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Earth Resources
A Continuing
Bibliography
with Indexes

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NASA SP-7041(52)

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 52

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between October 1 and December 31, 1986 in

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

NASA Scientific and Technical Information Branch 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 454 reports, articles, and other documents announced between October 1 and December 31, 1986 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 A86-10,000 in ascending accession number order;

STAR entries identified by accession number series N86-10,000 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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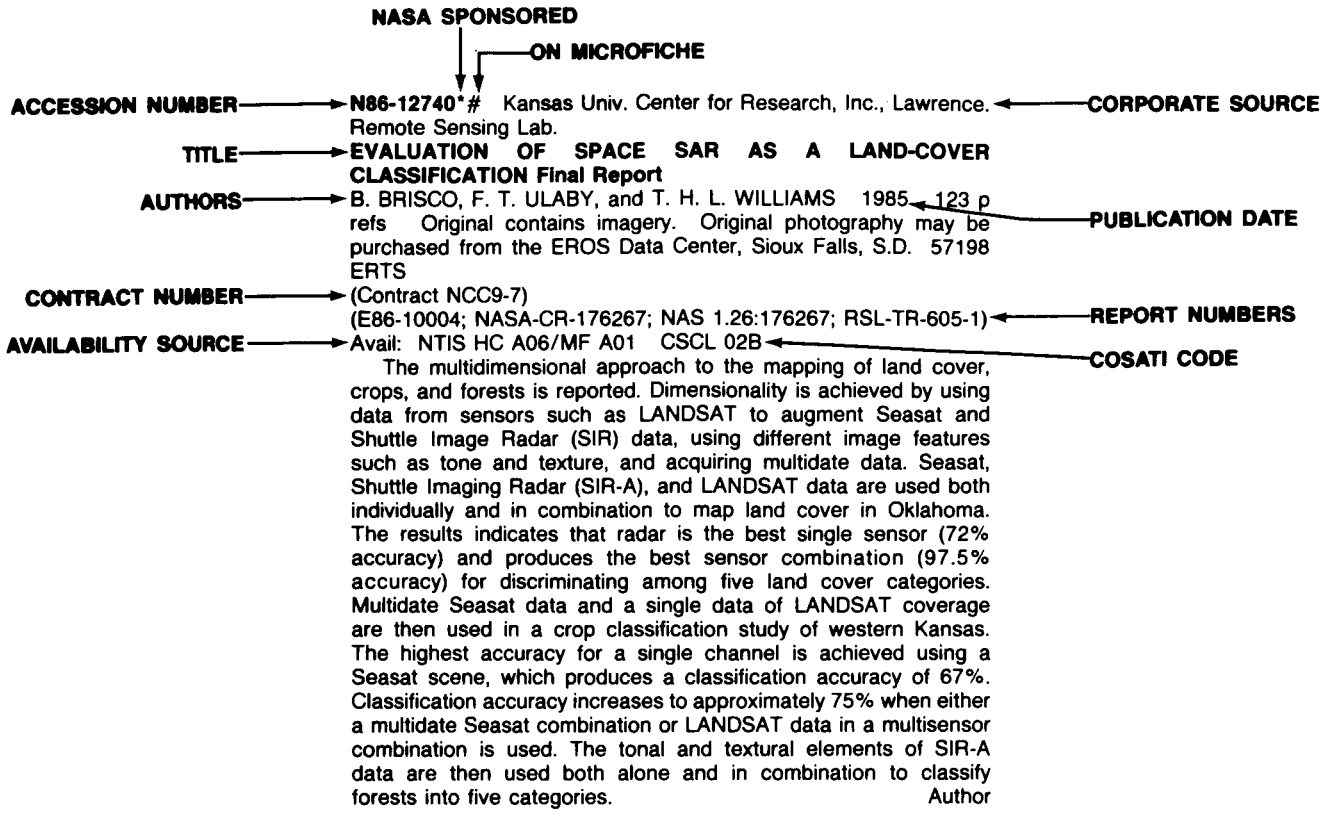
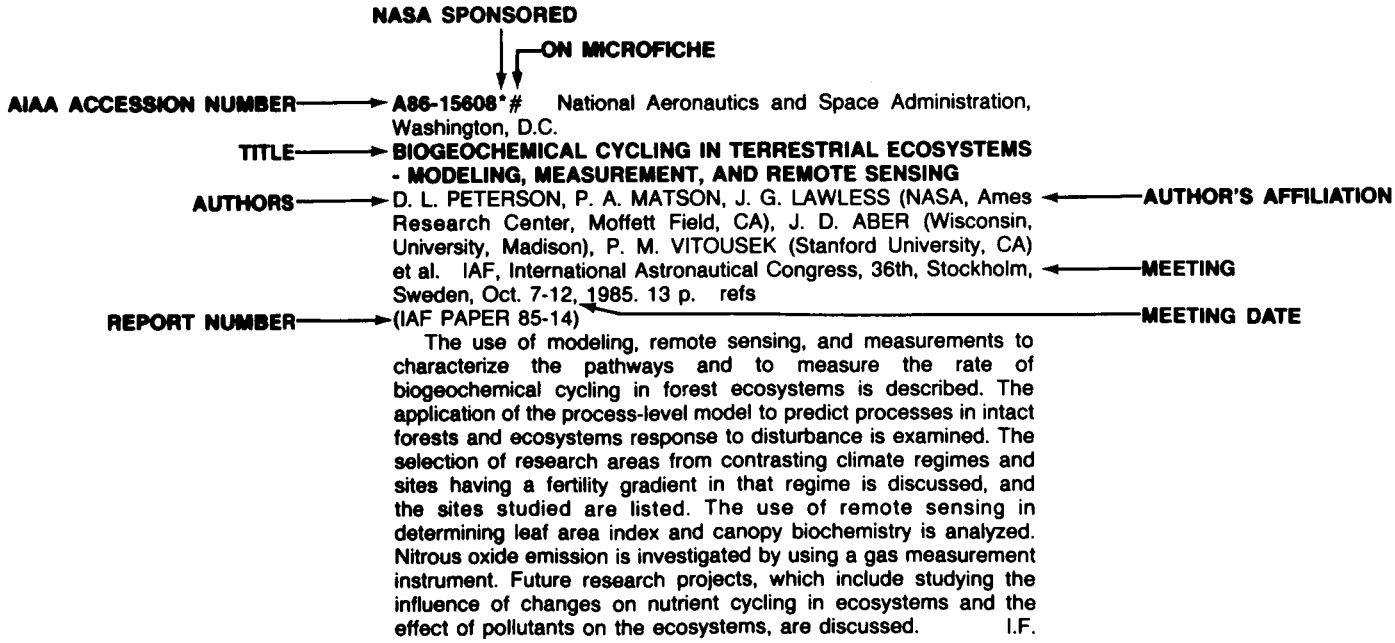
TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



EARTH RESOURCES

A Continuing Bibliography (Issue 52)

JANUARY 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.

A86-40006
PERFORMANCE EVALUATION OF A SATELLITE-BORNE SYNTHETIC APERTURE RADAR FOR SOIL MOISTURE MAPPING BY A COMPUTER SIMULATION TECHNIQUE
F. T. ULABY (Michigan, University, Ann Arbor) and M. FUJITA Radio Research Laboratory, Journal (ISSN 0033-8001), vol. 33, March 1986, p. 27-42. refs

In this paper, the ability of a satellite-borne synthetic aperture radar (SAR) to detect soil moisture is evaluated by means of a computer simulation technique. The computer simulation package includes the azimuth compression processing using a range-sequential processor. The results of computer simulations indicate that in estimating soil moisture content with a four-look processor, the difference between the assumed and estimated values of soil moisture is within + or - 20 percent of field capacity for 57 percent of the pixels for an agricultural flood-plain and for 50 percent of the pixels for a hilly terrain. The estimation accuracy for soil moisture may be improved by reducing the effect of fading by noncoherent averaging. Author

A86-40320* Delaware Univ., Newark.
REMOTE SENSING OF SPARTINA ANGLICA BIOMASS IN FIVE FRENCH SALT MARSHES
M. F. GROSS, V. KLEMAS, and J. E. LEVASSEUR International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 657-664. Sponsorship: Centre National pour l'Exploitation des Oceans. refs
(Contract CNEXO-83/7202; NAGW-374)

The utilization of regression models to estimate Spartina anglica biomass in marshes is studied. Radiance data for five S. anglica plots located along the coast of Brittany, France at 48 deg 40 min N between 1 deg 30 min W- 4 deg 30 min W was collected with a hand-held radiometer. Biomass data is derived from the radiance data, and the radiance and biomass data are employed in the formulation of simple regression models. The models are applied to the radiance data from the other four marshes. It is observed that the models predicted the biomass for all four marshes, and for three of the four marshes the estimated leaf and live biomass are within 1-13 percent of the harvest values. The effects of slit and dead tissues on the radiance from the S. anglica canopies are analyzed. It is noted that simple regression models which correlate radiance data to S. Anglica biomass in one marsh can be applied to the accurate prediction of leaf and live S. anglica biomass in other marshes. I.F.

