refs
(Contract BMFT-01-OF-0127; BMFT-01-OF-85029)

A special image processing technique has been applied to earth images taken by the Halley Multicolour Camera (HMC) on-board ESA's space probe Giotto on its way to a close encounter with comet Halley on March 14, 1986. The method depends on the knowledge of the point spread function of the optical system. Deconvolution has been achieved by a direct inversion of the convolution process subject to boundary conditions that would correspond to non-linear filter processes. Experimental evidence is presented that under the prevailing conditions the technique can provide pixel resolutions. Comparison with weather satellite images allow verification of the results for the earth observations. Author

A87-14165
AN EVALUATION OF LANDSAT MSS DIGITAL DATA FOR UPDATING HABITAT MAPS OF THE LOUISIANA COASTAL ZONE
L. N. MAY, JR. (NOAA, Southeast Fisheries Center, Bay Saint Louis, MS) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Aug. 1986, p. 1147-1158. Research supported by the Louisiana Geological Survey, U.S. Fish and Wildlife Service, and NOAA. refs

The use of October 27, 1979 Landsat MSS digital data and a machine classification technique to update a 1978 habitat map of a coastal lowland section in southeast Louisiana is analyzed. The registration of a four-band Landsat image to a cellularized habitat map using ground control points and image processing software is described. It is observed that the mapping accuracy of the classifications derived from the Landsat data are low and this is due to the difficulty of developing spectral signature for the habitat types. The spectral signature anomalies and the land/water

interface are investigated. It is detected that the machine classification technique is not adequate to map the spectral signatures of the habitat types. I.F.

A87-14176*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
VARIABILITY OF EARTH-EMITTED RADIATION FROM ONE YEAR OF NIMBUS-6 ERB DATA
T. D. BESS (NASA, Langley Research Center, Hampton, VA) Journal of the Atmospheric Sciences (ISSN 0022-4928), vol. 43, July 15, 1986, p. 1445-1453. refs

Outgoing longwave radiation (OLR) measurements from the Nimbus-6 ERB wide field-of-view instrument are used to study daytime and nighttime radiation variability on a 15 deg regional, zonal, and global scale. An analysis of components of variance is used to determine how much of the total variability is due to between-region and within-region variance. Most of the analysis is on July and January data from one year of Nimbus-6 ERB. Different geographical scales are considered: regions within latitude zones and latitude zones within hemispheres. Results show that much of the variability is spatial, peaks in the tropics and subtropics, and is concentrated in the Northern Hemisphere. Daytime variability is generally larger than nighttime variability for July but not for January. Variance in OLR in the tropics and subtropics is largely a function of cloud variability. Author

A87-14422
AN EVALUATION OF ULTRALIGHT AIRCRAFT CAPABILITY FOR REMOTE SENSING APPLICATIONS IN WEST AFRICA
J.-M. GREGOIRE and R. ZEYEN (CEC, Joint Research Centre, Ispra, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Aug. 1986, p. 1075-1081. refs

An ultralight aircraft was used to make concurrent, near continuous measurements and to acquire specral responses in several wavelengths over various ground features: water bodies (river and irrigation channels), geomorphological features (sand banks, levees, iron crust), aquatic vegetation (rice and spontaneous aquatic vegetation), and stubbles (millet and sorghum). The experiment was performed in Mali, along the Niger river. The airborne instrumentation made it possible to collect simultaneously spectral responses in the MSS and SPOT bands, flying height by laser rangefinder, and color video tapes of the area over-flown. Five profiles, several kilometres long, were obtained at heights above the ground varying from 20 to 75 m. Along each profile, spectral data and flying height were scanned every 0.1 s and recorded on the audio channel of a videotape, after multiplexing and analogue-to-digital conversion. The preliminary data analysis suggests a very high potential for ultralight aircraft in remote sensing applications. Author

A87-15076
CONFERENCE ON ATMOSPHERIC RADIATION, 6TH, WILLIAMSBURG, VA, MAY 13-16, 1986, EXTENDED ABSTRACTS
Conference sponsored by the American Meteorological Society. Boston, MA, American Meteorological Society, 1986, 382 p. For individual items see A87-15077 to A87-15170.

Numerous topics of interest for measurements and modeling of radiation in the atmosphere are discussed, with emphasis on satellite remote sensing capabilities, data analysis techniques and climatological impact. Attention is devoted to aerosols at all levels of the atmosphere, the current understanding of potential nuclear winter scenarios, and to instruments which are used for sensing radiance in the atmosphere. Consideration is also given to spectroscopy and band models, radiative transfer calculations, earth radiation budget (ERB) models and their interaction with GCMs, and to climate models. In-depth analyses are performed of data from the ERB instruments on the Nimbus-7 spacecraft and to validation procedures being developed for data collected by the ERB satellite. M.S.K.

A87-15089* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INSTRUMENTATION FOR REMOTE SENSING FROM SPACE
R. A. HANEL (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 51-54.

The design options available for satellite-based remote sensing are discussed. Emphasis is placed on the process of fitting the instrumental capabilities to the scientific goals of a particular program, to the payload capacity of the launch vehicle, and to the operational envelope of the satellite. Various materials and instrument configurations are inventoried for imaging systems for, e.g., detecting and mapping particles, X-rays, visible and IR radiation. Numerous examples of instruments on Voyager, Mariner and Landsat satellites are cited, along with the discoveries which they permitted. M.S.K.

A87-15096
OPTICAL PROPERTIES OF CLOUDS FROM AVHRR/2 DATA
K. T. KRIEBEL (DFVLR, Institut fuer Physik der Atmosphaere, Oberpfaffenhofen, West Germany) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 78-80. refs

Numerical conversion techniques are defined, and their application to AVHRR data illustrated, for deriving the optical depth of clouds from satellite reflectance measurements. The contribution of the cloud to the scene reflectance is quantified by eliminating all non-cloud pixels and then determining, by reference to a brightness temperature threshold value, if the pixel is fully or partially filled by clouds. Methods are described with which the directional-hemispherical reflectance of the cloud is obtained by use of the fully clouded pixels. M.S.K.

A87-15103* Research and Data Systems, Inc., Lanham, Md.
THE EL CHICHON STRATOSPHERIC AEROSOL LAYER AS OBSERVED BY THE NIMBUS-7 ERB EXPERIMENT - 1982-1985
B. S. GROVEMAN, P. E. ARDANUY (Research and Data Systems Corp., Lanham, MD), and H. L. KYLE (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 107-111. refs

Nimbus-7 wide-FOV irradiance data collected from 1981-1985 are used to evaluate the effects of the El Chichon eruptions of 1982 on the earth radiation budget. The north polar region displayed a maximum response of 20 percent in the winter of 1982-1983, with the variation being most apparent in the near-IR 2.8 micron and 0.2-3.8 microns shortwave bands. The data indicate that the particle size distribution was constant for a year after eruptions. M.S.K.

A87-15120* National Center for Atmospheric Research, Boulder, Colo.
EFFECTS OF SENSOR SPATIAL RESOLUTION ON CLOUD PROPERTIES RETRIEVED FROM IMAGERY DATA
J. A. COAKLEY, JR. (National Center for Atmospheric Research, Boulder, CO) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 171, 172. NASA-supported research.

Techniques being applied to test the sensitivity of the physical characteristics of clouds, as determined by remote sensing, to the spatial resolution of the scans are described. The sensitivity is being evaluated with an error assessment of data from the AVHRR instrument on Nimbus-7. A spatial coherence analysis is being applied to AVHRR data for a 250 sq km region in the Pacific off the Mexican coast. Errors in the derived cloud cover and radiances from which cloud-free regions and cloud-covered regions are being estimated on the basis of radiance values in pixel-sized areas. M.S.K.

A87-15131* Colorado State Univ., Fort Collins.
INTERANNUAL VARIABILITY STUDY OF THE EARTH RADIATION BUDGET FROM NIMBUS 7 MONTHLY DATA
L. D. SMITH, T. H. VONDER HAAR, and D. L. RANDEL (Colorado State University, Fort Collins) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 211-214.
(Contract NAS1-16465; NAG1-449)

The broadband data set on the earth radiation budget recorded by Nimbus-7 instrumentation from 1978-84 is summarized, along with the results of several statistical evaluations. The emitted longwave radiation (W/sq m), albedo and net radiation (W/sq m) are tabulated in terms of yearly means and summer and winter departures from those means. Global maps are also provided for 6-yr averaged values of the same parameters. The largest variabilities were observed over the equatorial Pacific Ocean, the Indian Ocean, and Indonesia, indicating the extent of annual variations of the size of the Intertropical Convergence Zone. M.S.K.

A87-15147* Colorado State Univ., Fort Collins.
DEFINING THE MINIMUM TEMPORAL AND SPATIAL SCALES AVAILABLE FROM A NEW 72-MONTH NIMBUS-7 EARTH RADIATION BUDGET CLIMATE DATA SET
D. L. RANDEL, G. G. CAMPBELL, T. H. VONDER HAAR, and L. SMITH (Colorado State University, Fort Collins) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 280-283.
(Contract NAG1-449)

Scale factors and assumptions which were applied in calculations of global radiation budget parameters based on ERB data are discussed. The study was performed to examine the relationship between the composite global ERB map that can be generated every six days using all available data and the actual average global ERB. The wide field of view ERB instrument functioned for the first 19 months of the Nimbus-7 life, and furnished sufficient data for calculating actual ERB averages. The composite was most accurate in regions with the least variation in radiation budget. M.S.K.

A87-15148* Research and Data Systems, Inc., Lanham, Md.
CLIMATE VARIABILITY AS OBSERVED BY THE NIMBUS-7 ERB
P. E. ARDANUY (Research and Data Systems Corp., Lanham, MD) and H. L. KYLE (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. 284-289. NASA-supported research. refs

Limits to the accuracy of the Earth Radiation Budget (ERB) data being obtained by the Nimbus-7 satellite are discussed with emphasis on the implications for the measured variabilities in the global climate. Error analyses are performed for both wide and narrow field of view instruments and the success of in-flight calibration efforts is noted. Alterations in the ERB due to the eruptions of El Chichon in 1982 and the 1982-1983 ENSO event are summarized, particularly the teleconnections which were observed during ENSO. M.S.K.

A87-15159* National Center for Atmospheric Research, Boulder, Colo.
COMPARISON OF ERBE INFERRED AND MODEL COMPUTED CLEAR-SKY ALBEDOS
B. P. BRIEGLEB and V. RAMANATHAN (National Center for Atmospheric Research, Boulder, CO) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. J32, J33.
(Contract NASA ORDER L-9477-B)

Over-ocean clear-sky albedos measured with instruments on the Earth Radiation Budget Satellite (ERBS) are compared with albedos simulated using a radiative transfer model (RTM). The comparison covers the monthly mean albedos for November 1984. The ERBS albedo was calculated with a scene identification algorithm. Techniques used to suppress cloud cover uncertainties are discussed. The plane-parallel delta-Eddington RTM accounted for O3, O2, CO2 and H2O gaseous absorption and background aerosol absorption. M.S.K.

A87-15162* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SATELLITE AND AIRCRAFT MEASUREMENTS OF STRATOSPHERIC AEROSOL PARTICLES
M. P. MCCORMICK (NASA, Langley Research Center, Hampton, VA) IN: Conference on Atmospheric Radiation, 6th, Williamsburg, VA, May 13-16, 1986, Extended Abstracts . Boston, MA, American Meteorological Society, 1986, p. J42-J45. refs

Data on the characteristics of the stratospheric aerosol as measured with sensors on the SAM II and SAGE I satellites and with ground-based and airborne lidar are discussed. Emphasis is placed on the impact of the El Chichon eruptions. The volcanic cloud was tracked to an altitude of 30 km, and was observed to travel around the earth in 3 weeks. The maximum stratospheric loading is estimated at 12 Mtons, which increased the stratospheric optical depth to 0.15-2.0 at the peak period. The particulate loading was predicted to lower the Northern Hemisphere average temperatures by 0.4-0.5 C in 1984-85. M.S.K.

A87-15250
INSTRUMENTS, INSTALLATIONS, AND AUTOMATION IN EXPERIMENTAL METEOROLOGY [PRIBORY, USTANOVKI, AVTOMATIZATSIIA V EKSPERIMENTAL'NOI METEOROLOGII]
A. D. ORLIANSKII, ED. Moscow, Gidrometeoizdat (Institut Eksperimental'noi Meteorologii, Trudy, No. 8/117/), 1985, 136 p. In Russian. No individual items are abstracted in this volume.

Papers are presented on such topics as the energy calibration of radiometers; a ring-filter aerosol collection system; a dust collector for the investigation of soil pollution; a spectrometer system for the study of the atmosphere in the 300-340 nm wavelength range; a wideband lidar amplifier-discriminator; and the use of semiconductor detectors in X-ray spectral analysis instrumentation. Consideration is also given to an X-ray radiometer system for the study of environment pollution and the use of luminescence analysis to determine the composition of atmospheric dust. B.J.

A87-15612#
MULTI SPECTRAL RADIOMETRY - FROM CLUSTERING MODE TO DIFFERENCING MULTIPLE DATA SETS
J. OTTERMAN (Maryland, University; NOAA, College Park) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 187-196. refs

Techniques for acquiring and interpreting satellite or airborne multispectral data on the condition of soils and vegetation in arid regions are discussed. Extrapolation-mode and clustering-mode thematic-mapping techniques and their limitations are reviewed; the advantages of quantitative evaluation of the surfce reflectivities (in each spectral band) and temperatures in images obtained at different times are indicated; techniques for modeling nonplanar surfaces (taking atmospheric effects into account) are illustrated using Landsat MSS data for Utah and NOAA-6 AVHRR data for the Sinai; and the suitability of various satellite systems for acquiring multitemporal or multiple-view-angle data is evaluated. T.K.