A86-40321* State Univ. of New York, Binghamton.
ESTIMATION OF CANOPY PARAMETERS FOR INHOMOGENEOUS VEGETATION CANOPIES FROM REFLECTANCE DATA. I - TWO-DIMENSIONAL ROW CANOPY
N. S. GOEL and T. GRIER (New York, State University, Binghamton) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 665-681. NASA-supported research. refs

A canopy-reflectance (CR) model for row-planted vegetation is presented. Its use of an estimation of important biophysical variables like leaf-area index (LAI) and average leaf angle (ALA) from bidirectional CR data is discussed. Using field-measured CR data for a partially covered soybean canopy, it is shown that one can accurately estimate LAI, ALA and extent of percentage of ground cover from CR data. Author

A86-40322* California Univ., Santa Barbara.
PERFORMANCE ANALYSIS OF IMAGE PROCESSING ALGORITHMS FOR CLASSIFICATION OF NATURAL VEGETATION IN THE MOUNTAINS OF SOUTHERN CALIFORNIA
S. R. YOOL, J. L. STAR, J. E. ESTES, D. B. BOTKIN, D. W. ECKHARDT (California, University, Santa Barbara) et al. International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 683-702. Research supported by the University of California. refs
(Contract NAGW-455)

The earth's forests fix carbon from the atmosphere during photosynthesis. Scientists are concerned that massive forest removals may promote an increase in atmospheric carbon dioxide, with possible global warming and related environmental effects. Space-based remote sensing may enable the production of accurate world forest maps needed to examine this concern objectively. To test the limits of remote sensing for large-area forest mapping, we use Landsat data acquired over a site in the forested mountains of southern California to examine the relative capacities of a variety of popular image processing algorithms to discriminate different forest types. Results indicate that certain algorithms are best suited to forest classification. Differences in performance between the algorithms tested appear related to variations in their sensitivities to spectral variations caused by background reflectance, differential illumination, and spatial pattern by species. Results emphasize the complexity between the land-cover regime, remotely sensed data and the algorithms used to process these data. Author

A86-40823
DIGITAL REGIONAL CARTOGRAPHY FROM LANDSAT IMAGES AGRICULTURAL REGIONS IN THE KIAMBU DISTRICT (KENYA) [CARTOGRAPHIE REGIONALE NUMERIQUE A PARTIR D'IMAGES LANDSAT LES REGIONS AGRICOLES DU DISTRICT DE KIAMBU /KENYA/]
J. BARAZA, J.-P. ROGALA (Regional Centre for Services in Surveying, Mapping and Remote Sensing, Nairobi, Kenya), and G. SAVARY (IBM France, S.A., Centre Scientifique, Paris, France) Photo Interpretation (ISSN 0031-8523), vol. 23, July-Aug. 1984, p. 13-16. In English, French, and Spanish.

A digital analysis of the Kiambu district Landsat images is performed to provide agricultural survey zoning based on qualitative criteria. From the initial image, delineating such objects as forests,

grain crops, bare ground, and grazing land, a second image is derived with pixels assigned to objects based on their radiometric properties. In the third image, regions are characterized by composition expressed in percentages of ground occupation types, and in the final image, zones are color indexed by the typical region represented. Digital processing of the last image involves successive analysis of all image points, with the neighborhood of each point consisting of a 44 x 44 pixel square. R.R.

A86-43962
VEGETATION MAPPING OF NOWITNA NATIONAL WILDLIFE REFUGE, ALASKA USING LANDSAT MSS DIGITAL DATA
S. S. TALBOT (U.S. Fish and Wildlife Service, Anchorage, AK) and C. J. MARKON (Technicolor Government Services, Inc., Anchorage, AK) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 791-799. refs

In connection with the Alaska National Interest Lands Conservation Act of 1980, the U.S. Fish and Wildlife Service has to identify and describe the wildlife habitats of the Nowitna National Wildlife Refuge (NWR). An examination of the considered habitats requires the employment of a suitable vegetation map. It is pointed out that the most practical approach to refuge vegetation mapping appears to be a Landsat-assisted approach. Specific objectives of the present report are related to the presentation of a Landsat-derived vegetation map showing the distribution of vegetation types within Nowitna NWR. In addition, a description of the variation in the physiognomy and composition of the vegetation in relation to broad ecological factors is provided. Attention is given to aspects of geographical setting, preprocessing, the development of training classes and associated statistics, spectral class labeling, classification, postclassification refinement, forest, scrub, dwarf scrub, herbaceous vegetation, water, and patterns. G.R.

A86-43964* Alaska Univ., Fairbanks.
COMPARISON OF LEAF AND CANOPY REFLECTANCE OF SUBARCTIC FORESTS
K. G. DEAN, Y. KODAMA, and G. WENDLER (Alaska, University, Fairbanks) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 809-811. refs
(Contract NCA2-OR-020-401)

Near-surface and aerial reflectance of foliage and canopies of subarctic forests were measured in central Alaska near Fairbanks. Bi-directional and hemispherical radiometric data were recorded over wavelengths ranging from 0.285 to 2.8 microns with emphasis on Landsat TM (Thematic Mapper) bands. Comparison of near-surface and aerial data indicates that the canopy of some species such as black spruce and aspen have reflectance values similar to their respective foliage. Other species such as birch have large differences. Canopy structure and understory vegetation appear to be the primary factors that control whether the reflectance of canopy and foliage are similar or different. The results suggest that radiation reflected from the canopy of some forest species will be close to laboratory measurements of foliage after atmospheric corrections. Author

A86-44047
SURFACE TEMPERATURE AS AN INDICATOR OF EVAPOTRANSPIRATION AND SOIL MOISTURE
P. REINIGER (CEC, Directorate-General for Science Research and Development, Brussels, Belgium) and B. SEGUIN (Institut National de la Recherche Agronomique, Station de Bioclimatologie, Montfavet, France) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 277-310. refs

Results were reported from efforts to define numerical models for extracting evapotranspiration (ET) data from images generated by the Heat Capacity Mapping Mission (HCMM). The radiometer had a 500 x 500 m resolution, which was considered well-suited to ET studies. An energy balance equation was defined to relate the surface temperature and the evaporation. In a variation called the TERGRA model, account was taken of limitations imposed on ET by stomatal closure in periods of water stress. A TELL-US model was also devised for vegetation-sparse areas. The latter model required as input the daily minimum and maximum temperatures governing the diurnal pattern of surface temperature. Several other models are also described, and all model predictions are compared with in-situ data. It is found that effective assessments of ET requires several daytime-only temperature measurements and thorough accounting of atmospheric effects. M.S.K.

A86-44048
ASSOCIATION AMONG SURFACE TEMPERATURES SENSED BY SATELLITE AND AGRICULTURALLY RELATED VARIABLES
P. R. NIXON, C. L. WIEGAND, and A. J. RICHARDSON (USDA, Agricultural Research Service, Weslaco, TX) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 311-340. refs

Reflective (0.1-1.2 micron) and thermal IR (10.5-12.5 microns) data acquired by the Heat Capacity Mapping Mission over various crop areas in the Rio Grande Valley of Texas were compared with ground truth data for agricultural variables. The 480 m resolution satellite images were evaluated for usefulness in assessing crop water stress, temperature as affected by the plant canopy, freeze damage assessment, and cloud cover corrections. The data was also employed to generate aridity indices for the coverage areas. Attention was given to variations in the data for different crop types (sugarcane, citrus groves and sorghum). The study also covered synoptic scale temperature gradients inland from the coast, air temperatures for a 220 km wide area, and soil associations and vegetative cover. High correlations were found between the IR surface temperature data and the evapotranspiration rate. The IR data were also valuable for predicting the severity of freeze events for the crops. M.S.K.