A87-15613*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FIRST INTERNATIONAL SATELLITE LAND SURFACE CLIMATOLOGY PROJECT (ISLSCP) FIELD EXPERIMENT FIFE
T. J. SCHMUGGE, P. J. SELLERS, and R. J. GURNEY (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 197-204. refs

The purpose of ISLSCP is to verify the use of satellite data for the estimation of land-surface properties. This is to be done through a series of field experiments using a combination of point measurements on the ground and areal measurements from aircraft overflights. In addition to validating satellite estimates of surface properties, approaches for obtaining areal averages of the radiation, moisture, and heat fluxes from remotely sensed data are to be studied. The procedure for doing this is to combine the surface point measurements of the fluxes with the aircraft areal observations using a surface-energy-balance model. This should make it possible to interpolate between the point estimates of these fluxes and calculate area-averaged quantities. The surface parameters to be estimated from aircraft observations include: surface radiation temperature, albedo, land-cover or vegetation index, and surface soil moisture. Author

A87-15628#
AVHRR CHANNEL 3 NOISE ANALYSIS AND FILTERING FOR EARTH SURFACE PARAMETERS RETRIEVAL
M. ROCOTTILLI, N. PIERDICCA, and F. PAURI (Telespazio, S.p.A., Rome, Italy) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 381-391. refs

A detailed analysis of the noise affecting NOAA-7/AVHRR channel-3 (3.7-micron) data has been performed, and different filtering techniques have been applied to recover the information content. Noise components have been identified, and the related effects on both the image data and calibration coefficients investigated. Among the different filtering methods examined, a procedure based on the similarity of channel 3 and channel 4, under favorable atmospheric conditions, seems to give acceptable results, especially for images collected over the sea. Since the calibration data are also affected by noise, a methodology has been developed to estimate the correct calibration coefficients to be applied for surface-temperature retrieval. Author

A87-15637#
DEVELOPMENT AND USE OF A 4-CAMERA VIDEO SYSTEM
J. VLCEK and D. KING (Toronto, University, Canada) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 483-489. Research supported by the Canadian Forestry Service, Department of Energy, Mines, and Resources, and NSERC. refs

The design, operation, an testing of a four-camera video sensing system (4CVS) developed at the University of Toronto are described. The system incorporates B&W solid-state cameras equipped with band-pass filters in synchronous operation and provides two kinds of separately recorded output: selectable 3-band false-color composite imagery and sequential 4-band B&W imagery. Examples are given of imagery generated by the system over a test site near Toronto. The illustrations show the high capability of multispectral video to discriminate terrain features based on their spectral-band reflectance differences. Results of a digital multispectral classification of an agricultural scene are included. Author

A87-15639#
AIRBORNE OBSERVATIONS OF POLARIZATION AND PHOTOMETRY OF TERRESTRIAL SURFACES
W. G. EGAN (Lamont-Doherty Geological Observatory, Palisades, NY) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 501-510. refs
(Contract NSF DPP-81-15231)

Polarimetric and photometric observations were made from an airborne platform over various relatively uniform ice, ocean, snow, and terrestrial surfaces on the margin of the Antarctic continent. Sensor wavelengths were 0.36, 0.400, 0.500 and 1.0 micron. Comparisons of the airborne (helicopter) observations with ground-based observations revealed that a set of characteristic remotely sensed polarimetric and photometric signatures can be determined for each representative terrestrial surface and can be affected by the scale of the viewing area, its surface structure and slope and the intervening atmosphere. Author

A87-15640#
ESTIMATION OF LAND SURFACE TEMPERATURE FROM MULTIPLE CHANNEL AVHRR DATA
S. R. J. AXELSSON (Linkoping Universitetet, Sweden) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 511-522. refs

Dual-wavelength differential methods are frequently used for atmospheric correction of sea-surface temperature measurements from the AVHRR sensor on board the Tiros-N satellites. Over land surfaces, the algorithms generate an increased error as a result of the reduced and more varying emissivity. In this paper, more nearly optimum algorithms are developed which adapt their coefficients to the statistics of emissivity, internal noise, and the atmospheric influence. Author

A87-15654#
ON THE ACCURACY OF SUBRESOLUTION MEASUREMENTS USING TWO-WAVELENGTH IR-THERMOGRAPHY
S. R. J. AXELSSON (Linkoping, Universitetet, Sweden) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 643-654.

A main limitation on the application of AVHRR data is the moderate ground resolution, which suppresses contrasts covering only a minor part of the resolution cell. However, the temperature and area of hot spots like gas flares can be estimated by combining thermal-IR data from 3.8 and 11 microns. In this paper, the two-wavelength method (Dozier, 1981) is studied in more detail. The results indicate that the subpixel temperature variations should be at least 20-30 K in order to be well separable from homogeneous pixels. In daylight, areas with high reflectance of solar radiation will give a response similar to that of hot spots. This effect enhances the two-wavelength temperature difference over urban areas, which have bare surfaces with both increased temperature and reflectivity. Author

A87-15664*# ITT Aerospace/Optical Div., Fort Wayne, Ind.
PRESENT AND FUTURE USES OF AVHRR MULTISPECTRAL DATA
R. J. KOCZOR (ITT, Aerospace/Optical Div., Fort Wayne, IN) and G. J. COMEYNE, JR. (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 739-748. refs

The present series of NOAA LEO satellites became operational in October 1978. Since then, four additional satellites have been launched in this series and three more are in fabrication. Planning is underway for at least three more. The AVHRR is a prime imaging sensor on these satellites. It is a multispectral imaging radiometer

which has evolved in both function and the use of its data products. Investigators in a wide variety of disciplines are finding the readily available, high quality, moderate-resolution data useful in their studies. Author

A87-15833#
SERVICING OF THE FUTURE EUROPEAN STATIONS/PLATFORMS THROUGH EUROPEAN MEANS
P. EYMAR, Y. PEYRIN (Aerospatiale, Les Mureaux, France), C. COUGNET (Matra, S.A., Toulouse, France), P. BRUDIEU, and P. DUTTO (CNES, Toulouse, France) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 16 p. refs
(IAF PAPER 86-48)

The payload capability of the projected ESA Hermes spaceplane allows efficient quarterly servicing of either the Columbus component of the NASA Space Station or an autonomous European space station, with a crew of two. Larger space station systems will require the use of an additional servicing system, such as Ariane 5. Attention is given to the effect of Space Station orbit choice on serviceability. O.C.

A87-15851#
OMNISTAR - LONG LIFE, FLEXIBLE SPACE PLATFORM FOR REMOTE SENSING
R. C. MAEHL (RCA, Astro-Electronics Div., Princeton, NJ) and E. MOWLE (Earth Observation Satellite Co., Lanham, MD) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 8 p.
(IAF PAPER 86-75)

This paper discusses the development and configuration of the OMNISTAR spacecraft, the first of which is currently under construction for use on the Landsat 6 Program, the first of the U.S. commercial Landsat missions. The rationale for the serviceable spacecraft will be reviewed with special attention to the critical areas of future expansion to accommodate a mixture of different types of payloads with differing mission requirements and the pressing launch vehicle considerations in the current environment. How these factors impact the system design will be considered in the context of the current Landsat 6 development and the overall system configuration will be discussed. The OMNISTAR approach to expandability will be considered along with an analysis of how the OMNISTAR platform will be applicable to future combined remote sensing missions as well as the basic Landsat mission without major redesign for the future or significant overdesign for current requirements. Author

A87-15855#
R-MOMS, THE RADARSAT MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER - A POTENTIAL CANDIDATE FOR POP ALSO
D. MEISSNER (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) and H. L. WERSTIUK (Canadian Department of Communications, Communications Research Centre, Ottawa, Canada) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 11 p.
(IAF PAPER 86-81)

Results of the Phase B study for R-MOMS (an optical sensor designed to give additional spectral information during daylight) on a long term RADARSAT mission are summarized. R-MOMS will consist of four spectral channels with the center wavelengths at 485, 555, 650 and 825 nm. R-MOMS will employ the same double-lens principle as MOMS-01 except that the number of usable pixels will be increased up to 13,500. K.K.

A87-15856#
THE RESULTS OF RESEARCH AND DEVELOPMENT ON SYNTHETIC APERTURE RADAR
Y. ITOH and Y. HISADA (National Space Development Agency of Japan, Tsukuba Space Center, Sakura) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 9 p. refs
(IAF PAPER 86-82)

The design of Japan's proposed synthetic aperture radar system (SAR) is described. The system's antenna, transmitter and receiver, and signal processor subsystems are examined. The deployment kinematics, structural stiffness, mechanical and thermal deformation, and electrical performance of the SAR's subsystems are experimentally evaluated. The data reveal that the proposed system design produces an efficient SAR system. I.F.

A87-15857#
POSEIDON SOLID STATE ALTIMETER
P. RAIZONVILLE, N. LANNELONGUE (CNES, Toulouse, France), J. C. ANNE, and P. DE CHATEAU THIERRY (Alcatel Espace, Toulouse, France) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 9 p.
(IAF PAPER 86-83)

The design and features of the Poseidon altimeter are described. The single frequency altimeter operates at a pulse repetition frequency of 1700 Hz, has a central frequency of 13.65 GHz, a bandwidth of 320 MHz, and a pulse duration of 100 microsec. The altimeter provides data on wave height, surface wind speed, and ice pact tract, and is concerned with the general circulation and variability of the oceans. The limitations of the signal processing of the altimeter related to the tracking and parameters fine estimation are discussed. The performance of an altimeter breadboard is evaluated. I.F.

A87-15859#
THE LANDSAT SENSORS - EOSAT'S PLANS FOR LANDSATS 6 AND 7
J. L. ENGEL (Santa Barbara Research Center, Goleta, CA) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 9 p.
(IAF PAPER 86-85)

This paper describes the design configuration of the Enhanced Thematic Mapper (ETM) sensors that are presently under construction for Landsats 6 and 7. The paper begins with a brief introduction to EOSAT and a status report on the Landsats 4 and 5 operations, followed by an overview description of the Thematic Mappers that are currently flying on Landsats 4 and 5. The enhancements to the Landsats 6 and 7 Thematic Mappers are then described in some detail, including the implementation of a panchromatic band of detectors providing 15 m spatial resolution for both ETM sensors. The Landsat-7 ETM may include as many as five bands of thermal detectors with 120/60 m spatial resolution; the implementation and performance of this option will be discussed. The paper also provides a brief description of two new sensors that are being considered for Landsats 6 and/or 7: a low-resolution (500 m), wide-field sensor (a Regional Mapper) with the Thematic Mapper's spectral coverage, and a high-resolution (10/20 m), narrow-field, pointable Advanced Landsat Sensor (ALS) utilizing multispectral linear array technology. Author

A87-15966#
THE DORIS ORBITOGRAPHY AND POSITIONING SYSTEM - THE DORIS/SPOT2 MISSION
B. LABORDE (CNES, Toulouse, France) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 7 p.
(IAF PAPER 86-249)

The DORIS (Doppler Orbitography and Radio-positioning Integrated from Space) system, which provides an accurate orbit determination of spacecraft carrying an altimeter payload and is now in development for the DORIS/SPOT2 mission, is described. The instrument operation and performance in Doppler measurements, dating, beacon selection and multiplexing, and

instrument synchronization are discussed, and the architecture of the DORIS/SPOT2 system is described, including the ground network and control center. C.D.

A87-16077#
THE INTERNATIONAL SATELLITE LAND-SURFACE CLIMATOLOGY PROJECT
H.-H. BOLLE (Berlin, Freie Universitaet, West Germany) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 8 p.
(IAF PAPER 86-411)

To assess the land-surface characteristics needed for climate studies on a global scale there exists only one change: the development of interpretation methods for satellite data to an extent that quantitative information about basic parameters becomes operationally feasible. The International Satellite Land-Surface Climatology Project coordinates the efforts necessary to reach this aim. Steps towards this end are the evaluation of retrospective satellite data by means of preliminary evaluation methods, the development of improved algorithms for the inference of land-surface properties, and the validation of the products derived from the satellite measurements by means of field experiments. An overview is given of the present status of the project. Author

A87-16460#
GEOMETRIC CORRECTION OF NIMBUS-7 CZCS IMAGE BY USING ROW AND COLUMN FUNCTIONS
T. HOSOMURA, H. SHIMODA, and T. SAKATA (Tokai University, Tokyo, Japan) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 215-221.

This paper presents a method for the geometric correction of NIMBUS-7 CZCS images by using the row and column functions. Using this method, it was possible to interpolate the CZCS image very fast and the accuracy of geometric correction was improved. Also the concentration of chlorophyll-like pigments are estimated by image enhancement technique. Author

A87-16461#
REGISTRATION OF THE REMOTE SENSING DATA FROM MULTI-SENSORS
R. PARVATHI and V. R. RAO (Indian Space Research Organization, Bangalore, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 223-229. refs

An attempt has been made to study the imagery obtained with multi-sensors from satellites Landsat, Space Shuttle payloads - MOMS, Metric Camera; SOYUZ (MKF-6), SALYUT-7 (MKF-6M) for the improved information content and feature identification. The positional accuracy of ground control points are studied for different sensors using the affine transformation. The adequacy of the affine transformation with first and and second order polynomials and the number of control points required are analyzed for different satellite imagery. The residual errors and their variation with increasing number of control points are compared with that of Landsat and the results are discussed for registration of multi-satellite data. Author

A87-16467#
STAR-1 - A DIGITAL HIGH RESOLUTION SYNTHETIC APERTURE RADAR FOR THE SOLUTION OF MODERN MAPPING NEEDS
M. KIRBY and B. BULLOCK (Intera Technologies, Ltd., Calgary, Canada) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 259-263.

Through the late 1970's Canada embarked on an ambitious program of introducing SAR technology to the Canadian remote sensing user community. The research and development efforts of the Canada Centre for Remote Sensing (CCRS) allowed companies like INTERA to obtain invaluable knowledge and experience in SAR technology and applications. As a result of this opportunity INTERA began a development program of its own in 1980 for the manufacturing of a digital high resolution synthetic aperture radar. In the fall of 1984 STAR-1 successfully flew its first test flight. Since that inauguration the system has been used to collect in excess of 20 million square kilometers of data around the world. This paper describes the system and presents some examples of the data products. Author

A87-17220
AN AVHRR INVESTIGATION OF SURFACE EMISSIVITY NEAR LAKE EYRE, AUSTRALIA
I. J. BARTON (CSIRO, Div. of Atmospheric Research, Mordialloc, Australia) and T. TAKASHIMA (Meteorological Research Institute, Ibaraki, Japan) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Oct. 1986, p. 153-163. refs

An attempt is made to gain information on land surface emissivities using only data from the AVHRR instrument on the NOAA-7 satellite. Measurements were taken of the water surface of Lake Eyre to determine the effect on the satellite radiances of the absorption by atmospheric water vapor. The results show that during the night the 11 micron emissivity is less than that at 12 microns for both sand and salt surfaces, but during the day the reverse is true for the salt surface while the emissivities are equal for the sand. Some radiometric measurements of sand emissivity are also presented. A comparison is made between the lake water surface temperatures derived from standard sea surface temperature algorithms and those obtained from a model of radiative transmission through the atmosphere. Author

A87-17601
EXPERIMENTAL STUDIES OF THE ATMOSPHERE USING SPACE TECHNIQUES [EKSPERIMENTAL'NYE ISSLEDOVANIIA ATMOSFERY S POMOSHCH'IU SREDSTV KOSMICHESKOI TEKHNIKI]
V. F. TULINOV, ED. and V. M. FERGIN, ED. Leningrad, Gidrometeoizdat (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov. Trudy, No. 21), 1985, 120 p. In Russian. For individual items see A87-17602 to A87-17611.

A collection of papers is presented which emphasizes atmospheric investigations carried out with Meteor satellites during the International Magnetospheric Study. Particular attention is given to the morphology and dynamics of electrons precipitating in the polar caps; anomalous fluxes of low-energy charged particles at equatorial and middle latitudes; the use of spaceborne lasers to determine the gas and aerosol composition of the atmosphere; and an automated lidar for the sounding of stratospheric aerosol. B.J.

A87-17607
THE USE OF SPACEBORNE LASERS TO DETERMINE THE GAS AND AEROSOL COMPOSITION OF THE ATMOSPHERE [ISPOL'ZOVANIE LAZEROV, USTANOVLENNYKH NA KOSMICHESKIKH APPARATAKH, DLIA OPREDELENIIA GAZOVOGO I AEROZOL'NOGO SOSTAVA ATMOSFERY]
O. K. KOSTKO and K. V. TULINOV IN: Experimental studies of the atmosphere using space techniques Leningrad, Gidrometeoizdat, 1985, p. 59-65. In Russian. refs

The feasibility of determining various components of the earth's atmosphere with a satelliteborne lidar is examined. It is concluded that the use of such physical remote-sensing methods as differential absorption and resonance scattering makes it possible to obtain global information about the composition and state of the atmosphere. B.J.

A87-17652
SYSTEMS APPROACH TO THE IMPLEMENTATION OF A TWO-SIDED LINK BETWEEN THE COMPLEX SCIENTIFIC INSTRUMENTATION ON THE METEOR-PRIRODA SATELLITE AND GROUND FACILITIES FOR CONTROL, RECEPTION, AND PRIMARY DATA PROCESSING [SISTEMNYI PODKHOD PRI OSUSHCHESTVLENII DVUSTORONNEI SVIAZI MEZHDU KOMPLEKSOM NAUCHNOI APPARATURY NA BORTU ISZ 'METEOR-PRIRODA' I NAZEMNYMI SREDSTVAMI UPRAVLENIIA, PRIEMA I PERVICHNOI OBRABOTKI DANNYKH]
D. N. MISHEV, D. PETKOV, A. KRUMOV, T. NAZYRSKI, A. STOIMENOV et al. IN: Remote sensing of the earth from the Meteor-Priroda satellite: The Bulgaria-1300-II Soviet-Bulgarian experiment . Leningrad, Gidrometeoizdat, 1985, p. 7-10. In Russian.

A87-17655
THE RM-1 RADIOMETER SYSTEM [RADIOMETRICHESKAIA SISTEMA RM-1]
D. N. MISHEV, T. NAZYRSKI, and G. KAMENOV IN: Remote sensing of the earth from the Meteor-Priroda satellite: The Bulgaria-1300-II Soviet-Bulgarian experiment Leningrad, Gidrometeoizdat, 1985, p. 23-27. In Russian.

The RM-1 microwave (4-cm) radiometer system (installed on the Meteor-Priroda satellite as part of the Bulgaria-1300-II instrumentation) is designed for the remote sensing of the earth surface (particularly water bodies). The modulation operating principle of the radiometer is described, and a block diagram is presented. Examples of brightness-temperature measurements along the satellite trajectory are given. B.J.

A87-17656
THE RM-2 SATELLITEBORNE THREE-CHANNEL MICROWAVE RADIOMETER [TREKHKANAL'NYI MIKROVOLNOVYI SPUTNIKOVYI RADIOMETR RM-2]
M. V. BUKHAROV, L. I. BUSHINA, S. A. KOCHEROV, L. A. PENIAZ, A. IU. PROZOROVSKII et al. IN: Remote sensing of the earth from the Meteor-Priroda satellite: The Bulgaria-1300-II Soviet-Bulgarian experiment . Leningrad, Gidrometeoizdat, 1985, p. 28-35. In Russian.

RM-2 is designed to measure the thermal emission of the earth atmosphere and surface at wavelengths of 0.8, 1.35, and 1.55 cm. The radiometer includes three independent modulation detectors connected to an antenna system with a common reflector and combined into a unified system by a common control and data acquisition system. The absolute accuracy of the measurements is enhanced by an autonomous calibration system using solid-state noise generators operating in the pulsed mode. B.J.

A87-17658
METHOD FOR THE LINKAGE OF SMP-32 DATA TO IMAGES OBTAINED WITH MSU-S INSTRUMENTATION, AND CERTAIN CHARACTERISTICS OF THE REFLECTION SPECTRA OF NATURAL OBJECTS [METODIKA PRIVIAZKI DANNYKH SMP-32 K IZOBRAZHENIIU, POLUCHAEMOMU APPARATUROI MSU-S, I NEKOTORYE KHARAKTERISTIKI SPEKTROV OTRAZHENIIA PRIRODNYKH OB'EKTOV]
V. N. DOSOV, N. G. MARKINA, L. A. PAKHOMOVA, and Z. S. GUSAROVA IN: Remote sensing of the earth from the Meteor-Priroda satellite: The Bulgaria-1300-II Soviet-Bulgarian experiment . Leningrad, Gidrometeoizdat, 1985, p. 57-66. In Russian.

The paper examines approaches to the linkage of data obtained with the SMP-32 multichannel spectrometer (installed as part of the Bulgaria-1300-II remote-sensing instrumentation on the Meteor-Priroda satellite) to coordinate images obtained with the MSU-S multispectral scanner. It is demonstrated that satisfactory linkage (providing for the analysis of reflection spectra of clouds, land, and sea) can be obtained through a visual analysis of the image, given a spatial dependence of the spectrometer signal at a wavelength of 0.8 micron. B.J.

A87-17659
CLUSTER ANALYSIS OF SPECTROMETER DATA [KLASTER-ANALIZ SPEKTROMETRICHESKIKH DANNYKH]
V. A. GOLOVKO and L. A. PAKHOMOV IN: Remote sensing of the earth from the Meteor-Priroda satellite: The Bulgaria-1300-II Soviet-Bulgarian experiment . Leningrad, Gidrometeoizdat, 1985, p. 66-75. In Russian. refs

The data-clustering algorithm for the SMP-32 multichannel spectrometer (installed on the Meteor-Priroda satellite as part of the Bulgaria-1300-II remote-sensing instrumentation) is described, and economical procedures for its computer implementation are considered. A choice of a criterion for the number of clusters is discussed, and it is shown that the most suitable criterion is the probability of correct classification. B.J.

A87-17661
COMBINED ANALYSIS OF SMP-32 AND MSU-S DATA [SOVMESTNYI ANALIZ DANNYKH SMP-32 I MSU-S]
V. N. DOSOV, V. V. KOZODEROV, and L. A. PAKHOMOVA IN: Remote sensing of the earth from the Meteor-Priroda satellite: The Bulgaria-1300-II Soviet-Bulgarian experiment . Leningrad, Gidrometeoizdat, 1985, p. 94-102. In Russian.

An analysis is made of data obtained with the SMP-32 multichannel spectrometer and the MSU-S multispectral scanner (installed on the Meteor-Priroda satellite as part of the Bulgaria-1300-II remote-sensing instrumentation) over a specific region of the USSR (the Kremenchug water basin). Data from the two instruments are examined from the viewpoint of discriminating and classifying natural objects on the earth surface. B.J.

A87-17662
DEPENDENCE OF THE INFORMATION CONTENT OF SPECTROMETER DATA ON THE QUANTIZATION CONDITIONS [ZAVISIMOST' INFORMATIVNOSTI SPEKTROMETRICHESKIKH DANNYKH OT USLOVII KVANTOVANIIA]
V. A. GOLOVKO IN: Remote sensing of the earth from the Meteor-Priroda satellite: The Bulgaria-1300-II Soviet-Bulgarian experiment . Leningrad, Gidrometeoizdat, 1985, p. 103-108. In Russian. refs

A method is proposed for estimating information losses depending on the quantization mode of analog signals of the spectrometer system. Quantitative results are presented concerning the estimation of the information content of data obtained with the SMP-32 multichannel spectrometer, installed on the Meteor-Priroda satellite as part of the Bulgaria-1300-II remote-sensing instrumentation. B.J.

A87-17664
DETERMINATION OF THE OPTICAL PARAMETERS OF THE ATMOSPHERE AND THE ALBEDO OF THE UNDERLYING SURFACE ACCORDING TO SPECTRAL MEASUREMENTS WITH SMP-32 AND MSU-S [OPREDELENIE OPTICHESKIKH PARAMETROV ATMOSFERY I AL'BEDO PODSTILAIUSHCHEI POVERKHNOSTI PO DANNYM SPEKTRAL'NYKH IZMERENII SMP-32 I MSU-S]
V. A. GOLOVKO IN: Remote sensing of the earth from the Meteor-Priroda satellite: The Bulgaria-1300-II Soviet-Bulgarian experiment . Leningrad, Gidrometeoizdat, 1985, p. 135-144. In Russian. refs

The paper proposes a method for the simultaneous remote determination of the optical parameters of the atmosphere and the spectral albedo of the underlying surface on the basis of two types of spectrometer systems. Specifically, attention is given to the determination of the parameters of the surface-atmosphere system and to using the SMP-32 multichannel spectrometer and the MSU-S multispectral scanner (part of the Bulgaria-1300-II instrumentation on the Meteor-Priroda satellite). B.J.

A87-17960#
NOISE REDUCTION ABATEMENT AND MITIGATION - A HISTORY OF NOISE CONTROL PROGRAMS AND REVIEW OF THE REGULATORY PROCESS
B. D. HARTMAN (St. Louis, Missouri Airport Authority, MO) AIAA, AHS, and ASEE, Aircraft Systems, Design and Technology Meeting, Dayton, OH, Oct. 20-22, 1986. 29 p.
(AIAA PAPER 86-2745)

The noise mitigation regulatory process and the history of noise mitigation programs are reviewed, and the direct and indirect costs that can be attributed to the noise mitigation measures are analyzed. The issues of funding availability for large airports are discussed along with policies, legal responsibility, airport access, capacity/delay, and fleet modernization are discussed. The aspect of relating these issues with the local attempts to achieve control over what should be perceived as a national problem are considered. The funding availability data for large airports are presented. I.S.

A87-18367
SAR-580 EXPERIMENTS IN JAPAN
K. MAEDA, F. KITAZAWA (National Space Development Agency of Japan, Earth Observation Systems Dept., Tokyo, Japan), and N. KODAIRA (Remote Sensing Technology Center of Japan, Tokyo) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1291-1300.

The SAR-580 experiments conducted at eight test sites in the Kanto-Tohoku area of Japan during October and November 1983 are described. The objectives of the experiments were to establish observation techniques using SAR, and to collect information on geological features, land use, agriculture, forestry, fishery, environment preservation, and coastal zone monitoring. The characteristics of the aircraft and SAR system are discussed. The experiments conducted include: (1) calibration of SAR data using corner reflectors, (2) incidence angle evaluation, (3) frequency evaluation, (4) polarization evaluation, (5) SNR evaluation, and (6) SAR and MSS data integration. The techniques for processing the SAR data are examined. I.F.

A87-18374
THE STUDIES ON SNOW DISTRIBUTION BASED ON NIMBUS-7 SMMR DATA
K. TSUCHIYA (Chiba University, Japan), K. TAKEDA (Remote Sensing Technology Center of Japan, Tokyo), and K. KOZAI (Environmental Research and Technology Institute, Tokyo, Japan) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1349-1354.

The brightness temperature was obtained with the SMMR of Nimbus-7 over the snow field of Hokkaido. The data indicate: (1) the relationship between snow depth and brightness temperature changes when snow depth becomes deeper than 50 cm and (2) the average brightness temperature of the daytime indicates negative correlation with snow depth, except 6.6 GHz channel data which indicates weak positive correlation. Author

A87-18375
EXPERIMENTS ON MEASUREMENT OF PHYSICAL PROPERTIES OF SNOW WITH A BREADBOARD MODEL OF MOS-1 MSR
K. TSUCHIYA (Chiba University, Japan) and K. TAKEDA (Remote Sensing Technology Center of Japan, Tokyo) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1355-1360. refs

Data observed over a snow field with a breadboard model of the MSR (Microwave Scanning Radiometer) to be installed in the MOS-1 (Marine Observation Satellite-1) are analyzed. The data indicates that: (1) the influence of incident angle on brightness temperature is larger in the horizontal polarization component than in the vertical polarization component and the effect of incident angle depends upon the property of snow with a larger value for dry snow; (2) the difference between snow surface configurations consisting of artificially made parallel ditches of 5-cm depth and 5-cm width with spacing of 10 and 30 cm respectively, which are oriented normal to electrical axis, do not affect brightness temperature significantly; (3) there is negative correlation between brightness temperature and snow depth up to the depth of 70 cm in case of dry snow which suggests that the snow depth can be measured with a two channel microwave radiometer up to this depth. Author

A87-18378
EARTH OBSERVATION BY MULTISTAGE REMOTE SENSING
H. OCHIAI (Toba Merchant Marine College, Japan), S. TAKEUCHI, K. CHO (Remote Sensing Technology Center of Japan, Tokyo), and T. KUROMIYA (Nakanihon Airservice Co., Ltd., Nagoya, Japan) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1381-1386.

Two case studies were conducted by multistage remote sensing using satellite and airborne MSS data, sea surface observation of the Ise Bay, and observations of the distribution pattern of lava and ash caused by the volcanic eruption in Miyakejima Island. Through these studies the combined use of satellite and airborne data is shown to be effective for the verification of Landsat data applicability for various earth surface monitoring. Author

A87-18417
A REMOTE SENSING DATA PROCESSING SYSTEM USING MICRO-COMPUTER AND ITS ANALYSIS EXAMPLES
T. OSHIMA and K. MIYASHITA (Hosei University, Koganei, Japan) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1681-1684.

A87-18465
MULTI-SPECTRAL OBSERVATION OF CIRRUS AND SNOWFIELDS FROM SPACE
K. TSUCHIYA (Chiba University, Japan) and K. TACHI (National Space Development Agency of Japan, Earth Observation Center, Hatoyama) IN: Space exploitation and utilization; Proceedings of the Symposium, Honolulu, HI, December 15-19, 1985 . San Diego, CA, Univelt, Inc., 1986, p. 211-219. refs
(AAS PAPER 85-623)

Radiometric characteristics and detectability of thin cirrus and snow fields were studied, taking advantage of high-resolution radiometric and spatial resolution of Landsat TM image data. It is found that the features of thin cirrus can be clearly recognized in the Band-1 through Band-4 and Band-6 images; over land with snow cover, however, only Band-6 (thermal IR) data are effective in classifying thin cirrus. It is also found that Band-5 and Band-7 data are very effective in detecting melting snow fields. D.H.

A87-18468
OPERATION ANALYSIS FOR EARTH OBSERVATION SATELLITES
K. SHODA (Toshiba Corp., Advanced Space Programs Dept., Kawasaki, Japan) IN: Space exploitation and utilization; Proceedings of the Symposium, Honolulu, HI, December 15-19, 1985 . San Diego, CA, Univelt, Inc., 1986, p. 275-282.
(AAS PAPER 85-630)

An overview and sample application are considered for a computer program developed for operation planning of earth observation satellites. The program can be applied to both satellite design and operation (orbit selection, event analysis, and power balance analysis). Given the sensor field of view, necessary overlap ratio, and desirable ranges of orbital altitude and inclination, the program provides possible orbital elements. D.H.

A87-18519#
AN ATMOSPHERIC-CORRECTION SCHEME FOR OPERATIONAL APPLICATION TO METEOSAT INFRARED MEASUREMENTS
J. SCHMETZ (ESA, European Space Operations Centre, Darmstadt, West Germany) ESA Journal (ISSN 0379-2285), vol. 10, no. 2, 1986, p. 145-159. refs

Surface and cloud-top temperatures are derived operationally from Meteosat IR measurements in the atmospheric window region (10.5-12.5 microns). An efficient radiative-transfer scheme is developed for operational use in order to calculate the atmospheric correction to be added to the equivalent black-body temperature at the satellite level to yield the actual surface or cloud-top temperature. The scheme resolves the Meteosat-2 IR-1 channel with six spectral bands, and it considers the absorption due to water-vapor lines, the water-vapor continuum, and aerosols. The reflectivity of the sea surface is taken into account with a zenith-angle-dependent reflectance function. The downwelling radiance is approximated by an empirical formula which depends on the near-surface temperature and humidity. This saves computer time as no explicit calculation of the downwelling radiance is required. Author

A87-18654
A MULTISPECTRAL METHOD FOR DETERMINING VERTICAL PROFILES OF O3 AND NO2 CONTENT AND AEROSOL EXTINCTION OF RADIATION IN THE ATMOSPHERE [MNOGOSPEKTRAL'NYI METOD OPREDELENIIA VERTIKAL'NYKH PROFILEI SODERZHANIIA O3, NO2 I AEROZOL'NOGO OSLABLENIIA RADIATSII V ATMOSFERE]
IU. M. TIMOFEEV, V. V. ROZANOV, A. V. POBEROVSKII, and A. V. POLIAKOV (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR) Meteorologiia i Gidrologiia (ISSN 0130-2906), Aug. 1986, p. 66-73. In Russian. refs

The accuracy of determining vertical O2 and NO2 profiles and aerosol extinction is analyzed via the numerical simulation of satellite atmospheric transparency measurements obtained with a multichannel spectrometer in the 0.25-1 micron range. A comparison is made between the utilization efficiencies of multispectral and filter measurements. K.K.