A86-44160* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MULTIPLE INCIDENCE ANGLE SIR-B EXPERIMENT OVER ARGENTINA MAPPING OF FOREST UNITS
J. CIMINO, D. CASEY, S. D. WALL (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), A. BRANDANI (CONICET; Centro de Geologia de Costas, Mar del Plata, Argentina), and J. RABASSA (Provincia de Buenos Aires, Comision de Investigaciones Cientificas de la Provincia, La Plata, Argentina) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 498-509. NASA-supported research. refs

Multiple incidence angle SIR-B data of the Cordon la Grasa region of the Chubut Province of Argentina are used to discriminate various forest types by their relative brightness versus incidence angle signatures. The region consists of several species of Nothofagas which change in canopy structure with elevation, slope, and exposure. In general, the factors that appear to impact the radar response most are canopy structure, density, and ground cover (presence or absence of dead trunks and branches in particular). The results of this work indicate that (1) different forest species, and structures of a single species, may be discriminated using multiple incidence angle radar imagery and (2) it is essential to consider the variation in backscatter due to incidence angle when analyzing the comparing data collected at varying frequencies and polarizations. Author

A86-44161*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SIR-B OBSERVATIONS OF MICROWAVE BACKSCATTER DEPENDENCE ON SOIL MOISTURE, SURFACE ROUGHNESS, AND VEGETATION COVERS
J. R. WANG, J. C. SHIUE (NASA, Goddard Space Flight Center, Greenbelt, MD), E. T. ENGMAN (USDA, Agricultural Research Center, Beltsville, MD), M. RUSEK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and C. STEINMEIER (Freiburg, Universitaet, Freiburg im Breisgau, West Germany) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 510-516. refs

An experiment was conducted from an L-band SAR aboard Space Shuttle Challenger in October 1984 to study the microwave

backscatter dependence on soil moisture, surface roughness, and vegetation cover. The results based on the analyses of an image obtained at 21-deg incidence angle show a positive correlatlion between scattering coefficient and soil moisture content, with a sensitivity comparable to that derived from the ground radar measurements reported by Ulaby et al. (1978). The surface roughness strongly affects the microwave backscatter. A factor of two change in the standard deviation of surface roughness height gives a corresponding change of about 8 dB in the scattering coefficient. The microwave backscatter also depends on the vegetation types. Under the dry soil conditions, the scattering coefficient is observed to change from about -24 dB for an alfalfa or lettuce field to about -17 dB for a mature corn field. These results suggest that observations with a SAR system of multiple frequencies and polarizations are required to unravel the effects of soil moisture, surface roughness, and vegetation cover.
Author

A86-44162* Michigan Univ., Ann Arbor.
PRELIMINARY EVALUATION OF THE SIR-B RESPONSE TO SOIL MOISTURE, SURFACE ROUGHNESS, AND CROP CANOPY COVER
M. C. DOBSON and F. T. ULABY (Michigan, University, Ann Arbor) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 517-526. refs
(Contract JPL-956921; JPL-957191; NAS7-918)

Two predawn ascending data-takes by the Shuttle Imaging Radar-B (SIR-B) were used to evaluate the effects of surface roughness, crop canopy, and soil moisture on radar backscatter. The two images, separated by three days, were both obtained at 30-deg local angle of incidence, but with opposite azimuth viewing directions. The imagery was externally calibrated with respect to the radar backscattering coefficient sigma(0) via response to arrays of point and area-extended targets of known radar cross section. Three land-cover classes: (1) corn, (2) corn stubble and plowed bare soil, and (3) disked bare soil, soybeans, soybean stubble, alfalfa, and clover could be readily separated for either observation date on the basis of image tone alone. The dependence of sigma(0) on the surface roughness and canopy brightness inhibits the capability of SIR to globally estimate the near-surface soil moisture from the value of sigma(0) for single date observations, unless the surface roughness or canopy cover conditions are accounted for. However, within given ranges of these conditions, the sigma(0) was found to be highly correlated with the soil moisture. I.S.

A86-44164*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FOREST CANOPY CHARACTERIZATION AND VEGETATION PENETRATION ASSESSMENT WITH SPACE-BORNE RADAR
M. IMHOFF, C. VERMILLION (NASA, Goddard Space Flight Center, Greenbelt, MD), M. STORY (Science Applications Research Corp., Greenbelt, MD), F. KHAN (Bangladesh Space Research and Remote Sensing Organization, Science and Technology Div., Dhaka), and F. POLCYN (Michigan, Environmental Research Institute, Ann Arbor) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 535-542. refs

Synthetic Aperture Radar (SAR) images from the National Aeronautics and Space Administration's Shuttle Imaging Radar-B mission were used to analyze the effects of radar incidence angle on information content and vegetation penetration. Three SAR data sets using incidence angles of 26, 46, and 58 deg were acquired over the mangrove jungles of Southern Bangladesh. The data sets were digitally processed using 3 x 3, 7 x 7, and 11 x 11 spatial filters and geometrically registered to a multisource-multilevel-corraborative data base consisting of Landsat data, forest map data, and in situ acquired forest enumeration and topographic information. Analyses revealed that significant vegetation 'penetration' was found at all angles, and that tree and canopy structural morphology may exert an influence on this phenomenon. Author

A86-44171* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MICROWAVE PENETRATION AND ATTENUATION IN DESERT SOIL - A FIELD EXPERIMENT WITH THE SHUTTLE IMAGING RADAR
T. G. FARR, C. ELACHI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), P. HARTL, and K. CHOWDHURY (Stuttgart, Universitaet, West Germany) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 590-594. NASA-supported research. refs

Receivers buried in the Nevada desert were used with the Shuttle Imaging Radar to measure microwave attenuation as a function of soil moisture in situ. Results agree closely with laboratory measurements of attenuation and suggest that penetration of tens of centimeters in desert soils is common for L-band (1.2-GHz) radar. Author

A86-44445#
RESULTS OF THE GROUP AGROMET MONITORING PROJECT (GAMP)
A. ROSEMA (Environmental Analysis and Remote Sensing, Ltd., Delft, Netherlands) ESA Journal (ISSN 0379-2285), vol. 10, no. 1, 1986, p. 17-41. refs
(Contract ESA-5228/83-D/JS(SC))

Meteosat and conventional meteorological data obtained by the Group Agromat Monitoring Project during the 1979 growing season have been successfully integrated to achieve continuous mapping and monitoring of rainfall, evapotranspiration, germination dynamics and biomass development in the Sahelian zone of Mali and Mauretania. The rainfall, evapotranspiration and biomass mapping results have been verified, and the germination and biomass mappings were based on Meteosat-derived ground information. A + or - 30 percent accuracy of rainfall mapping, based on Meteosat-derived cloud information, and a + or - 10 percent (0.5 mm) accuracy of evapotranspiration mapping, based on Meteosat-derived ground information, were obtained. The application of Meteosat data for the evaluation of soil water infiltration immediately after rainfall is shown by the mapping and analysis of thermal inertia. R.R.

A86-44672
REMOTE SENSING OF NATURAL OBJECTS FROM SALYUT-7 [DISTANTSIONNOE ZONDIROVANIE PRIRODNYKH OB'EKTOV SO STANTSII 'SALIUT-7']
L. A. RONZHIN and IU. L. RESHTOGA Geodeziia i Kartografiia (ISSN 0016-7126), April 1986, p. 19-27. In Russian. refs

The advantages of narrow-band remote sensing are illustrated by Salyut-7 observations of various land-types in the Soviet Union. Attention is given to investigations of ore-bearing regions, geological structures in a mountain-forest region, and crop fields. B.J.

A86-44674
THE USE OF SPACE REMOTE-SENSING DATA IN FORESTRY [ISPOL'ZOVANIE KOSMICHESKOI INFORMATSII V LESNOM KHOZIAISTVE]
V. I. SUKHIKH Geodeziia i Kartografiia (ISSN 0016-7126), April 1986, p. 30-36. In Russian. refs

A86-46051
ASP, ANNUAL MEETING, 51ST, WASHINGTON, DC, MARCH 10-15, 1985, TECHNICAL PAPERS. VOLUMES 1 & 2
Falls Church, VA, American Society of Photogrammetry, 1985. Vol. 1, 458 p.; vol. 2, 456 p. For individual items see A86-46052 to A86-46124.