A87-18868
GUARDIAN OF THE AIR
J. BUCKLEY (General Electric Co., Space Systems Div., Valley Forge, PA) Space (ISSN 0267-954X), vol. 2, Sept.-Nov. 1986, p. 16, 18, 19.

An account is given of the design features, projected performance capabilities and mission responsibilities of the NASA Upper Atmosphere Research Satellite (UARS), which is scheduled for launch by the Space Shuttle in 1989 and will be entrusted with the monitoring of the chemistry, dynamics, and radiative inputs of the earth's upper atmosphere. Attention will be given in UARS-based research to the relative effects of natural and human perturbations, as well as the role of the upper atmosphere in climate and climatic variability. O.C.

A87-19055* Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
DESIGN OF A SINGLE-AXIS PLATFORM FOR BALLOON-BORNE REMOTE SENSING
L. M. COYLE, G. AURILIO, G. U. NYSTROM (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA), J. BORTZ, B. G. NAGY (A and B Design Engineering Co., Inc., West Acton, MA) et al. Review of Scientific Instruments (ISSN 0034-6748), vol. 57, Oct. 1986, p. 2512-2518.
(Contract NSG-5175)

The design of two telescope pointing systems for remote optical sensing of the stratosphere from a balloone-borne gondola is described. The telescope pointing accuracy is + or - 0.02 deg in elevation, from a gondola which has static and dynamic tilts up to + or - 3 deg. Each system consists of a telescope, an elevation control subsystem, and a pitch-stabilized single-axis reference platform. Author

A87-19056* Harvard-Smithsonian Center for Astrophysics, Cambridge, Mass.
PERFORMANCE OF A SINGLE-AXIS PLATFORM FOR BALLOON-BORNE REMOTE SENSING
W. A. TRAUB, K. V. CHANCE, and L. M. COYLE (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA) Review of Scientific Instruments (ISSN 0034-6748), vol. 57, Oct. 1986, p. 2519-2522.
(Contract NSG-5175)

The balloon flight performance of the Mark I single-axis platform and telescope is presented. Three performance indicators are examined: inclinometer output, gyro output, and infrared detector signal. The gondola itself experiences periodic angular disturbances with maximum amplitudes in the 0.1-2.0 deg range, with peaks occurring at periods of about 1, 2, 7, 20, and 250 s. The 2- and 20-s oscillations are identified with simple and compound pendulum motions, while the 250-s oscillations are speculated to be caused by atmospheric waves. The system meets the basic goal of providing a stable pointing direction within an uncertainty which is much less than the 0.3 deg telescope beam diameter. Author

A87-19094* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MILLIMETER-WAVE IMAGING SENSOR
W. J. WILSON, R. J. HOWARD, A. C. IBBOTT, G. S. PARKS, and W. B. RICKETTS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Transactions on Microwave Theory and Techniques (ISSN 0018-9480), vol. MTT-34, Oct. 1986, p. 1026-1035. refs

A scanning 3-mm radiometer system has been built and used on a helicopter to produce moderate-resolution (0.5 deg) images of the ground. This millimeter-wave sensor can be used for a variety of remote-sensing applications and produces images through clouds, smoke, and dust when visual and IR sensors are not usable. The system is described and imaging results are presented. Author

A87-19403
ANALYSIS OF ERS-1 SAR PERFORMANCE THROUGH SIMULATION
T. K. PIKE (DFVLR, Institut fuer Hochfrequenztechnik, Oberpfaffenhofen, West Germany) IN: National Radar Conference, Los Angeles, CA, March 12, 13, 1986, Proceedings . New York, Institute of Electrical and Electronics Engineers, Inc., 1986, p. 13-18. ESA-supported research. refs

The ESA Remote-Sensing Satellite (ERS-1), due for launch in 1989, will carry a Synthetic Aperture Radar (SAR) operating at 5.3 GHz (C-band). This paper describes a method of investigating degradations in the expected performance of this SAR system. The method is base on digital simulation of the SAR system. In particular deviations from the ideal caused by noise and nonlinearities in the subsystem hardware elements are addressed. Author

A87-19425
THE ERS-1 RADAR ALTIMETER MISSION
C. R. FRANCIS (ESA, European Space Research and Technology Center, Noordwijk, Netherlands) (IAF, International Astronautical Congress, 36th, Stockholm, Sweden, Oct. 7-12, 1985) Acta Astronautica (ISSN 0094-5765), vol. 14, 1986, p. 287-295.
(IAF PAPER 85-100)

The radar altimeter, an integral part of the ERS-1 satellite (scheduled for launch in 1989) payload, will provide a measurement of sea state along with measurements over ice and major ocean currents. The instrument and its operating environment are described as well as mission objectives and calibration/validation problems. Consideration is also given to the synergystic nature of radar altimeter data with respect to data from other sources. K.K.

N87-10263*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THIRTEENTH INTERNATIONAL LASER RADAR CONFERENCE
Aug. 1986 335 p Conference held in Toronto, Ontario, 11-15 Aug. 1986; sponsored by NASA, Washington, D.C., Atmospheric Environment Service, and York Univ.
(NASA-CP-2431; L-16201; NAS 1.55:2431) Avail: NTIS HC A15/MF A01 CSCL 20E

One hundred fifteen papers were presented in both oral and poster sessions. The topics of the conference sessions were: spaceborne lidar applications; extinction/visibility; differential absorption lidar; winds and tropospheric studies; middle atmosphere; clouds and multiple scattering; pollution studies; and new systems.

N87-10264*# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
ESA ACTIVITIES IN SPACE LASER SOUNDING AND RANGING
H. LUTZ *In* NASA. Langley Research Center 13th International Laser Radar Conference 1 p Aug. 1986
Avail: NTIS HC A15/MF A01 CSCL 20E

Laser remote sensing from space is undoubtedly one of the most promising means to obtain essential atmospheric and geophysical parameters on a global scale. Efforts including feasibility assessments, technology developments, and mission definition studies are in progress at the European Space Agency (ESA) to prepare for the prospective use of laser remote sensing systems in space. An overview of the programs under way is presented and the perspectives of laser remote sensing in the context of ESA's Long-Term European Space Plan are discussed. Author

N87-10265*# National Aeronautics and Space Administration, Washington, D.C.
LIDAR REMOTE SENSING FROM SPACE: NASA'S PLANS IN THE EARTH SCIENCES
R. J. CURRAN *In* NASA. Langley Research Center 13th International Laser Radar Conference 1 p Aug. 1986
Avail: NTIS HC A15/MF A01 CSCL 20E

A multidisciplinary study of the Earth System to provide a better understanding of the complex interrelated processes involved in the system, the Earth Observing System (EOS), is being developed. Capabilities of the Space Station, both the polar orbiting platform and the lower inclination platforms, will be used to accommodate a number of large active and/or passive sensors. Two lidar instruments being considered as part of the Eos payload are the Lidar Atmospheric Sounder and Altimeter (LASA) and the Laser Atmospheric Wind Sounder (LAWS). The LASA instrument is separable into two portions: the atmospheric sounder component and the retroranging component. The LASA atmospheric sounder will sample the spatial distribution of several atmospheric parameters. The retroranging component will be used to determine the precise three-dimensional position of specifically placed retro-reflectors and to sense how these retro-reflectors change position over monthly to yearly time periods. The LAWS utilizes a lidar system capable of measuring the Doppler shift in the backscattered intensity to determine the wind velocity profile. B.G.

N87-10337*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE APPLICATION OF LIDAR TO STRATOSPHERIC AEROSOL STUDIES
M. P. MCCORMICK *In* NASA. Langley Research Center 13th International Laser Radar Conference 2 p Aug. 1986
Avail: NTIS HC A15/MF A01 CSCL 04A

The global climatology and understanding of stratospheric aerosols evolving primarily from lidar and satellite measurements is presented. The importance of validation of these remotely sensed data with in situ measurements is also discussed. The advantage of lidar for providing high vertical and horizontal resolution and its independence from a remote source for measurement will become evident with examples of long term lidar data sets at fixed sites and the use of lidar on airborne platforms. Volcanic impacts of the last 20 years are described with emphasis on the last 8 years where satellite data are available. With satellite and high resolution lidar measurements, an understanding of the global circulation of volcanic material is attempted along with the temporal change of aerosol physical parameters and the stratospheric cleansing or decay times associated with these eruptions. E.R.

N87-10529# Technische Univ., Clausthal-Zellerfeld (West Germany). Inst. fuer Geologie und Palaeontologie.
SPACE IMAGING RADAR FOR REMOTE SENSING OF THE EARTH: AN EVALUATION Final Report, Dec. 1984
P. KRONBERG and B. THEILEN-WILLIGE Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 131 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-024; ISSN-0170-1339; ETN-86-97843) Avail: NTIS HC A07/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 27.50

The usefulness of SIR A-type imagery for thematic inventories and mapping of land use, geomorphology, hydrology, and geology was evaluated by comparing data contents of SIR A, LANDSAT MSS, and Metric Camera imagery from test sites in various parts of the world. Results indicate that spaceborne SAR (synthetic aperture radar) sensors (as well as spaceborne optical sensors) provide useful information only under specific surface conditions (morphology, surface cover, geological setting, climate). Possibilities and limitations in the use of spaceborne SAR-imagery for inventories and mapping projects are discussed. Correlative evaluations of spaceborne SAR and optical sensor imagery (providing surface roughness and spectral reflectance information for the area covered) are recommended. ESA

N87-10530 Arizona Univ., Tucson.
IN-FLIGHT ABSOLUTE RADIOMETRIC CALIBRATION OF THE LANDSAT THEMATIC MAPPER Ph.D. Thesis
C. J. KASTNER 1985 212 p
Avail: Univ. Microfilms Order No. DA8603342

The inflight absolute radiometric calibration of the Thematic Mapper (TM) is being conducted using the results of field measurements at White Sands, New Mexico. These measurements are made to characterize the ground and atmosphere at the time the TM is acquiring an image of White Sands. The data are used as input to a radiative transfer code that computes the radiance at the entrance pupil of the TM. The calibration is obtained by comparing the digital counts associated with the TM image of the measured ground site with the radiative transfer code result. The calibrations discussed here are for the first four visible and near-infrared band of the TM. Dissert. Abstr.

N87-10610 California Univ., Santa Barbara.
A COMPONENT DECOMPOSITION MODEL FOR EVALUATING ATMOSPHERIC EFFECTS IN REMOTE SENSING Ph.D. Thesis
S. LI 1985 151 p
Avail: Univ. Microfilms Order No. DA8609703

A radiance value of a target pixel recorded by a remote sensor can be decomposed into three components: attenuated target signature, pure atmospheric radiation, and the contribution made by the ground through the atmospheric scattering process. Given the meteorological and optical parameters of a layer-structured atmosphere, its transmittance and radiance distribution can be accurately calculated with a plane-parallel radiative transfer model. By applying the component decomposition model in an atmosphere with an underlying homogeneous Lambertian surface, the band-averaged pure atmospheric radiance and the downward and upward direct, diffuse, and total transmittances are calculated for the six reflective wavelength bands of the LANDSAT Thematic Mapper. By applying the component decomposition model in an atmosphere-snow system, the band-averaged upward atmospheric transmittances from an anisotropic snow surface are calculated and compared with their counterparts for Lambertian surfaces of

the same albedo. Knowing the pattern of the surface anisotropic reflectance factor, an adjusted band-averaged point spread function can be calculated and be used to retrieve the upwelling radiance from an inhomogeneous surface with a stable anisotropic reflectance pattern. Dissert. Abstr.

N87-11105*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DESIGN AND DEVELOPMENT OF A MULTIBEAM 1.4 GHZ PUSHBROOM MICROWAVE RADIOMETER
R. W. LAWRENCE, M. C. BAILEY, R. F. HARRINGTON, C. P. HEARN, J. G. WELLS, and W. D. STANLEY (Old Dominion Univ., Norfolk, Va.) Sep. 1986 65 p
(NASA-TM-89005; NAS 1.15:89005) Avail: NTIS HC A04/MF A01 CSCL 09C

The design and operation of a multiple beam, digital signal processing radiometer are discussed. The discussion includes a brief description of each major subsystem and an overall explanation of the hardware requirements and operation. A series of flight tests was conducted in which sea-truth sites, as well as an existing radiometer were used to verify the Pushbroom Radiometer performance. The results of these tests indicate that the Pushbroom Radiometer did meet the sensitivity design goal of 1.0 kelvin, and exceeded the accuracy requirement of 2.0 kelvin. Additional performance characteristics and test results are also presented. Author

N87-11248# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
ILLUSTRATION OF WIND FIELD TIME AND SPACE STATISTICS DURING THE TOSCANE-T CAMPAIGN
R. EZRATY, P. QUEFFEULOU, and M. CHAMPAGNE *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 59-61 Dec. 1985
Avail: NTIS HC A25/MF A01

Using selected periods of wind data collected during the TOSCANE-T campaign, the differences that may occur using different speed averaging times are illustrated. A comparison with Pierson's model results is presented in terms of standard deviation. From a simulation, it is shown that differences between 10 mn averages may reach up to 2.6 m/sec within a 1 hr period. Comparisons of speed measurements at different coastal locations show the same order of magnitude of variations although coastal topographic effects are present. ESA

N87-11251# Physics Lab. RVO-TNO, The Hague (Netherlands).
ANALYSIS OF THE ESA WIND SCATTEROMETER CAMPAIGN DATA
G. P. DELOOR *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 73-76 Dec. 1985
Avail: NTIS HC A25/MF A01

All data of the ESA wind scatterometer campaign as provided by the Central Data Library were analyzed. The data obtained fit the available empirical model and the parameters of this model were determined. The data set was related to the measured wind speed at 19.5 m and to the neutral stability wind. They are also compared with other data sets. ESA

N87-11253# Centre National de la Recherche Scientifique, Strasbourg (France). Groupement Scientifique de Teledetection Spatiale.
DETERMINATION OF LAND SURFACE PARAMETERS BY SATELLITE AND ASSOCIATED INVERSE PROBLEMS [DETERMINATION DES PARAMETERES SOL DE SURFACE A PARTIR DES SATELLITES ET LES PROBLEMES INVERSES ASSOCIES]
F. BECKER and M. RAFFY *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 85-92 Dec. 1985 In FRENCH; ENGLISH summary
Avail: NTIS HC A25/MF A01

Relationships between ground parameters and those derived from satellites are discussed. It is shown that it is not possible to preserve the models at all scales if all parameters are extended in the same way from local to spatial scales. In order to preserve the models, a definition of the parameters at satellite scale is suggested as the result of the inversion of the models of measure. The stability of these models and the pertinence of the proposed definitions are discussed. ESA

N87-11274# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
IMAGING SPECTROMETRY: PAST, PRESENT, FUTURE
M. J. ABRAMS and A. F. H. GOETZ *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 215-218 Dec. 1985
Avail: NTIS HC A25/MF A01

Imaging spectrometry for the remote sensing of the Earth from aircraft and satellites is discussed. Results with an aircraft instrument show that remote, direct identification of surface materials is possible. The airborne and spaceborne sensors can acquire images in 100 to 200 spectral bands. The next generation aircraft scanner (AVIRIS) is expected to be operational in 1987. Plans are underway for a Shuttle instrument (SISEX) to fly in 1991. ESA

N87-11276# Centre National d'Etudes Spatiales, Toulouse (France).
HIGH-SPECTRAL RESOLUTION REMOTE SENSING INSTRUMENTS DEVELOPED AND UNDER DEVELOPMENT AT CNES
P. VERMANDE *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 227-232 Dec. 1985
Avail: NTIS HC A25/MF A01

The operating principles of a field spectroradiometer are outlined and spectral signatures obtained are shown. A spectro-imager potentially for use on board a satellite is presented. Spectral analysis is performed by interferometry. The capability for detecting low radiance levels is considerbly better than in the case of dispersive instruments and the nature of the output data more amenable to processing in a wide variety of ways. ESA

N87-11285# Technische Univ., Munich (West Germany).
THE CO2 LASER IMAGING SPECTROSCOPY FOR EARTH OBSERVATION
F. LEHMANN and W. WIESEMANN (Battelle Inst., Frankfurt am Main (West Germany).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 273-276 Dec. 1985 Sponsored by Bundesministerium fuer Forschung und Technologie
Avail: NTIS HC A25/MF A01

Based on the results of CO2-laser laboratory spectroscopy (laser reflection spectroscopy of minerals, soils, rocks, vegetation, moistened surfaces, water, oil spills on water, in the wavelength interval 9.2 to 10.8 microns), and airborne campaigns with the 2-laser profiling instrument DIALEX, a program for the development of an optical multisensor Lidar Multispectral Earth Observation System was started. It combines four CO2-laser imaging spectrometers and an airborne thematic mapper multispectral scanner, to be flown in a Dornier 228 aircraft. ESA

N87-11291# Quebec Univ., Chicoutimi. Lab. de Physique Atmospherique.
ANEMOTHERMOGRAPHIC REMOTE SENSING USING AIRBORNE SENSORS: A NEW METHOD OF MICROMETEOROLOGICAL CARTOGRAPHY [LA TELEDETECTION ANEMOTHERMOGRAPHIQUE PAR CAPTEUR AEROPORTE: UNE NOUVELLE METHODE DE CARTOGRAPHE MICROMETEOROLOGIQUE]
R. VERREAULT, G. VACHON, G. H. LEMIEUX, M. LABONTE, and S. PERRON *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 303-306 Dec. 1985 In FRENCH Sponsored by Institut Scientifique du Saguenay, Canada, and Quebec Government's Fonds pour la Formation de Chercheurs et l'Aide a la Recherche, Canada
Avail: NTIS HC A25/MF A01

A method for measuring atmospheric circulation in the atmospheric boundary layer was developed. It uses night time aerial photography by flash lamp at altitudes up to 2500 m. A network of analogical and/or digital transducers measures other meteorological parameters such as surface and atmospheric temperature and moisture content. Anemography was used to study circulation during a temperature inversion at night in an orchard featuring radiative freezing. ESA

N87-11292# Arizona Univ., Tucson. Optical Sciences Center.
ABSOLUTE CALIBRATION OF REMOTE SENSING INSTRUMENTS
S. F. BIGGAR, C. J. BRUEGGE, B. A. CAPRON, K. R. CASTLE, M. C. DINGUIRARD, R. G. HOLM, L. J. LINGG, Y. MAO, J. M. PALMER, A. L. PHILLIPS et al. *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 309-314 Dec. 1985 Sponsored by NASA
Avail: NTIS HC A25/MF A01

Source-based and detector-based methods for the absolute radiometric calibration of a broadband field radiometer are described. Using such a radiometer, calibrated by both methods, the calibration of the integrating sphere used in the preflight calibration of the Thematic Mapper was redetermined. The results are presented. The in-flight calibration of space remote sensing instruments is discussed. A method which uses the results of ground-based reflectance and atmospheric measurements as input to a radiative transfer code to predict the radiance at the instrument is described. A calibrated, helicopter-mounted radiometer is used to determine the radiance levels at intermediate altitudes to check the code predictions. Results of such measurements for the calibration of the Thematic Mapper on Landsat 5 and an analysis that shows the value of such measurements are described. ESA

N87-11293# Universite des Sciences et Techniques de Lille (France). Lab. d'Optique Atmospherique.
ATMOSPHERIC EFFECTS IN REMOTE SENSING: A PROGRAM TO SIMULATE SATELLITE SIGNALS IN THE SOLAR SPECTRUM [EFFECTS ATMOSPHERIQUES EN TELEDETECTION: LOGICIEL DE SIMULATION DU SIGNAL SATELLITAIRE DANS LE SPECTRE SOLAIRE]
D. TANRE, C. DEROO, P. DAHAUT, M. HERMAN, J. J. MORCRETTE, J. PERBOS, and P. Y. DESCHAMPS *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 315-319 Dec. 1985 In FRENCH Sponsored by CNRS, CNES, and ESA
Avail: NTIS HC A25/MF A01

A computer program which simulates atmospheric radiation effects on satellite tracking signals and data from satellites was developed. The program enables the signal measured at the sensor to be estimated. It takes into account surface reflectance and the effects of the double transversing of the atmosphere: Sun-surface and surface-satellite. Atmospheric absorption and scattering are included. ESA

N87-11294# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE FIRST INTERNATIONAL SATELLITE LAND-SURFACE CLIMATOLOGY PROJECT (ISLSCP) FIELD EXPERIMENT (FIFE)
T. J. SCHMUGGE and P. J. SELLERS *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 321-325 Dec. 1985
Avail: NTIS HC A25/MF A01

The International Satellite Land Surface Climatology Project (ISLSCP) will verify the use of satellite data for the estimation of land-surface properties through field experiments using point measurements on the ground and areal measurements from aircraft overflights. In addition to validating satellite estimates of surface properties, it studies approaches for obtaining areal averages of the radiation, moisture and heat fluxes made using remotely sensed data. The procedure suggested combines the surface point measurements of the fluxes with the aircraft areal observations using a surface energy balance model to interpolate between the point estimates of these fluxes and calculate area-averaged quantities. The surface parameters to be estimated from aircraft observations include: surface radiation temperature, albedo, land cover or vegetation index, and surface soil moisture (the latter to be obtained using passive and active microwave approaches). The area-averages of the surface properties are compared with satellite data where possible. The First ISLSCP Field Experiment is planned for 1987 at a site having relatively uniform vegetation cover in the central great plains of the USA. for 1987 at a site having relatively uniform vegetation cover in the central great plains of the USA. ESA

N87-11295# Scripps Institution of Oceanography, La Jolla, Calif.
CALIBRATION OF GOES-5 AND GOES-6 VISSR/VAS SHORT-WAVELENGTH CHANNELS
R. FROUIN and C. GAUTIER *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 327-333 Dec. 1985
Avail: NTIS HC A25/MF A01

The GOES-5 and GOES-6 VISSR/VAS short wavelength channels are calibrated for the periods from October 1983 through July 1984 (GOES-5) and from October 1983 through January 1985 (GOES-6). The White Sands Monument area in New Mexico and space are used as calibration targets. The radiance directed to the satellite from the surface target is computed using a radiative transfer model. Measured surface and atmospheric properties are used as input to the model. The coefficients relating the brightness count (CN) to the incident radiance R (R=aCNsq+b) are found to vary little (10%) from the mean values for the entire study periods, indicating the good behavior of the instruments in orbit. The mean values are 0.0083 W/sqm/sr/micron (GOES-5) and 0.0089 W/sqm/sr/micron (GOES-6) for a; and -5.2 (GOES-5) and -7.1 (GOES-6) for b. ESA

N87-11296# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PRELIMINARY RESULTS OF A QUANTITATIVE COMPARISON OF THE SPECTRAL SIGNATURES OF LANDSAT THEMATIC MAPPER (TM) AND MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER (MOMS).
J. BODECHTEL (Technische Univ., Munich (West Germany).), J. ZILGER, and V. V. SALOMONSON *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 335-341 Dec. 1985
Avail: NTIS HC A25/MF A01

Operationally acquired Thematic Mapper and experimental MOMS-01 data are evaluated quantitatively concerning the systems spectral response and performance for geoscientific applications. Results show the two instruments to be similar in the spectral bands compared. Although the MOMS scanner has a smaller IFOV, it has a lower modulation transfer function performance for small, low contrast features as compared to Thematic Mapper. This deficiency does not only occur when MOMS was switched to the

low gain mode. It is due to the CD arrays used (ITEK CCPD 1728). ESA

N87-11298# Technische Univ., Munich (West Germany). Faculty of Geosciences.
CALIBRATION OF MODULAR OPTOELECTRONIC MULTISPECTRAL SCANNER CHARGED COUPLE DEVICE (MOMS-CCD) DATA AND QUALITATIVE TEST USING THEMATIC MAPPER (TM) DATA
J. HENKEL and H. KAUFMANN (Karlsruhe Univ. (West Germany).) *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 347-350 Dec. 1985
Avail: NTIS HC A25/MF A01

Relative and absolute radiometric calibration of MOMS-CCD-Data are demonstrated using a part of an image near Nakuru, Kenya. Preflight calibration data are used for the absolute correction, variance and mean value for relative correction. Landsat-TM Data of the same region are chosen for comparison. To test different sensor data ratio, principal component analysis is applied. ESA

N87-11304# Sherbrooke Univ. (Quebec).
VARIATION OF ATMOSPHERIC EFFECTS ON MEASURED RADIANCE AS A FUNCTION OF IMAGING ALTITUDE [VARIATIONS DES EFFECTS ATMOSPHERIQUES SUR LES RADIANCES MESUREES EN FONCTION DE L'ALTITUDE DE PRISE DE VUE]
A. ROYER, F. NERRY, P. TEILLET (Canada Centre for Remote Sensing, Ottawa (Ontario).), and S. TILL *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 375-381 Dec. 1985 In FRENCH
(Contract CNRC-OSU83-0094))
Avail: NTIS HC A25/MF A01

The effects of atmospheric scattering in the visible and near infrared wavebands on the radiance of water measured by remote sensing were analyzed using data from 3 overflights of the MEIS-2 pushbroom imager at different altitudes. It is shown that over continents, taking into account a vertical aerosol profile according to an exponential law defined by two parameters, the volume reflectance of water for each altitude produces equal values. In marine environment, a law of variation of the optical thickness of aerosols in proportion to altitude, defined by one parameter, enables the volume reflectance of water for each altitude to be evened out to within 0.05%. The method can provide accurate analyses for operational applications to image correction without ground measurements during overflights. ESA

N87-11305# Rijkswaterstaat, The Hague (Netherlands). Survey Dept.
AN ATMOSPHERIC CORRECTION METHOD USING GUZZI-SPECTRORADIOMETER INPUT DATA
L. M. M. VEUGEN and H. T. C. VANSTOKKOM *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 383-388 Dec. 1985
Avail: NTIS HC A25/MF A01

An atmospheric correction method using input data of a Guzzi-spectroradiometer is presented. The data consist of global and diffuse irradiance data in nine wavelength intervals in the visible and near infrared. The irradiance data are transformed to aerosol spectral optical thicknesses using the model presented in Stokkom and Guzzi (1984). A linear inversion procedure makes possible the computation of the size distribution of the local aerosols. This distribution is used as input for the direct calculation of the transmittances at the wavelength bands of the remote sensor, and for the computation of the aerosol phase function. Together with the known Rayleigh phase function, the diffuse irradiance at the remotely sensed object and the path radiance at the satellite borne sensor are obtained using a Sobolev modified approximate radiative transfer model (SMART-model). ESA

N87-11306# Nottingham Univ. (England). Dept. of Geography.
ESTIMATION OF ATMOSPHERIC CORRECTIONS FROM MULTIPLE AIRCRAFT IMAGERY
M. D. STEVEN and E. M. ROLLIN *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 389-392 Dec. 1985 Sponsored by UK Natural Environment Research Council
Avail: NTIS HC A25/MF A01

Multiheight measurements from aircraft are used to estimate atmospheric transmittance and path radiance using the known dependence of transmittance on path length. Multiangle measurements from overlapping scans were also applied, but the difference of path lengths offered by the range of scanner angles was insufficient to determine the parameters with accuracy especially with the uncertainties introduced by non-Lambertian reflection. The atmosphere is not horizontally homogeneous in the presence of cloud and even on cloudless days variations in optical depth can occur in dense haze. The variations have a coherent spatial distribution which can be applied to distinguish zones of different atmospheric characteristics. ESA

N87-11307# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE SENSING OF ATMOSPHERIC WATER USING THE FUTURE AMSU SYSTEM
G. SZEJWACH, I. JOBARD (Ecole Polytechnique, Palaiseau (France).), and O. Z. ZANIFFE *In* ESA Proceedings of the Third International Colloquium on Spectral Signatures of Objects in Remote Sensing p 393-396 Dec. 1985
Avail: NTIS HC A25/MF A01

Microwave radiances for various conditions of atmospheric temperature, moisture and cloudiness at the frequencies of the AMSU passive sounder system were computed. Results emphasizing precipitating cases are presented. Results from a parameterization scheme to infer total cloud liquid content as well as precipitable water over the ocean are also presented. ESA

N87-11462 Deutscher Wetterdienst, Offenbach am Main (West Germany).
SATELLITE MEASUREMENTS OF THE CLOUDINESS AND THE GLOBAL RADIATION FOR GLOBAL STATISTICS [SATELLITENMESSUNGEN DER BEWOELKING UND GLOBALSTRAHLUNG FUER EINE GLOBALE STATISTIK]
E. RASCHKE, F. DIEKMANN, A. GRATZKI, J. JACOBS, M. RIELAND, and H. J. LUTZ *In its* Reports of Meteorology, No. 23: Proceedings of the German Meteorologists Conference on the Global Climate and Our Environment p 224-227 1986 In GERMAN
Avail: Issuing Activity

Suitably reduced data sets were made up in the International Satellite Cloud Climatology Project (ISCCP) in order to provide global statistical data about meteorological satellite pictures of cloud cover and global radiation at the soil. Multispectral IR data from NOAA-satellites are available for cloud identification. The high inverse correlation between the reflection and transmission power of cloud fields for solar radiation can be applied using satellite photographs to calculate the global radiation reaching the soil. ESA

N87-11470# Lawrence Livermore National Lab., Calif.
CONSTRUCTING A COHERENT LONG-TERM GLOBAL TOTAL OZONE CLIMATOLOGY FROM THE BUV, MFR, AND SBUV/TOMS DATA SETS
J. S. ELLIS and F. M. LUTHER Feb. 1986 11 p Presented at the 2d Conference on Satellite Meteorology: Remote Sensing and Applications, Williamsburg, Pa., 12 May 1986
(Contract W-7405-ENG-48)
(DE86-009722; UCRL-93549; CONF-8605102-1) Avail: NTIS HC A02/MF A01