Papers are presented on a comparison of adjustement methods when parameters exceed conditions, improving the interpretability of high-altitude color infrared photography for the inventory, monitoring, and management of wildland resources, a computerized technique for the comparison of remotely sensed data (COMPAR), and the development of a digital geographic database for determining irrigation water allocations. Also considered are a Landsat-generated predictive model for prehistoric archaeological

sites, a comparison of Thematic Mapper simulation and Thematic Mapper data for urban environments, computer image correlation for the determination of camera station parameters, the development of a Permit Geographic Information System for coastal zone management, and the Landsat Thematic Mapper World Data Base. Other topics include the identification of linear features in agricultural landscapes through spatial analyses of Thermal Infrared Mutispectral Scanner data, calibration for radiometric measurements with nonwhite reflectance standards, upgrading the triangulation capacity of the Digicart system, and aerial monitoring of erosional characteristics to improve flood control and sediment management. Papers are also presented on the correction of stereomodel deformation in optic disk cup measurement, multimodel techniques in industrial photogrammetry, and Thematic Mapper crop spectral separability as determined by field radiometry. R.R.

A86-46058
USING REMOTELY SENSED DATA TO MAP VEGETATIVE COVER FOR HABITAT EVALUATION IN THE SAGINAW RIVER BASIN
R. S. LUNETTA (U.S. Army, Detroit, MI), R. G. CONGALTON, A. M. B. REKAS, and J. K. STOLL (U.S. Army, Engineer Waterways Experiment Station, Vicksburg, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 88-97. refs

A86-46060
A COMPARISON OF STEREOSCOPIC AND MONOSCOPIC INTERPRETATIONS ON STANDARD ASCS AERIAL PHOTOGRAPHY
J. L. SMITH (Virginia Polytechnic Institute and State University, Blacksburg) and G. LONG (Continental Forest Industries, Allendale, SC) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 107-114.

Nine average tree height/pine basal area categories were stereoscopically and monoscopically interpreted on standard ASCS aerial photography. The accuracies of these visual categorizations were compared using field verifications and multivariate discrete analysis techniques. Monoscopic interpretations of the original nine category classification system and of the three height classes were significantly poorer than the corresponding stereoscopic interpretations. However, the two methods produced interpretation accuracies for the three basal area categories which could not be statistically distinguished. Author

A86-46069
RECOGNITION OF SOUTHERN PINE SPECIES ON SMALL-SCALE COLOR-INFRARED AERIAL PHOTOGRAPHY
D. L. EVANS, J. S. HUGHES, and P. Y. BURNS (Louisiana State University, Baton Rouge) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 204-211. refs

Color-infrared (CIR), 1:58,000 and 1:12,000-scale aerial photographs were used to produce timber type maps of selected coompartments in the Kisatchie Ranger District of Kisatchie National Forest in Louisiana. Longleaf-slash and loblolly-shortleaf pine categories were readily interpreted by use of color and tonal characteristics on the 1:58,000-scale imagery flown on December 4 and 5, 1981. Although these two pine categories could not be distinguished on the 1:12,000-scale imagery flown on May 8, 1982, hardwoods were easily separated from pines. Additional CIR imagery flown on November 12, 1979 (1:130,000-scale) and March 22, 1984 (1:2,000-scale) exhibit the same photographic characteristics which made pine category separation possible. Apparently, low sun angle and stand and tree morphologic characteristics combine to produce a significant difference in reflective properties of the two pine groups. Verification plots were used to assess agreement between the type maps and field conditions. Of 122 plots, 108 were correctly identified, an approximate agreement of 89 percent. These findings strongly indicate that a combination of winter and late-spring CIR imagery may be most appropriate for production of accurate forest type maps of this region. Author

A86-46074
UNSUPERVISED CLUSTER ANALYSIS OF LANDSAT MSS DATA FOR INVENTORIES OF RAINED TROPICAL SAVANNA AGRICULTURE
D. W. HOWES (Eastern Kentucky University, Richmond, KY) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 243-252. refs

A86-46079
USE OF SPECTRAL REFLECTANCE TO CHARACTERIZE THE RESPONSE OF SOYBEAN TO OZONE STRESS
W. W. CURE (North Carolina State University, Raleigh) and A. S. HEAGLE (USDA, Raleigh, NC) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 294-301. refs

Exposure to ozone, a major component of photochemical air pollution, can injure leaves and reduce the yields of some crop plants. Field experiments to study the response of soybean and other crop species to ozone are presently being conducted at different locations in the U.S. using specially designed open-top field exposure chambers. At one site near Raleigh, NC, methods are being developed to use canopy reflectance as a nondestructive means of assessing the response of soybean to ozone stress. Characterization of the rate of senescence as the rate of change of reflectance at 560 and 620 nm appears most promising. A unique spectroradiometer system has been developed that allows overhead access to the plants in open-top chambers. Optical fibers, 50 to 60 meters in length, are extended to selected chambers from a monochromator and detector located in a small trailer on the edge of the field. A two-position, optical fiber switch allows light to be directed to the monochromator either from the plants or a standard reflecting surface. Author

A86-46081
REVISING AGRICULTURAL LAND USE MAPS BY DIGITAL CHANGE DETECTION ON LANDSAT DATA
R. S. MUSSAKOWSKI (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 312-321.

A86-46082
IMPROVING THE INTERPRETABILITY OF HIGH-ALTITUDE COLOR INFRARED PHOTOGRAPHY FOR THE INVENTORY, MONITORING AND MANAGEMENT OF WILDLAND RESOURCES
R. R. COLWELL (Oregon State University, Corvallis) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 323-330. USDA-supported research. refs

A86-46083
AN ANALYSIS OF SIR-A IMAGERY FOR MAPPING SOILS IN THE LAS CRUCES AREA OF NEW MEXICO
W. L. TENG (National Air and Space Museum, Washington, DC) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 341-351. refs

The usefulness of Shuttle Imaging Radar (SIR-A) imagery for mapping soils was assessed in a study of the Las Cruces area of New Mexico. A contact photographic print of the SIR-A image was analyzed visually, and units were delineated based on variations in image tone, texture, and association. The SIR-A units were compared with published soil survey mapping units and

landform units previously mapped by the author from panchromatic airphotos. In general, SIR-A image patterns correspond, regionally, to varying degrees of landscape dissection (more dissected areas are lighter-toned) and, locally, to differences in surface roughness (rougher areas are lighter-toned). In some smooth, dark-toned areas, the presence of coppice dunes is evident by their locally lighter tones. Arroyos are easily distinguished, due to their generally coarse-grained materials, and are enhanced where oriented orthogonally to the radar look direction. Some discrimination of grain sizes in the arroyos may be possible. Although mapping of soil units does not appear to be feasible at this time, the separation of different units is possible, particularly in areas of prominent topography. In general, information derived from the SIR-A image complements that from airphotos. Author

A86-46084* Autometric Corp., Inc., Falls Church, Va.
CROPLAND SOIL MOISTURE ESTIMATES DERIVED FROM DUAL POLARIZATION 1.66 CENTIMETER PASSIVE MICROWAVE IMAGERY FROM NIMBUS 7
P. H. HARDER (Autometric, Inc., Falls Church, VA) and M. J. MCFARLAND (Texas A&M University, College Station) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 352-361. Research supported by Texas A & M University and NASA. refs

A86-46087* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
IDENTIFICATION OF LINEAR FEATURES IN AGRICULTURAL LANDSCAPES THROUGH SPATIAL ANALYSES OF THERMAL INFRARED MULTISPECTRAL SCANNER DATA
R. E. PELLETIER (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 381-390. refs

A86-46088* Wisconsin Univ., Madison.
THE UTILITY OF DUAL-POLARIZATION SYNTHETIC APERTURE RADAR IMAGERY FOR VEGETATION TYPE DISCRIMINATION IN JAMAICA
R. W. KIEFER (Wisconsin, University, Madison) and C. A. WESSMAN IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 393-403. refs
(Contract NGT-50-002-800)