The backscatter ultraviolet spectrometer (BUV) aboard the NIMBUS 4 satellite provided global ozone data until mid-1977. The Total Ozone Mapping Spectrometer (TOMS) and Solar Backscattered Ultraviolet (SBUV) instrument aboard the NIMBUS

7 satellite began providing global ozone in November 1978. The only satellite derived global total ozone data available between the termination of the BUV data and the startup of the SBUV/TOMS data is that from the Multichannel Filter Radiometer (MFR) instrument aboard the Defense Meteorological Satellite Program (DMSP) series of satellites. The MFR and the SBUV/TOMS data are compared during the data overlap period in order to determine how well the MFR data might be used to represent the SBUV/TOMS and BUV data during the data gap period. DOE

N87-11472# World Climate Programme, Geneva (Switzerland).
REPORT OF THE WORKSHOP ON GLOBAL LARGE-SCALE PRECIPITATION DATA SETS FOR THE WORLD CLIMATE RESEARCH PROGRAMME
Jan. 1986 61 p Workshop held at Camp Springs, Md., 24-26 Jul. 1985
(WCP-111; WMO/TD-94; ETN-86-97806) Avail: NTIS M A01; print copy available at WMO, Geneva, Switzerland

An implementation scheme for the use of satellite visible and infrared image data to obtain estimates of large-scale convective-type precipitation and the use of microwave data to obtain instantaneous rain rate measurements, to obtain global large-scale precipitation data sets from a combination of data sources was discussed. Ground-based techniques and data processing were considered. ESA

N87-12069*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MEASUREMENT OF H02 AND OTHER TRACE GASES IN THE STRATOSPHERE USING A HIGH RESOLUTION FAR-INFRARED SPECTROMETER AT 28 KM Semiannual Status Report, 1 Jul. 1984 - 31 Dec. 1986
W. A. TRAUB and K. V. CHANCE Nov. 1986 13 p
(Contract NSG-5175)
(NASA-CR-179898; NAS 1.26:179898; SASR-15; SASR-16; SASR-17; SASR-18; SASR-19) Avail: NTIS HC A02/MF A01 CSCL 04A

The highlights of the stratospheric program were reviewed for the past 2.5 years. The major efforts were analysis of the data from the BIC-2 campaign, and the building or new instrumentation to replace that lost at the end of BIC-2. For clarity, the review will be done by topic, rather than chronologically: construction of the initial far-infrared spectrometer, balloon slight program, laboratory measurement, data analysis, and duplicate stabilized platform. B.G.

N87-12604# Naval Research Lab., Washington, D. C.
THE SPACE STATION MILLIMETER FACILITY
K. W. WEILER, B. K. DENNISON, R. M. BEVILACQUA, J. H. SPENCER, and K. J. JOHNSTON 9 Jun. 1986 58 p
(AD-A168983; NRL-MP-5794) Avail: NTIS HC A04/MF A01 CSCL 22B

A large millimeter wavelength interferometer array is proposed for construction on the planned Space Station (The Space Station Millimeter Facility--SSMF). It will have manifold applications in both basic and applied research and will be the premier instrument in the world at high radio frequencies. Earth resource mapping, middle atmospheric studies, and high frequency radio astronomy are only a few of the areas which will be significantly advanced by the availability of such an instrument. Particularly in astronomy, the ability to do observations above the disturbing and absorbing effects of the Earth's atmosphere will allow opportunities for exploration of all objects from the Sun, through the Solar System bodies, to the interstellar medium of the Milky Way and other galaxies, and out to the most distant quasars with resolution and sensitivity equalling or exceeding all existing or planned millimeter wavelength telescopes. One of the last unexplored regions of the electromagnetic spectrum, the mm-IR gap, can finally be closed. A flexible design for the SSMF is proposed, and estimate of its construction costs is made, and numerous scientific applications in a number of disciplines are discussed. GRA

N87-12966# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PHOTOGRAPHIC SENSORS: BASIC CONCEPTS [SENSORES FOTOGRAFICOS: CONCEITOS BASICOS]
C. C. LIU and J. E. RODRIGUES Sep. 1986 43 p In PORTUGUESE; ENGLISH summary
(INPE-3990-MD/031) Avail: NTIS HC A03/MF A01

This paper of photographic systems is prepared for the Postgraduate course on Remote Sensing of the Instituto de Pesquisas Espaciais (INPE) and is suitable both as teaching material or as reference. It provides almost all aspects of photography, taking and processing photographs, physical factors affecting their quality, type of camera, films, filters and so on. This work is not exhaustive but is a summary of subjects extensively covered in the literature. Therefore, readers should be quickly able to understand and apply the photographic remote sensing techniques to their disciplines. Author

N87-12970*# Stanford Telecommunications, Inc., Sunnyvale, Calif.
COMPARISON OF VARIOUS TECHNIQUES FOR CALIBRATION OF AIS DATA
D. A. ROBERTS, Y. YAMAGUCHI (Geological Survey of Japan, Kawasaki.), and R. J. P. LYON *In* JPL Proceedings of the Second Airborn Imaging Spectrometer Data Analysis Workshop p 21-30 15 Aug. 1986
Avail: NTIS HC A10/MF A01 CSCL 14B

The Airborne Imaging Spectrometer (AIS) samples a region which is strongly influenced by decreasing solar irradiance at longer wavelengths and strong atmospheric absorptions. Four techniques, the Log Residual, the Least Upper Bound Residual, the Flat Field Correction and calibration using field reflectance measurements were investigated as a means for removing these two features. Of the four techniques field reflectance calibration proved to be superior in terms of noise and normalization. Of the other three techniques, the Log Residual was superior when applied to areas which did not contain one dominant cover type. In heavily vegetated areas, the Log Residual proved to be ineffective. After removing anomalously bright data values, the Least Upper Bound Residual proved to be almost as effective as the Log Residual in sparsely vegetated areas and much more effective in heavily vegetated areas. Of all the techniques, the Flat Field Correction was the noisest. Author

N87-12991# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
INTERCOMPARISON OF DMSP OLS, NOAA AVHRR, GOES VISSR (DEFENSE METEOROLOGICAL SATELLITE PROGRAM OPERATIONAL LINESCAN SYSTEM, NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ADMINISTRATION ADVANCED VERY HIGH RESOLUTION RADIOMETER, GOES VISIBLE INFRARED SPIN-SCAN RADIOMETER) AND LANDSAT MSS IMAGERY FOR CLOUD PR OPERTY DETERMINATION: RECOMMENDATIONS FOR DIGITAL DATA ANALYSIS Final Report, 18 Jun. - 18 Dec. 1985
R. G. ISAACS, J. C. BARNES, L. D. PETRO, and R. D. WORSHAM 18 Jan. 1986 144 p
(Contract F19628-85-C-0102)
(AD-A169285; P142F; AFGL-TR-86-0012) Avail: NTIS HC A07/MF A01 CSCL 04B

Concurrent visible and infrared cloud imagery from four satellite sensors (DMSP OLS, NOAA AVHRR, GOES VISSR, Landsat MSS) have been intercompared. Inherent differences in cloud field analyses are noted due to sensor characteristics such as spatial and spectral resolution and scene/sensor geometry. Digital data were manipulated to simulate one sensor's data from that of another. Recommendations for further analysis of the collected data sets are provided. GRA

N87-13059*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
LIGHTNING MAPPER AND THE FUTURE
H. J. CHRISTIAN *In its* NASA/MSFC FY-85 Atmospheric Processes Research Review 2 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

A trade-off analysis was completed that reveals how the lightning mapper detection efficiency will change as a function of interference filter bandwidth, pixel field of view, and telescope aperture. It is shown that the critical parameter on which we have minimum flexibility is filter band-width. The problem is that too narrow a filter bandwidth is incompatible with wide areal coverage. The trade-off analysis demonstrates that an 80 percent lightning detection efficiency will technically be relatively straight-forward, while a 90 percent detection efficiency will apparently be difficult to achieve. Three focal plane designs are currently under consideration. One would use a single large, solid state silicon integrating array with multiple output channels and off-the-focal-plane analog, time domain, background removing fibers. A second design would use the same technology, but the sensor would consist of up to four virtually independent focal plane arrays. This design reduces the areal coverage of each detector. Thus narrower interference filters could be utilized. Superior performance would be realized at a probable increase in cost. The final design would use a three-dimensional focal plane in order to perform background removal at the focal plane. Superior performance would be achieved along with reduced weight and power requirements. Unfortunately, this focal plane technology is still under development. Author

N87-13068*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AIRBORNE DOPPLER LIDAR ACTIVITIES
D. R. FITZJARRALD and J. W. BILBRO *In its* NASA/MSFC FY-85 Atmospheric Processes Research Review 2 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

During August and September 1984, 20 research flights were conducted by the CV990 with airborne doppler lidar installed. Nine of these flights were dedicated to the Lidar project. Excellent data were obtained in the Carquenez Strait downwind of San Francisco Bay, showing the divergence of the flow as it passes into the Central Valley. The data clearly show the horizontal and vertical structure of the wind flow in the pass region and adjoining parts of the Central Valley. Data were also obtained in the vicinity of Mount Shasta in northern California, showing the flow in the lee of the isolated mountain. Preliminary analyses of these flights using the Mcidas interactive graphics system have been accomplished, and procurements have been initiated for detailed scientific analyses. A partial failure of a crucial optical component resulted in contamination of a portion of the wind data that were obtained in the Mount Shasta and subsequent flights. Analyses are underway to attempt reconstruction of the data to minimize the effects of the failure. Data were obtained in conjunction with a microwave wind profiler at Penn State University. It is expected that data reconstruction will be of use in this case. Procurement has been initiated for scientific analyses of these results. The improved airborne Lidar system performed well. In most of the research flights a large number of different scan angles were used to obtain the vertical structure of the wind fields being investigated.
Author

N87-13089*# Alabama Univ., Huntsville. Environmental and Energy Center.
PRELIMINARY PLANNING FOR THE SATELLITE PRECIPITATION AND CLOUD EXPERIMENT (SPACE) FIELD PROGRAM
S. F. WILLIAMS and R. T. MCNIDER *In* NASA. Marshall Space Flight Center NASA/MSFC FY-85 Atmospheric Processes Research Review 2 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

Preliminary planning has been performed to support NASA/Marshall Space Flight Center (MSFC) in the coordination of the field experiment to be conducted in Central Tennessee, Northern Alabama, and Mississippi during the Spring/Summer of 1986. The goal of Satellite Precipitation and Cloud Experiments (SPACE) is to investigate mesoscale cloud/precipitation systems and development of associated satellite remote sensing technology. The field program will incorporate remote sensing observations from aircraft, satellite imagery, radar observations, ground based lightning measurements, rawinsonde observations, and various surface meteorological observations. The coordination of existing and special observation networks will provide a data base for analysis of precipitation events and provide ground truth comparisons for remote sensing capabilities. Existing surface-based observational networks include National Weather Service Meso/Alpha Scale Rawinsonde, radar, and surface measurements; the Tennessee Valley Authority automated and manual precpitation recording stations; and NASA/MSFC lightning measurement stations. Special observational features to be implemented include a meso/beta scale rawinsonde network, a special surface observational network within the rawinsonde network, and the installation of a RADAP II/ICRAD data processing unit on the National Weather Service radar at Nashville, TN. Initial coordination of these observational requirements to accomplish the goals of SPACE have been performed. Author

N87-13095*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTISPECTRAL ATMOSPHERIC MAPPING SENSOR OF MESOSCALE WATER VAPOR FEATURES
P. MENZEL (Wisconsin Univ., Madison.), G. JEDLOVEC, G. WILSON, R. ATKINSON, and W. SMITH, w4560409 *In its* NASA/MSFC FY-85 Atmospheric Processes Research Review 4 p Oct. 1985
Avail: NTIS HC A07/MF A01 CSCL 04B

The Multispectral atmospheric mapping sensor was checked out for specified spectral response and detector noise performance in the eight visible and three infrared (6.7, 11.2, 12.7 micron) spectral bands. A calibration algorithm was implemented for the infrared detectors. Engineering checkout flights on board the ER-2 produced imagery at 50 m resolution in which water vapor features in the 6.7 micron spectral band are most striking. These images were analyzed on the Man computer Interactive Data Access System (McIDAS). Ground truth and ancillary data was accessed to verify the calibration. Author

N87-13104# Atmospheric and Environmental Research, Inc., Cambridge, Mass.
IMPROVING NUMERICAL WEATHER PREDICTION BY MAXIMIZING THE USE OF ASSIMILATED SATELLITE DATA Final Report, 1 Jan. 1983 - 31 Dec. 1985
L. D. KAPLAN, J. F. LOUIS, R. N. HOFFMAN, R. G. ISAACS, and W. J. GUTOWSKI 20 Dec. 1985 169 p
(Contract F19628-83-C-0027)
(AD-A169295; P79-FINAL; AFGL-TR-85-0298) Avail: NTIS HC A08/MF A01 CSCL 04B

An extensive literature review showed a disparity between the large amount of satellite data currently or potentially available for meteorological parameters and the relatively small amount that is actually utilized. The review also documented the various existing data retrieval techniques. Algorithms were developed and modified to retrieve temperature and moisture profiles from satellite infrared and millimeter/microwave radiances. Tools were developed, based on existing Air Force computer codes, to include and test the effect of satellite data in numerical weather prediction. The use of the logarithm of specific humidity as a forecast variable was investigated. The FGGE level II and III data sets existing at AFGL were completed to include all of the special observing periods and to form the basis of data assimilation tests. Finally, an attempt was made to optimize a cloudiness parameterization scheme on the basis of satellite retrievals. A number of recommendations are made for further work in satellite data retrieval, data assimilation and numerical weather prediction. They include the continuation of some of the items presented here, as well as suggestions for new avenues of research. GRA

N87-13732*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
RADIOMETRIC RESPONSIVITY DETERMINATION FOR FEATURE IDENTIFICATION AND LOCATION EXPERIMENT (FILE) FLOWN ON SPACE SHUTTLE MISSION
R. G. WILSON, R. E. DAVIS, R. E. WRIGHT, JR., W. E. SIVERTSON, JR., and G. F. BULLOCK Dec. 1986 21 p
(NASA-TM-89017; L-16180; NAS 1.15:89017) Avail: NTIS HC A02/MF A01 CSCL 82B

A procedure was developed to obtain the radiometric (radiance) responsivity of the Feature Identification and Local Experiment (FILE) instrument in preparation for its flight on Space Shuttle Mission 41-G (November 1984). This instrument was designed to obtain Earth feature radiance data in spectral bands centered at 0.65 and 0.85 microns, along with corroborative color and color-infrared photographs, and to collect data to evaluate a technique for in-orbit autonomous classification of the Earth's primary features. The calibration process incorporated both solar radiance measurements and radiative transfer model predictions in estimating expected radiance inputs to the FILE on the Shuttle. The measured data are compared with the model predictions, and the differences observed are discussed. Application of the calibration procedure to the FILE over an 18-month period indicated a constant responsivity characteristic. This report documents the calibration procedure and the associated radiometric measurements and predictions that were part of the instrument preparation for flight. Author