A86-46099
THE EFFECT OF SURFICIAL PROPERTIES ON LITHOLOGICAL DISCRIMINATION USING MSS DIGITAL DATA - AN UPDATE
B. E. KIRACOFE (Synectics Corp., Rome, NY) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 518-527. refs

Current knowledge using machine perception needs to be combined with knowledge of the relationships which exist in the physical environment in order to identify structural methodologies for natural resources assessment. This paper will report on the continuing research using image processing technologies with Landsat MSS data to focus on the vegetative/lithologic relationships which exist within the Adirondack Mountains, NY. Author

A86-46101* Utah Univ., Salt Lake City.
AN INTEGRATED LANDSAT/ANCILLARY DATA CLASSIFICATION OF DESERT RANGELAND
K. P. PRICE, M. K. RIDD, and J. A. MEROLA (Utah, University, Salt Lake City) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 538-545. Research supported by the Utah Department of Agriculture. Previously announced in STAR as N85-15248.
(Contract NAGW-95)

Range inventorying methods using Landsat MSS data, coupled with ancillary data were examined. The study area encompassed nearly 20,000 acres in Rush Valley, UT. The vegetation is predominately desert shrub and annual grasses, with same annual forbs. Three Landsat scenes were evaluated using a Kauth-Thomas brightness/greenness data transformation (May, June, and August dates). The data was classified using a four-band maximum-likelihood classifier. A print map was taken into the field to determine the relationship between print symbols and vegetation. It was determined that classification confusion could be greatly reduced by incorporating geomorphic units and soil texture (coarse vs fine) into the classification. Spectral data, geomorphic units, and soil texture were combined in a GIS format to produce a final vegetation map identifying 12 vegetation types. Author

A86-46105
IMAGE PROCESSING FOR SURVEYING NATURAL VEGETATION - POSSIBLE EFFECTS ON CLASSIFICATION ACCURACY
S. R. YOOL, D. W. ECKHARDT, J. L. STAR, T. L. BECKING, and J. E. ESTES (California, University, Santa Barbara) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 595-603. refs

Scientists studying the biosphere are concerned that massive forest clearing will result in net carbon dioxide emissions to the atmosphere that would promote global warming and associated environmental effects. Data from sensors aboard orbiting spacecraft may facilitate the production of acurate world forest maps that are needed to evaluate this concern. It is important to understand the limits of satellite-borne sensor data and data processing techniques for world forest mapping. Tests of data processing approches using Landsat data from a complex forested scene in California show the relative performances of ratioing, filtering and principal components approaches. Untransformed channels appear to perform best overall. Performances for untransformed, ratioed and the principal components of Landsat data channels are comparable for forest classes having complete cover. Filtered Landsat data channels performed poorest overall, but perform best on select forest classes. Performance variability appears to be related to variations in background reflectance, surface illumination and spatial pattern by class. Author

A86-46106* National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
MONITORING VEGETATION RECOVERY PATTERNS ON MOUNT ST. HELENS USING THERMAL INFRARED MULTISPECTRAL DATA
K. J. LANGRAN (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 612-617.

The eruptions of Mount St. Helens created new surfaces by stripping and implacing large volumes of eroded material and depositing tephra in the blast area and on the flanks of the mountain. Areas of major disturbance are those in the blast zone that were subject to debris avalanche, pyroclastic flows, mudflows, and blowdown and scorched timber; and those outside the blast zone that received extensive tephra deposits. These zones represent a spectrum of disturbance types and intensities that can be indexed by temperature, impact force, and depth of subsequent deposition. This paper describes an application of NASA's Thermal Infrared Multispectral Scanner (TIMS) in

monitoring vegetation recovery patterns in disturbed areas. Preliminary study results indicate a significant correlation between measured effective radiant temperature and vegetated/nonvegetated areas, percent vegetation cover, and vegetation type. Author

A86-46112
AERIAL PHOTO IDENTIFICATION OF FOREST HABITATS
WM. BEFORT and J. J. ULLIMAN (Idaho, University, Moscow) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 679-688. refs

To learn whether forest sites could be classified as to ecological habitat type by use of large-scale aerial sampling photography, 156 stands in northern Idaho and eastern Washington were photographed at scales around 1:1000. A type-identification key was assembled, and five interpreters were asked to assign habitat type labels to 111 stereophoto sample strips, representing 16 field-identified habitat types. A success rate of approximately 75 per cent was achieved. Extreme misclassifications were rare, and interpretations were highly correlated with the positions of the types along a bioclimatic gradient. Author

A86-46117
RESOURCE INVENTORY OF ONDO STATE (NIGERIA) BASED ON REGIONAL INTERPRETATION OF RADAR MOSAICS
P. O. ADENIYI (Lagos, University, Nigeria) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 755-765. refs

The development of an inventory of the land use/land cover for the State of Ondo, Nigeria is studied using X-band, 3-cm wavelength, real aperture, and 1:250,000 SLAR mosaics. The classification of the mosaics was based on vegetation of similar physiognomic characteristics and the mapping unit is a 3 mm minimum. Geomorphological and land use/land cover interpretations of the radar mosaics are described. The geomorphological analysis reveals eight geomorphological units, two in low land areas and six in areas underlain by metamorphic rocks. It is observed that the spatial distribution of land use/land cover is 62.33 percent agricultural land, 35.94 percent forest, 1.33 percent grassland/wooded-shrub land, and 0.09 percent built-up area. I.F.

A86-46122
RESEARCH OF MULTISPECTRAL VIDEO FOR REMOTE SENSING BY THE AGRICULTURAL RESEARCH SERVICE
P. R. NIXON (USDA, Agricultural Research Service, Weslaco, TX) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 854-859. refs

A86-46123* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
STRESS ASSESSMENT AND SPECTRAL CHARACTERIZATION OF SUSPECTED ACID DEPOSITION DAMAGE IN RED SPRUCE (PICEA RUBENS) FROM VERMONT
B. N. ROCK and J. E. VOGELMANN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 860-870. NASA-supported research. refs

The effects of acid deposition on Picea rubens are studied. The Picea rubens located at Camels Hump Mt., Mt. Ascutney, and Ripton, VT were analyzed using stress level evaluations, in situ spectral data, pressure bomb analysis, and aircraft sensors. Spruce stress per circular plot and percent spruce mortality are calculated. The relation between stress levels and elevation and exposure and weather patterns is examined. It is observed that variations in the reflectance curves of the foliage and branches are related to cellular health, the type of cellular arrangement, and the degree of leaf tissue hydration; the leaf and twig specimens from high stress sites are more reflective in the red portion of the visible and less reflective in the NIR portion of the spectrum. The pressure bomb data reveal that the xylem water tension is higher in specimens from high stress sites. It is noted that remote sensing permits discrimination and mapping of suspected acid deposition damage. I.F.

A86-47810#
CORRELATION OF METAL CONCENTRATION WITH ANOMALIES IN NARROW BAND MULTISPECTRAL IMAGERY OF THE VEGETATION RED REFLECTANCE EDGE
J. R. MILLER, E. W. HARE (York University, North York, Canada), R. A. NEVILLE, R. P. GAUTHIER, W. D. MCCOLL (Canada Centre for Remote Sensing, Ottawa) et al. IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 143-153. NSERC-supported research. refs

A geobotanical remote sensing experiment was conducted in the late summer of 1983 in northern Ontario over a known metal anomaly. Field data included measurements of vegetation spectral reflectance, in addition to collection of samples of soil and vegetation which were analyzed chemically to determine metal concentrations. Multispectral imagery was acquired with a five-channel pushbroom imager, known as MEIS II, configured with narrow band (3 nm bandwidth) interference filters to define the reflected vegetation radiance in the spectral region of the red reflectance edge. Preliminary analysis of the imagery, using an inverted Gaussian model for the red edge, is described. Author

A86-47821#
GEOBOTANICAL REMOTE SENSING OF HEAVY METAL STRESSED VEGETATION USING LANDSAT MSS DATA
C. BANNINGER (Institut fuer digitale Bildverarbeitung und Graphik, Graz, Austria) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 339-345. BMFWF-supported research. refs

Landsat MSS-derived radiance values and transformations from three different scene dates of a coniferous and a mixed coniferous-broadleaf forest situated in southeastern Austria show a close relationship with the copper, lead, and zinc content of the underlying soils. Landsat MSS bands 6 and 7 and the first principal component display generally strong negative correlations with respect to all three metals and their combinations and the three Landsat scene dates, whereas the ratio and normalized difference transformations employing MSS bands 5, 6, and 7 normally exhibit weaker and less consistent negative correlations. Ground, Landsat, and statistical data and results suggest that a reduction in canopy density associated with an increase in soil metal content is responsible for the observed decrease in canopy reflectance. Author

A86-47822*# California Univ., Berkeley.
ANALYSIS OF SUBSTRATE AND PLANT SPECTRAL FEATURES OF SEMI-ARID SHRUB COMMUNITIES IN THE OWENS VALLEY, CALIFORNIA
S. L. USTIN (California, University, Berkeley), B. N. ROCK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and R. A. WOODWARD (California, University, Davis) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 347-359. refs

Airborne Imaging Spectrometer (AIS) data were analyzed to deduce plant density and species composition in three semi-arid shrub-dominated communities of Owens Valley, CA, occurring on either a sand, granite alluvium, or basalt substrate. The high-spectral resolution AIS data were related to spectra obtained

with field portable spectrometers, which in turn were related to plant and soil characteristics of the communities. Many of the dominant species have unique spectral features which permit their identification in AIS pixel images. The canopy-induced shadow may be a major factor influencing substrate spectral properties during fall and winter, because of low sun angles. Moreover, changes in spectral signatures following dormancy and leaf senescence tend to decrease contrasts between the plant community and the geologic substrate, also suggesting that fall and winter are a difficult time of year for spectral analyses. I.S.

A86-47828*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AERIAL DETECTION OF LEAF SENESCENCE FOR A GEOBOTANICAL STUDY
M. SCHWALLER (NASA, Goddard Space Flight Center, Greenbelt, MD) and S. J. TKACH (Phillips Petroleum Co., Bartlesville, OK) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 449-456. refs

A geobotanical investigation based on the detection of premature leaf senescence was conducted in an area of predominantly chalcocite mineralization of the Keweenaw Peninsula in Michigan's Upper Peninsula. Spectrophotometric measurements indicated that the region from 600 to 700 nm captures the rise in red reflectance characteristic of senescent leaves. Observations at other wavelengths do not distinguish between senescent and green leaves as clearly and unequivocably as observations at these wavelengths. Small format black and white aerial photographs filtered for the red band (600 to 700 nm) and Thematic Mapper Simulator imagery were collected during the period of fall senescence in the study area. Soil samples were collected from two areas identified by leaf senescence and from two additional sites where the leaf canopy was still green. Geochemical analysis revealed that the sites characterized by premature leaf senescence had a significantly higher median soil copper concentration than the other two areas. Author

A86-47838*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE DETECTION OF SOIL GEOCHEMICAL ANOMALIES FROM AN AIRCRAFT PLATFORM - EXAMPLES FROM THE VIRGINIA PIEDMONT
R. BELL (NASA, Goddard Space Flight Center, Greenbelt, MD) and C. S. EVANS (Maryland, University, College Park) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 577-583. refs

The use of remote-sensing data on forest leaf flush to identify areas with anomalously high soil heavy-metal concentrations is demonstrated using airborne Thematic Mapper Simulator (TMS) leaf-area-index data obtained over two sites in Virginia in spring 1983 and 1984. Mean-reflectance differences, especially in the 760-900-nm and 630-690-nm bands, corresponding to delayed leaf flush are found to be good indicators of higher heavy-metal concentration. Airborne and ground-based canopy-temperature measurements are also shown to be significantly higher in high-heavy-metal areas than in control areas. T.K.

A86-47842#
SOIL THERMAL INERTIA AND SENSIBLE AND LATENT HEAT FLUXES BY REMOTE SENSING
D. HO (IBM France, S.A., Paris) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 635-643. refs

A simulation model of the heat-exchange process on the surface and in the soil (Ho, 1985) has shown that the surface temperature cycle is insensitive to the lower boundary conditions and the initial soil temperature profile. This makes it possible to treat the soil in a steady-state model like a transmission-line problem. As a result, the ground conducting flux can be considered as a function of the surface temperature and thermal inertia. From the daily temperature cycle it is possible to estimate the instants at which the conducting flux vanishes. Using Meteosat and NOAA visible and infrared data for November 4 and 5, 1982 over a region south of Chott Djerid (Tunisia) it is found that the conducting flux vanishes at around 07:30 and 16:00 LT. The sensible and latent heat fluxes at these instants are equal to the net radiation. The thermal inertia is also estimated by searching for the time when the sensible and latent heat fluxes vanish. At that instant, around 03:30 LT in this test case, thermal inertia is only a function of the net radiation and surface temperature. The result shows that thermal-inertia and heat-flux maps can eventually be generated from remotely sensed data. Author

A86-47845*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LITHOLOGIC MAPPING IN A FORESTED REGION USING REMOTELY SENSED DATA
E. MASUOKA, R. BELL (NASA, Goddard Space Flight Center, Greenbelt, MD), D. KYLE, T. GARMAN, M. TUTTLE (Maryland, University, College Park) et al. IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 683-691. refs

Forest canopies over different sedimentary lithologies of valleys and ridges are composed of different dominant species and have significantly different reflectance and emittance. In a botanical survey of eighty-seven forest sites, sedimentary lithologies were found to differ in the species which dominate the forest canopy. Sandstone sites had abundant chestnut oak (Quercus prinus), black oak (Q. velutina), and northern red oak (Q. rubra). On shale sites chestnut oak, white oak (Q. alba), northern red oak and red pine (Pinus resinosa) were dominant. Limestone sites had a variable species composition with the most common species, northern red oak, white oak, and black locust (Robinia pseudocacia) accounting for only 30 percent of the total trees. Thematic Mapper Simulator (TMS) data obtained during the growing season were analyzed to determine if sandstones, shales, and limestones could be distinguished on the basis of forest-canopy reflectance. The observations compared in the analysis were means of the eight TMS bands for 10 x 10-pixel test sites selected from areas with complete canopy closure. In August imagery the three lithologies were separable based on differences in TMS band 3 (630-690 nm) and band 8 (10.4-12.5 microns). Author

A86-47846*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MAPPING DIVERSE VEGETATION WITH MULTICHANNEL RADAR IMAGES
J. P. FORD, D. E. WICKLAND, A. OCAMPO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and R. R. SHARITZ (Georgia, University, Aiken, SC) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 693-699. NASA-supported research.

Airborne-SAR, SIR-A, Seasat SAR, and Landsat TM images of the Savannah River Plant, a gently sloping area of South Carolina covered with diverse vegetation, are presented and briefly characterized. Preliminary results indicate that multiple-polarization images constructed from the airborne-SAR data give some indication of forest density and understory growth but do not permit discrimination between evergreen and deciduous forests. Heat-tolerant vegetation growing on sand bars in streams bearing thermal effluents from nuclear reactors on the site is found to have a distinguishing polarization signature. T.K.

A86-48395
REMOTE SENSING OF SHIFTING CULTIVATION AND GRAZING PATTERNS IN KENYA'S SEMI-ARID REGION
W. PHILIPSON (Cornell University, Ithaca, NY) and G. O. WAYUMBA ITC Journal (ISSN 0303-2434), no. 4, 1985, p. 261-267. refs

In a representative semi-arid region in Kitui district, Kenya, medium scale, multi-date, panchromatic black-and-white aerial photographs and Landsat MSS data were analyzed using various manual and computer-assisted methods. The manual methods included stereoscopic analysis of the aerial photographs, and positive/negative masking colour additive viewing and diazo processing of the Landsat images. The digital methods used with the Landsat data were supervised classification (minimum distance to mean and parallelepiped classifiers), with and without rationing and canonical transformation, unsupervised classification (clustering); and a combined supervised and unsupervised classification (controlled cluster). The merits of the various methods are described including an assessment of their applicability in semi-arid regions. Author

A86-48954
DETECTION OF SURFACE SOIL VARIATION USING HIGH-RESOLUTION SATELLITE DATA - RESULTS FROM THE U.K SPOT-SIMULATION INVESTIGATION
G. G. WRIGHT and R. V. BIRNIE (Macaulay Institute for Soil Research, Aberdeen, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 757-766. refs

A86-48956
AN EVALUATION OF SPOT-SIMULATION IMAGERY FOR LAND-USE MAPPING AND ECOLOGICAL INVESTIGATIONS IN UPLAND AREAS OF NORTHERN IRELAND
N. L. BETTS, M. M. CRUICKSHANK, and R. W. TOMLINSON (Belfast, Queen's University, Northern Ireland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 779-790.