N87-13879# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STRATOSPHERIC ELECTRIC FIELD AND CONDUCTIVITY MEASUREMENTS OVER ELECTRIFIED CLOUDS IN THE SOUTH AMERICAN REGION
I. R. C. A. PINTO, O. PINTO, JR., W. D. GONZALEZ, S. L. G. DUTRA, J. WYGANT, and F. S. MOZER Nov. 1986 19 p Sponsored in part by Fundo Nacional de Desenvolvimento Cientifico e Tecnologico Submitted for publication
(INPE-4046-PRE/1012) Avail: NTIS HC A02/MF A01

Stratospheric DC electric fields and conductivity measurements associated with electrified clouds, identified through satellite imagery, are presented. These measurements were obtained at an altitude of 26 km by a balloon-borne double probe detector, launched from Cachoeira Paulista (geographic coordinates 23 degrees 40 minutes S, 45 degrees W) on April 2, 1980. The electric fields correspond to electrified clouds with charges of the order of a few coulombs and the conductivity exhibits variations around 4 x 10 to the minus 12th power mho/m. Such variations, which merit more investigation, did not show an apparent relation with the simulataneous electric field measurements. Using the vertical electric field and conductivity measurements, a current density is also estimated. Author

N87-13902# SASC Technologies, Inc., Hampton, Va.
OBJECTIVE ANALYSIS AND PREDICTION TECHNIQUES - 1985 Scientific Report, 1 Dec. 1984 - 30 Nov. 1985
A. M. GERLACH 30 Nov. 1985 250 p
(Contract F19628-82-C-0023)
(AD-A169746; AFGL-TR-86-0002; SR-10) Avail: NTIS HC A11/MF A01 CSCL 04B

Summarized is weather research in several technical areas: in numerical weather prediction, use of supplemental moisture information in global optimum interpolation analysis of humidity, development of a relocatable limited area model; in mesoscale forecasting, FOUS guidance error study, forecast guidance displays; in boundary layer meteorology, specialized computer programs for studies of atmospheric refractive index, windflow model, troposcatter raytrace models; in radar meteorology, detection of synoptic scale wind anomalies, gust front detection, 3-D cloud and precipitation mapping, icing detection, severe storm indicators; in satellite meteorology, development of microprocessor-based satellite data ingest system, system design (hardware, software) for McIDAS upgrade; in climatology, data processing and display studies for statistical properties of cumulus cloud structures, spatial/temporal cloud cover distributions from conventional observations, rainfall rate recurrence statistics and cumulus cloud vs. satellite brightness values. Author (GRA)

N87-13911# World Climate Programme, Geneva (Switzerland).
REPORT OF THE WORKSHOP ON SURFACE RADIATION BUDGET FOR CLIMATE APPLICATIONS
J. T. SHUTTLES, ed. and G. OHRING, ed. May 1986 139 p Workshop held in Columbia, Md, 18-21 Jun. 1985; sponsored by NASA, World Climate Research Program, and International Association of Meteorology and Atmospheric Physics Sponsored in cooperation with ICSU
(WCP-115; WMO/TD-109; ETN-86-98307) Avail: NTIS MF A01; print copy available at WMO, Geneva, Switzerland

Determination of the surface radiation budget (SRB) for climate applications, particularly for studies related to the World Climate Research Program is discussed. The SRB consists of the upwelling and downwelling radiation fluxes at the surface, separately determined for the broadband shortwave (SW) and longwave (LW) spectral regions. The SW albedo, LW emittance, and temperature of the surface are also considered to be elements of SRB information. Because of the focus on the global climate, determining the SRB from satellite measurements, and using ground-based and aircraft measurements for process studies and validation of the satellite-determined fluxes is emphasized. ESA

N87-14365# GKSS-Forschungszentrum Geesthacht (West Germany). Inst. fuer Physik.
ORBIT CALCULATION FOR ARTIFICIAL EARTH SATELLITES
J. STRAKA 1986 119 p In GERMAN; ENGLISH summary
(GKSS-86/E/21; ETN-87-98876) Avail: NTIS HC A06/MF A01

A NOAA program package for the determination of the position of an artificial Earth satellite was investigated. This program serves as a standard tool for research in the field of remote sensing. It is explained how perturbations of the Kepler orbit can be described with celestial mechanics methods. The method of Zeipel for the determination of perturbations of several orders of magnitude and the application of this method for the development of the theory of Brouwer for the motion of Earth satellites are presented. Results of the program for the orbit of the NOAA-7 satellite are discussed. ESA

N87-14770# European Space Agency, Paris (France). ESA Land Applications Working Group.
REMOTE SENSING FOR ADVANCED LAND APPLICATIONS
B. BATTRICK, ed. and E. ROLFE, ed. Jul. 1986 123 p Original contains color illustrations
(ESA-SP-1075; ETN-86-98538) Avail: NTIS HC A06/MF A01

Mission objectives and measurement requirements for a land applications remote sensing satellite to provide an integrated set of optical and microwave data were investigated. Thematic land applications related to renewable and nonrenewable Earth resources, and environmental aspects, such as land transformation processes, that affect interactions between the Earth surface and atmosphere were considered. A multispectral optical and SAR payload on a polar platform is recommended. A high-resolution imaging spectrometer, a microwave radiometer with more than one channel, as well as a gas-correlation spectrometer, and meteorological instruments of the type necessary for atmospheric corrections and environmental studies must be added. ESA

09

GENERAL

Includes economic analysis.

A87-10875* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE INDUSTRIALIZATION OPPORTUNITIES
C. M. JERNIGAN, ED. (NASA, Marshall Space Flight Center, Huntsville, AL) and E. PENTECOST, ED. (NASA, Washington, DC) Park Ridge, NJ, Noyes Publications, 1985, 624 p. No individual items are abstracted in this volume.

The current status of efforts to develop commercial space projects is surveyed, with a focus on US programs, in reviews and reports presented at the Second Symposium on Space Industrialization held in Huntsville in February 1984. Areas explored include policy, legal, and economic aspects; communications; materials processing; earth-resources observation; and the role of space carriers and a space station. Also included in the volume are 132 brief descriptions of the NASA Microgravity Science and Applications Program Tasks as of December 1984. These tasks cover the fields electronics materials; solidification of metals, alloys, and composites; fields and transport phenomena; biotechnology; glass and ceramics; combustion science; and experimental technology. T.K.

A87-15602#
SPACE REMOTE SENSING IN FRANCE - THE NEAR FUTURE
L. LAIDET (Ambassade de France aux Etats Unis, Washington, DC) and M. TRAIZET (CNES, Paris, France) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 25-33.

French remote-sensing programs for the 1980s and 1990s are surveyed. The principal features of the four SPOT satellites (with high-resolution panchromatic/multispectral imaging instruments), the Meteosat series, SAR instruments, the Poseidon oceanographic satellites, and the Topex-Poseidon satellites being developed in cooperation with NASA are presented in tables and briefly characterized. The general aim of the programs is the development of operational systems to meet user needs, with commercial exploitation where feasible. T.K.

A87-15698#
INDIAN PROGRAMME IN EARTH OBSERVATION SYSTEMS
D. N. MOORTHI (Indian Space Research Organization, Washington, DC) IN: International Symposium on Remote Sensing of Environment, 19th, Ann Arbor, MI, October 21-25, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 1087-1101. refs

The history and current status of Indian programs for airborne and spaceborne terrestrial remote sensing are reviewed. Topics examined include airborne optical, IR, and radar surveys; the experimental Bhaskara I and II satellites; the Rohini satellites; the ongoing Indian Remote-Sensing Satellite (IRS) program; the 150-kg Stretched Rohini series; the very-high-resolution visible/IR radiometers of the GEO Insat-series satellites; earth stations and image-processing facilities; and the National Natural-Resources management System. T.K.

A87-15785
REMOTE-SENSING APPLICATIONS IN PAKISTAN - CURRENT STATUS AND FUTURE PROGRAMMES
S. A. K. ALIZAI and M. I. MIRZA (Pakistan Space and Upper Atmosphere Research Commission, Remote Sensing Applications Centre, Karachi) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, Sept. 1986, p. 1147-1151. refs

A87-15835#
EARTH OBSERVATION COMMITTEE ASSESSMENT
W. M. STROME (PCI, Inc., Toronto, Canada) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 7 p. refs
(IAF PAPER 86-52)

The role of the Space Station in the future development of earth observations from space is assessed. Earth observations from space are to be utilized to determine the state of the planet at any given time, and to monitor and predict changes. The benefits the Space Station can apply to the study of the atmosphere and meteorology, ocean and coastal observations, and land data are discussed. The polar platform of the Space Station is most useful for earth observation. I.F.

A87-15848#
REMOTE SENSING FOR THE FUTURE - THE EOSAT GROUND SEGMENT
D. FISCHEL (Earth Observation Satellite Co., Lanham, MD), Y. BAN (Santa Barbara Research Center, Goleta, CA), and B. P. CLARK (Computer Sciences Corp., Silver Spring, MD) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 6 p. refs
(IAF PAPER 86-70)

The functional configuration of the Landsat 6/7 Ground Segment is described. The Landsat 6, to be launched by EOSAT in 1989, is designed to collect, process, and distribute multispectral imagery over land, using an Enhanced Thematic Mapper (ETM), which will provide standard seven-band 30-m TM data and higher resolution (15 m) panchromatic data. The principal differences of the Landsat 6/7 Ground Segment, with respect to that of the Landsat 5, are the redefined User Services and Shipping functions required to support the commercial environment, and the separation of other areas, such as Mission Management, Mission Support, Data Library, Spacecraft Scheduling, and Spacecraft Operations Control, to better bound these areas. I.S.

A87-15849*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVING SYSTEM - CONCEPTS AND IMPLEMENTATION STRATEGY
R. E. HARTLE (NASA, Goddard Space Flight Center, Greenbelt, MD) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 9 p. refs
(IAF PAPER 86-72)

The concepts of an Earth Observing System (EOS), an information system being developed by the EOS Science and Mission Requirements Working Group for international use and planned to begin in the 1990s, are discussed. The EOS is designed to study the factors that control the earth's hydrologic cycle, biochemical cycles, and climatologic processes by combining the measurements from remote sensing instruments, in situ measurement devices, and a data and information system. Three EOS platforms are planned to be launched into low, polar, sun-synchronous orbits during the Space Station's Initial Operating Configuration, one to be provided by ESA and two by the United States. I.S.

A87-15850#
PLANS FOR SPOT BEYOND SPOT 1 AND SPOT 2
L. DULHERM and JP. DURPAIRE (CNES, Toulouse, France) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 4 p.
(IAF PAPER 86-74)

The follow-up plans to SPOT 1 are described. SPOT 2 and SPOT 3, identical to the SPOT 1 satellite, will be ready for launch in mid-1987 and August 1989, respectively. The next satellite of the series, SPOT 4, is to be launched in mid-1992. In addition to the improvements on the High Resolution Visible payload, a complementary payload, named 'Vegetation', will be flown on SPOT 4, designed to monitor the evolution of crops and spontaneous vegetation and to observe the oceans. I.S.

A87-16103#
FACTORS IN THE SUCCESS OF COMMERCIAL REMOTE SENSING COMMERCIAL VIABILITY AND THE ROLE OF GOVERNMENT
L. R. GREENWOOD (Ball Corp., Ball Aerospace Systems Div., Boulder, CO) and P. T. DENNIS (Dennis and Associates, Boulder, CO) IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986. 7 p. refs
(IAF PAPER 86-450)

A87-16426
ASIAN CONFERENCE ON REMOTE SENSING, 6TH, HYDERABAD, INDIA, NOVEMBER 21-26, 1985, PROCEEDINGS
Conference organized by the National Remote Sensing Agency of India; Sponsored by the Oil and Natural Gas Commission, Department of Ocean Development of India, Japan Association of Remote Sensing, et al. Tokyo, University of Tokyo, 1986, 672 p. For individual items see A87-16427 to A87-16527.

Topics treated include the applications of remote sensing to agriculture, forestry, soil, land use, water resources, geology/geomorphology, oceanography/marine resources, and meteorology. The data processing of remote sensing data and education and training for remote sensing are discussed. Papers are presented on specific land use and socioeconomic studies of rural settlements through SIR images, the polarization of reflected light as a function of remote sensing of sea state, and digital mapping of flood plain land use, ocean color mapping using Landsat MSS data. I.F.

A87-16427#
NATIONAL REPORT OF THE PEOPLE'S REPUBLIC OF CHINA TO THE SIXTH ASIAN CONFERENCE ON REMOTE SENSING
D. WU (China National Committee for Asia Association on Remote Sensing, Beijing, People's Republic of China) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 1-5.

The establishment and objectives of the Chinese National Committee for the Asian Association for Remote Sensing are described. Major events in China's space technology and the application of this technology to remote sensing are examined. The economic and social benefits that remote sensing can provide to China are considered. Various applications for remote sensing such as the monitoring of forests and natural resources are discussed; an example of the application of remote sensing to the Yellow River Delta in China is presented. I.F.

A87-16428#
RESEARCH ACTIVITIES IN REMOTE SENSING IN JAPAN
S. MURAI, M. TAKAGI (Tokyo, University, Japan), and T. SAKATA (Tokai University, Tokyo, Japan) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 6-8.

The functions of the Advanced Utilization of Space Sensing Data research project are described. The objectives of the project involve the distribution of NOAA/AVHRR data, and the preprocessing and analysis of AVHRR and TM data. Research in the area of microwave remote sensing, data acquisition and processing systems, atmospheric correction for satellite data, and the advanced utilization of satellite data in land resources, ocean physics, and meteorology is proposed. I.F.

A87-16429#
REMOTE SENSING ACTIVITIES IN KOREA
E.-H. KIM (Korea Advanced Institute of Science and Technology, Seoul, Republic of Korea) and K.-Y. PARK (Korea Institute of Construction Technology, Inchon, Republic of Korea) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 9-11.

A87-16430#
REMOTE SENSING ACTIVITIES IN SRI LANKA
S. JAYATILAKA (Survey Department, Centre for Remote Sensing, Colombo, Sri Lanka) and S. D. F. C. NANAYAKKARA IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 12-15.

A87-16431#
THAILAND REMOTE SENSING CENTRE - TOWARDS REGIONAL COOPERATION
C. SWASDIYAKORN, S. VIBULSRESTH, C. PEANVIJARNPONG, and S. SUWANARPA (National Research Council, Bangkok, Thailand) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 16-25.

The operations of the Thailand Remote Sensing Center, which serves as the regional and national remote sensing data center, are examined. The acquisition, processing, and distribution of the Landsat data are described. Present and proposed research activities, such as the application of Landsat data to surveying and monitoring of natural resources, are discussed. The information exchange functions and international technology transfer programs of the center are considered. I.F.

A87-16432#
REMOTE SENSING ACTIVITIES IN INDIA. VI
Y. S. RAJAN, G. BEHERA, B. MANIKIAM, J. KRISHNAMURTHY, and V. R. RAO (Indian Space Research Organization, Earth Observation Systems Programme Office, Bangalore, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 26-34. refs

Remote sensing applications in India are discussed. The space and ground segments of the Indian remote sensing program are examined. The functions of the National Natural Resources Management System are described. Remote sensing data is being utilized for land use, the exploration of natural resources, oceanography, geology, forestry, water management, and meteorology. I.F.

A87-16449#
ACTIVITIES OF EDUCATION AND TRAINING IN INDIA
D. S. KAMAT (National Remote Sensing Agency, Indian Institute of Remote Sensing, Dehra Dun, India) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 139-143.

Remote sensing training in India is examined. A list of the Indian institutes which offer training in remote sensing is presented. The type of personnel trained in remote sensing techniques and the three levels of training are described. The curricula offered are concerned with remote sensing and photogrammetry fundamentals, photointerpretation and generation of theme identification keys, ground truth and field verification, digital analysis using interactive video color displays, and thematic map generation. The future manpower demands for remote sensing in India are discussed. I.F.

A87-16450#
REMOTE SENSING EDUCATION AND TRAINING AT ASIAN INSTITUTE OF TECHNOLOGY (AIT)
K. NUALCHAWEE (Asian Institute of Technology, Bangkok, Thailand) IN: Asian Conference on Remote Sensing, 6th, Hyderabad, India, November 21-26, 1985, Proceedings . Tokyo, University of Tokyo, 1986, p. 150-154.

The activities and facilities of the Asian Regional Remote Sensing Training Center (ARRSTC)/AIT are described. The objectives of ARRSTC/AIT are to provide basic training in remote sensing technology and analysis techniques to resources scientists and technicians, and to provide specially oriented use in specific applications and related activities. The multinational faculty and staff utilize imageries and map collections, visual analysis equipment, drafting and cartographic aids, photoprocessing

facilities, and a computer for digital image processing in order to train personnel in remote sensing. I.F.

A87-16937
ON DEFINING REMOTE SENSING
J. FUSSELL, D. RUNDQUIST, and J. A. HARRINGTON, JR. (Nebraska, University, Lincoln) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, Sept. 1986, p. 1507-1511. refs

An examination of definitions as tools explains why remote sensing has no generally accepted definition and why such a situation is likely to continue. In this study, the history of the term remote sensing is sketched, with comments on its usage; the continuing search for substitute terms is noted; maximal and minimal definitions are examined; synonyms and antonyms are compared; and definitions are classified into three groups. Finally, extended meaning is given to the term remote; different definitions are provided for various audiences; and a set of essential elements to be included in a comprehensive definition is suggested. Author

A87-17300#
RESULTS OF PHASE-A STUDIES OF A TROPICAL EARTH RESOURCES SATELLITE [RESULTATEN VAN DE FASE A STUDIES VAN EEN TROPICAL EARTH RESOURCES SATELLITE]
R. VAN KONIJNENBURG (Nederlands Instituut voor Vliegtuigontwikkeling en Ruimtevaart, Delft, Netherlands) Ruimtevaart, vol. 35, Feb. 1986, p. 9-14. In Dutch.

The current status of the Tropical Earth Research Satellite (TERS) being developed for Indonesia is reported. TERS is to be a 950-kg platform in a 1681-km 0-deg-inclination orbit; the remote-sensing payload features three channels between 500 and 800 nm, 8-m single-band and 16-m multispectral resolution over a 60-km swath, directability between 10 deg N and 10 deg S latitude, selective pointing using cloud-detector data, and direct data transmission (no recorder). Major applications discussed include monitoring rice production and forests, mapping, oceanography and fisheries, and cloud monitoring. Phase-A studies have demonstrated the technical viability of TERS, and current efforts are concentrated on organizing user support and sponsors. T.K.

A87-17651
REMOTE SENSING OF THE EARTH FROM THE METEOR-PRIRODA SATELLITE: THE BULGARIA-1300-II SOVIET-BULGARIAN EXPERIMENT [DISTANTSIONNOE ZONDIROVANIE ZEMLI SO SPUTNIKA 'METEOR-PRIRODA': SOVETSKO-BOLGARSKII EKSPERIMENT 'BOLGARIIA-1300-II']
L. A. PAKHOMOV, ED. Leningrad, Gidrometeoizdat, 1985, 160 p. In Russian. For individual items see A87-17652 to A87-17665.

A collection of papers on the Bulgaria-1300-II remote-sensing program is presented, with emphasis on project objectives, the engineering implementation of the missions, and results of data interpretation and analysis. Particular consideration is given to measurements made with the SMP-32 multichannel spectrometer and the MSU-S multispectral scanner on the Meteor-Priroda satellite. B.J.

A87-18373
COMMERCIALIZATION OF SATELLITE REMOTE SENSING WORLDWIDE
F. B. HENDERSON, III (Geosat Committee, San Francisco, CA) IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1343-1348.

The views of the Geosat Committee regarding the proposed commercialization of Landsat are summarized. The legal and political aspects of the commercialization are discussed. International implications concerning the dissemination of Landsat data are examined. I.F.

A87-18382
DEVELOPMENT OF MARINE OBSERVATION SATELLITE (MOS-1)
Y. ISHIZAWA, T. MASUDA, M. KUSANAGI (National Space Development Agency of Japan, Tokyo), T. SHIMAMURA, G. SHIRAKO (NEC Corp., Yokohama, Japan) et al. IN: International Symposium on Space Technology and Science, 14th, Tokyo, Japan, May 27-June 1, 1984, Proceedings . Tokyo, AGNE Publishing, Inc., 1984, p. 1417-1424.

The Marine Observation Satellite (MOS-1) is Japan's first satellite in the series of marine and land observation satellites, and is scheduled to be launched by a N-II launch vehicle in the summer of 1986. The MOS-1 program started in April 1980 with the following major objectives: (1) establishment of fundamental technologies for both marine and land observation satellites; (2) observation of the state of sea surface and atmosphere using visible, infrared and microwave radiometers, and verification of these sensors; and (3) basic experiments for a data collection system. To achieve those objectives the MOS-1 carries three radiometers and a data collection repeater. This paper summarizes the configuration of the MOS-1 system and the status of development. Author

A87-18451
SPACE EXPLOITATION AND UTILIZATION; PROCEEDINGS OF THE SYMPOSIUM, HONOLULU, HI, DECEMBER 15-19, 1985
P. M. BAINUM, ED. (Howard University, Washington, DC), K. IKEDA, ED. (Mitsubishi Heavy Industries, Ltd., Tokyo, Japan), T. NOMURA, ED. (Tokyo, University, Japan), T. YAMANAKA, ED. (National Aerospace Laboratory, Tokyo, Japan), G. L. MAY, ED. et al. Symposium organized and sponsored by AAS and Japanese Rocket Society. San Diego, CA, Univelt, Inc. , 1986, 738 p. For individual items see A87-18452 to A87-18470, A87-18472 to A87-18497.

Various papers in the area of space exploitation and utilization are presented. The general topics addressed include: national and international space programs, advanced space-based communications systems, remote sensing of the earth, earth resources satellite technology, future trends in the development of launch vehicle technology, space-based manufacturing, future use of robotic technology for space application, and astrodynamics. C.D.

A87-18470
CURRENT STATUS OF JAPAN'S EARTH RESOURCES SATELLITE-1
Y. ISHIZAWA, S. TAKAMURA, N. SAITO (National Space Development Agency of Japan, Tokyo), S. NIWA, R. KURAMASU (Technology Research Association of Resources Remote Sensing System, Tokyo, Japan) et al. IN: Space exploitation and utilization; Proceedings of the Symposium, Honolulu, HI, December 15-19, 1985 . San Diego, CA, Univelt, Inc., 1986, p. 291-298.
(AAS PAPER 85-633)

The development of ERS-1, is reported. Mission objectives include establishing the remote sensing technology by SAR and optical sensors and monitoring natural resources. The ERS-1 is to weigh approximately 1400 kg and have a mission life of about two years. The orbit will be sun-synchronous with an altitude of 568 km, inclination of 97.7 degrees, recurrent period of 44 days, and local time of descending node of 10:30 plus or minus 30 minutes. D.H.

A87-18472* National Aeronautics and Space Administration, Washington, D.C.
THE FUTURE OF EARTH REMOTE SENSING IN THE US THROUGH THE SPACE STATION ERA
P. J. MOUGINIS (NASA, Washington, DC; Hawaii, University, Honolulu) IN: Space exploitation and utilization; Proceedings of the Symposium, Honolulu, HI, December 15-19, 1985 . San Diego, CA, Univelt, Inc., 1986, p. 307-311.
(AAS PAPER 85-635)

This paper reviews the objectives of the Terrestrial Geology Program within NASA. The Geology Program is one of four within

the Land Processes Branch of the Office of Space Science and Applications, and complements the Terrestrial Ecosystems, Hydrology and Remote Sensing Science Programs. Examples of science currently being supported by the Geology Program, and new sensor developments are discussed as they lead towards the Space Station Era in the mid-1990's. Author

N87-11683# Executive Office of the President, Washington, D.C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT: 1984 ACTIVITIES
1985 148 p
Avail: NTIS HC A07/MF A01

The achievements for the United States aeronautics and space programs for the year 1984 are summarized. The achievements are presented according to sponsoring agency. B.G.

N87-11836# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data and Information Service.
NOAA (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION) N-ROSS/ERS-1 ENVIRONMENTAL DATA DEVELOPMENT (NNEEDD) PRODUCTS AND SERVICES
F. E. KNISKERN Feb. 1986 24 p
(PB86-213527; NOAA/TR/NESDIS-15) Avail: NTIS HC A02/MF A01 CSCL 22B

The study focuses on products and services expected from the Navy-Remote Ocean Sensing System (N-ROSS) and the European Space Agency's (ESA) first Remote-Sensing Satellite (ERS-1). The NOAA N-ROSS/ERS-1 Environmental Data Development (NNEEDD) Activity will put into place a system capable of handling all-all-weather oceanic data planned through the remainder of the century, including the polar-platform associated with the Space Station. The statement may appear all-encompassing, but these two satellite systems carry all generic-types of ocean-measuring instruments except ocean color. The NNEEDD Activity will provide global data from the approved new satellite systems. GRA

N87-12040# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE BRAZILIAN SATELLITE REMOTE SENSING
M. N. BARBOSA and D. BASTOS-NETTO Oct. 1986 21 p Presented at the International Conference on Remote Sensing for Development, Berlin, West Germany, 1-7 Sep. 1986
(INPE-4006-PRE/999) Avail: NTIS HC A02/MF A01

Almost twenty years since the first use of Remote Sensing techniques in Brazil, a review of the results achieved and a plans for the future are made, in accord with the aims and priorities of the new Brazilian Administration. Conscious of this spirit, INPE has revised its ongoing projects and established a new, goal-oriented organization structure. After one year of work, some achievements are already available and are presented in this paper. The analysis of these preliminary results, in conjunction with governmental priorities and the state-of-the-art at the international level, will serve as a guide in the years to come. Author

N87-12988# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
IN RETROSPECT: THE IMPACT OF RESEARCH PRODUCTION IN THE AREA OF REMOTE SENSING [EM RETROSPECTIVE: O IMPACTO DA PRODUCAO CIENTIFICA NA AREA DE SENSORIAMENTO REMOTO]
E. M. LEAODEMORAESNOVO Sep. 1986 48 p In PORTUGUESE; ENGLISH summary
(INPE-3987-NTE/261) Avail: NTIS HC A03/MF A01

Research in the area of remote sensing and its impact on the Brazilian scientific community is analyzed. A historical approach was adopted establishing a relationship among the main development phases of remote sensing in Brazil and the main research lines adopted by the Remote Sensing Department. It was concluded that the Remote Sensing Project had its main objectives changed along with its history. The lack of human resources prepared to deal with this new subject can be considered the main reason for low scientific production. While in other areas of INPE, people were sent to receive special training in developed countries, in the Remote Sensing area it did not happen. Author

N87-13845# Netherlands Agency for Aerospace Programs, Delft.
PROPOSAL TO NIVR FOR A SYSTEM DEFINITION STUDY OF A JOINT INDONESIAN-NETHERLANDS TROPICAL EARTH RESOURCES SATELLITE (TERS)
1984 30 p Prepared in cooperation with Indonesian National Inst. of Aeronautics and Space
(JTERS-84-11; ETN-86-97499) Avail: NTIS HC A03/MF A01

A study to provide a technical definition of the Tropical Earth Resources Satellite (TERS) spacecraft, ground station, data preprocessing facilities and satellite operations in sufficient detail for a reliable estimate of the required budget and time for the realization of a TERS project is proposed. It should also provide a better insight in the feasibility aspects of such a project. The technical definition includes system and subsystem design specifications, and definition of the products to be applied to the users. The execution of the project is defined up to and including the in-orbit checkout. ESA

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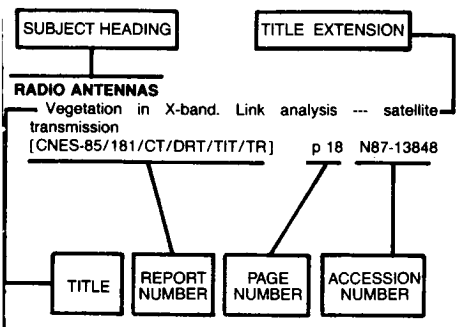

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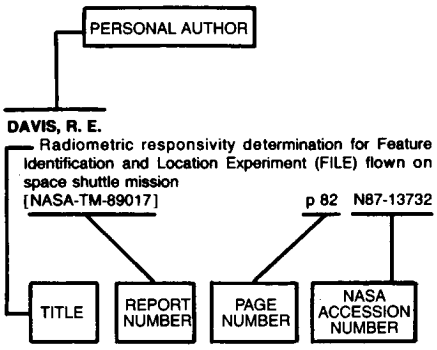

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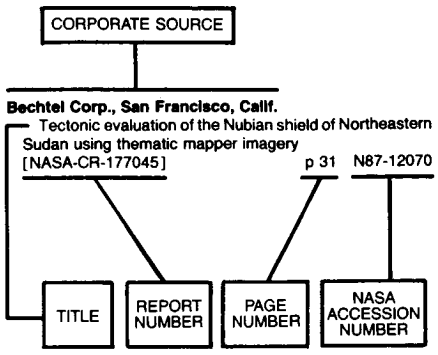

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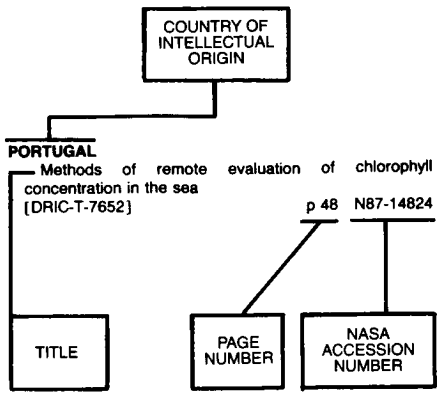

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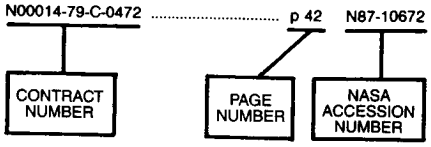

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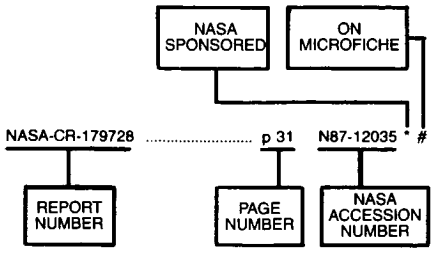

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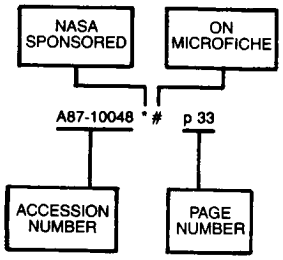

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