A86-48958
SPOT-SIMULATION CAMPAIGN - A PRELIMINARY LAND-USE CLASSIFICATION FOR A 200/SQ KM RIVER CATCHMENT
C. I. ESSERY and D. N. WILCOCK (Ulster, University, Coleraine, Northern Ireland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 801-814. refs

A preliminary land-use classification of the River Main drainage basin has been produced using SPOT-simulation imagery. The most successful classification procedure was a band-3/band-2 ratio. The major problem of the imagery was the similarity between bogland vegetation and bare soil. This problem has been overcome by means of an edited box-classification and the resulting areal estimates of land-use have been found to agree closely with the known ground truth. The advantages and limitations of the SPOT system are discussed in the context of the Northern Ireland landscape. Author

A86-49480
SURVEYING CHINA'S AGRICULTURAL RESOURCES - PATTERNS AND PROGRESS FROM SPACE
S. A. MORAIN (New Mexico, University, Albuquerque) Geocarto International, no. 1, 1986, p. 15-24. refs

An agricultural remote sensing center was developed at Beijing Agricultural University (BAU) in order to assess, monitor, and tabulate China's agricultural production. The BAU is the main research center for developing techniques for crop yield and production estimation and resource analysis throughout the six agroeconomic zones of China. Three examples revealing the applicability of remote sensing to China's agricultural production are described. The studies include: (1) an aerial, small format camera assessment of panda bear habitats in Baoxing County; (2) an evaluation of land-use categories in Yixing County using Landsat MSS data; and (3) biomass assessment using geometrically uncorrected AVHRR data of Inner Mongolia. I.F.

A86-49481
THE USE OF REMOTE SENSING IN MAPPING AND MONITORING VEGETATIONAL CHANGE ASSOCIATED WITH BUSHFIRE EVENTS IN EASTERN AUSTRALIA
A. K. MILNE (New South Wales, University, Kensington, Australia) Geocarto International, no. 1, 1986, p. 25-32. refs

A86-49511
CONTRACTION OF A TREE-COVERED AREA ACCORDING TO SIMULATED LANDSAT AND SPOT IMAGES - A SIGN OF HOW THE SAHEL ADAPTS ITSELF TO DROUGHT [LA CONTRACTION DE LA SURFACE ARBOREE, D'APRES LES IMAGES LANDSAT ET SPOT SIMULEES - SIGNE D'ADAPTATION SAHELIENNE A LA SECHERESSE]
M.-F. COUREL (Centre d'Etudes et de Realisations Cartographiques et Geographiques, Paris, France) Photo Interpretation (ISSN 0031-8523), vol. 24, Jan.-Feb. 1985, p. 9-13, 15. In French, English, and Spanish.

A86-49602#
METHODICAL INVESTIGATIONS CONCERNING THE IDENTIFICATION AND MAPPING OF HEATH AREAS (INCLUDING TRANSITIONAL POPULATIONS AND SUCCESSION STAGES) IN SATELLITE IMAGES [METHODISCHE UNTERSUCHUNGEN ZUR IDENTIFIKATION UND KARTIERUNG VON HEIDEFLAECHEN /EINSCHLIESSLICH UEBERGANGSGESELLSCHAFTEN UND SUKZESSIONSSTADIEN/ IN SATELLITENAUFNAHMEN]
H. ROHDENBURG (Braunschweig, Technische Universitaet, Brunswick, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublik Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 16 p. In German. refs

A86-49603#
EMPLOYMENT OF REMOTE SENSING, IN CASES RELATED TO WATER, SOIL, AND LAND USE, WITHIN THE FRAMEWORK OF PROJECTS OF THE FEDERAL INSTITUTE FOR EARTH SCIENCES AND RAW MATERIALS [ANWENDUNG DER FERNERKUNDUNG AUF DEN GEBIETEN WASSER, BODEN UND LANDNUTZUNG IM RAHMEN VON PROJEKTEN DER BUNDESANSTALT FUER GEOWISSENSCHAFTEN UND ROHSTOFFE /BGR/]
W. KRUCK BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublik Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 9 p. In German.

Since the time when images provided by earth resources satellites became available, 'remote sensing' has become an important factor for the West German institute considered in this paper. The projects concerned with water, soil, and land use involve mainly dry areas of the earth. The investigations required are often very complex, and there is an interaction between aspects of water, soil, and land use. The activities involved are illustrated by providing a description of some specific projects which have been selected as examples for the conducted studies. The project Burkina Faso (Upper Volta), for instance, involved an evaluation of imagery provided by Landsat I and II. The information obtained is related to geology, mineral deposits, soil, land use, and hydrology. Other projects described were concerned with Tahoua, Niger, and an area in northern Syria. G.R.

A86-49609#
QUANTIFICATION OF LAND DEGRADATION IN DEVELOPING COUNTRIES WITH THE AID OF REMOTE SENSING METHODS [QUANTIFIZIERUNG DER LANDSCHAFTSDEGRADATION IN ENTWICKLUNGSLAENDERN MIT FERNERKUNDUNGSMETHODEN]
W. ENDLICHER (Erlangen-Nuernberg, Universitaet, Erlangen, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 15 p. In German. refs

In the study of the processes which lead to land degradation, an important aspect is related to a quantification of such a degradation. Such a 'quantification' is concerned with the degree of soil erosion observed in connection with various forms of land use or with the local and regional extension of land degradation. It is pointed out that remote sensing methods are best suited for a quantification of land degradation in the chorological and regional dimension. The correctness of such a conclusion is demonstrated, taking into account, as a study area, the coastal highlands of Central Chile. Land degradation in this area can be recognized on the basis of soil erosion observations and the appearance of the vegetation. Attention is given to a diachronic-comparative quantification of linear soil erosion in the chorologic dimension on the basis of aerial photographs, and the quantification of land degradation in the case of the regional dimension on the basis of Landsat MSS data. G.R.

A86-49718* Los Alamos National Lab., N. Mex.
RADIATION PHYSICS AND MODELLING FOR OFF-NADIR SATELLITE-SENSING OF NON-LAMBERTIAN SURFACES
S. A. GERSTL and C. SIMMER (Los Alamos National Laboratory, NM) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Aug. 1986, p. 1-29. DOE-sponsored research. refs
(Contract NASA ORDER S-10786-C)

The primary objective of this paper is to provide a deeper understanding of the physics of satellite remote-sensing when off-nadir observations are considered. Emphasis is placed on the analysis and modeling of atmospheric effects and the radiative transfer of non-Lambertian surface reflectance characteristics from ground-level to satellite locations. The relative importance of spectral, spatial, angular, and temporal reflectance characteristics for satellite-sensed identification of vegetation types in the visible and near-infrared wavelength regions is evaluated. The highest identification value is attributed to angular reflectance signatures. Using radiative transfer calculations to evaluate the atmospheric effects on angular reflectance distributions of vegetation surfaces, atmosphere-invariant angular reflectance features such as the 'hot spot' and the 'persistent valley' are identified. A new atmospheric correction formalism for complete angular reflectance distributions is described. A sample calculation demonstrates that a highly non-Lambertian measured surface reflectance distribution can be retrieved from simulated satellite data in the visible and near infrared to within about 20 percent accuracy for almost all view directions up to 60 deg off-nadir. Thus the high value of angular surface reflectance characteristics (the 'angular signature') for satellite-sensed feature identification is confirmed, which provides a scientific basis for future off-nadir satellite observations.
Author

A86-49719
SAMPLE SIZE FOR GROUND AND REMOTELY SENSED DATA
P. J. CURRAN and H. D. WILLIAMSON (Sheffield, University, England) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Aug. 1986, p. 31-41. refs
(Contract NERC-GR/3/5096)

Sampled data are used to calibrate and determine the accuracy of both remotely sensed data and the products of remotely sensed data. The problems of achieving a balance between the size and the error of these samples are discussed at the level of the sites within the scene. Using an area of limestone grassland as an illustrative example, the sample size required to characterize a wide range of grassland fields was determined. With a maximum of 5-percent error at the 95-percent confidence level, the minimum sample size per field was noted to vary between 1-58 for ground radiometric and airborne multispectral scanner measurements, and 142-293 for green leaf area index measurements. The collection of such large sample sizes is unusual in remote sensing. It is concluded that there is a need for an increased awareness of the magnitude of the sampling error, and an attempt should be made to use the known spatial autocorrelation in the data to reduce the error for a given sample size. Author

A86-49763
THE EFFICIENCY OF THE UTILIZATION OF SPACE REMOTE-SENSING DATA IN FOREST MANAGEMENT [EFFEKTIVNOST' ISPOL'ZOVANIIA KOSMICHESKOI INFORMATSII V LESNOM KHOZIAISTVE]
V. V. EZHKOV, A. P. METALNIKOV, A. S. ISAEV, V. I. SUKHIKH, V. S. KUDRIAVTSEV (Gosudarstvennyi Komitet SSSR po Nauke i Tekhnike; Vsesoiuznoe Aerofotolesoustroitel'noe Ob'edinenie Lesproet; Ministerstvo Lesnogo Khoziaistva RSFSR, Moscow; AN SSSR, Institut Lesa i Drevesiny, Krasnoyarsk, USSR) et al. Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 3-12. In Russian. refs

A86-49767
IDENTIFICATION OF REGIONAL FEATURES OF WESTERN SIBERIAN SWAMPS FROM SPACE IMAGERY [VYIAVLENIE REGIONAL'NYKH OSOBENNOSTEI BOLOT ZAPADNOI SIBIRI NA OSNOVE KOSMICHESKIKH SNIMKOV]
S. M. GOROZHANKINA (AN SSSR, Institut Lesa i Drevesiny, Krasnoyarsk, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 29-37. In Russian. refs

A86-49771
REMOTE SPECTROMETRY METHODS FOR ASSESSING THE CONDITION OF WINTER RYE FIELDS AFTER WINTERING [DISTANTSIONNYE SPEKTROMETRICHESKIE METODY OTSENKI SOSTOIANIIA OZIMOI RZHI POSLE PEREZIMOVKI]
S. F. BUGA, E. A. IANOVSKAIA, A. F. IANOVSKII, and L. A. USHKEVICH (AN BSSR, Institut Fiziki, Minsk; Belorusskii Nauchno-Issledovatel'skii Institut Zashchity Rastenii, Priluki, Belorussian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 71-76. In Russian. refs

A86-49773
THE POSSIBILITY OF USING IR DATA TO EVALUATE EVAPOTRANSPIRATION IN CROPS [VOZMOZHNOSTI ISPOL'ZOVANIIA DANNYKH IK-DIAPAZONA DLIA OTSENKI EVAPOTRANSPIRATSII POSEVOV SEL'SKOKHOZIAISTVENNYKH KUL'TUR]
A. A. FEOKTISTOV (Vsesoiuznyi Nauchno-Issledovatel'skii Tsentr AIUS-agroresursy, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 94-99. In Russian. refs

N86-28490# GEC-Marconi Electronics Ltd., Chelmsford (England). Research Labs.
SAR FOR AGRICULTURE AND FORESTRY
S. QUEGAN, P. N. CHURCHILL (Hunting Surveys Ltd., Boreham Wood, England), A. WRIGHT, J. LAMONT, A. J. RYE, and J. W. TREVETT *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA p 7-14 Dec. 1985
Avail: NTIS HC A06/MF A01

The data handling, system engineering and information extraction necessary for a land-use SAR are discussed. Data handling requires techniques for change detection and interpretation; in both areas present knowledge is inadequate. The lack of multitemporal SAR data and coordinated plant parameter data are a severe hindrance to the development of techniques and physical understanding. The present state of knowledge does not permit clear definition of the parameters for a land use SAR sensor, nor the requirement for ancillary data. Image interpretation is argued to be best carried out on a land-unit rather than pixel-by-pixel basis. Texture is shown to be a potential source of information independent of mean backscatter for land-cover.

Human and machine measures of texture can be shown to correspond. ESA

N86-28491# National Aerospace Lab., Amsterdam (Netherlands).
USE OF A SAR IN AGRICULTURE AND FORESTRY
G. J. L. NOOREN, J. C. A. VANDERLUBBE, E. P. W. ATTEMA (Technische Hogeschool, Delft, Netherlands), L. KRUL, tj068073, and G. P. DELOOR (Physics Lab. RVO-TNO, The Hague, Netherlands) *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA p 15-20 Dec. 1985
(Contract ESA-5777/83-NL-MS)
Avail: NTIS HC A06/MF A01

Applications of SAR in agriculture and forestry were assessed, and classification and segmentation algorithms for SAR imagery were derived. Analysis suggests that for most of the applications, SAR imagery is inadequate. The segmentation algorithm is a bad estimator for field size, gives satisfactory results for field identification, and leads to accurate determination of field averaged pixel value. The performance improves when the number of looks is increased. The use of multitemporal data gives more improvement. The classifier is based on segments rather than pixels. For crop rotation detection, it gives a good result with a smaller training set than is usually required. The area determination is better than in the case of segmentation only. ESA

N86-28495# Hunting Geology and Geophysics Ltd., Boreham Wood (England).
LAND FEATURE EXTRACTION FROM SAR IMAGES
P. N. CHURCHILL, S. QUEGAN (Marconi Co. Ltd., Chelmsford, England), N. VECK, and J. W. TREVETT *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 51-55 Dec. 1985 Sponsored by ESA and British Government
Avail: NTIS HC A06/MF A01

The reliability and precision with which land features can be extracted from airborne and satellite borne SAR's are reviewed. The study demonstrates the benefits of combining optical with microwave sensors. The combination of different bands along the electromagnetic spectrum permits a greater depth of information to be analyzed. The combination of different ways of interacting with the vegetative canopy permits a wider analysis to be undertaken. Optical sensors tend to represent the reflection from the surface of the canopy, while active microwave sensors react with the structure of the canopy. ESA

N86-28498# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
STUDY OF THE POTENTIAL OF SAR FOR CROP IDENTIFICATION AND MONITORING
T. LETOAN, C. KERR, H. LAUR, A. LOPES, R. TOUZI, A. K. FUNG (Texas Univ., Arlington.), J. M. DURAND (Centre National d'Etudes Spatiales, Toulouse, France), Y. KERR, and J. PERBOS *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 73-85 Dec. 1985
(Contract ESA-6153/NL-MS)
Avail: NTIS HC A06/MF A01

It is shown that classification of vegetation covers with SAR data is possible using spectral and, to a lesser extent, textural information. To fully demonstrate this potential for a wide range of crop and climatic conditions adapted SAR data sets must be available. They should be mainly multitemporal, multipolarisation (HH and VV) and/or multifrequency SAR images associated with detailed ground data. Progress in processing techniques must be made, in particular in filtering and segmentation methods. Extraction of vegetation parameters is possible. ESA

N86-30245# Hebrew Univ., Jerusalem (Israel). Inst. of Earth Sciences.
A PROCEDURE FOR EVALUATION OF DUST POTENTIAL IN DESERT TERRAINS
R. GERSON, S. GROSSMAN, and R. AMIT 1985 87 p
(Contract DAJA45-83-C-0041)
(AD-A166491) Avail: NTIS HC A05/MF A01 CSCL 08B

The evaluation of dust potential in hot deserts is based on the association of well defined dust bearing soils and surficial deposits with specific landforms. Thses landforms are readily identified on airphotos (and in many cases on topographic maps and space imagery). The user may follow a sequence of operations, from the selection of a target area through the identification of relevant landforms and associated soils/surficial deposits, to the evaluation of the content, composition and distribution of dust in these media. The accompanying report is essential for the proper use of this procedure. GRA

N86-30933*# Foldes, Inc., Wayne, Pa.
A DESIGN STUDY FOR THE USE OF A MULTIPLE APERTURE DEPLOYABLE ANTENNA FOR SOIL MOISTURE REMOTE SENSING SATELLITE APPLICATIONS Final Report
P. FOLDES Aug. 1986 208 p
(Contract NAS1-17209)
(NASA-CR-178154; NAS 1.26:178154) Avail: NTIS HC A10/MF A01 CSCL 09A

The instrumentation problems associated with the measurement of soil moisture with a meaningful spatial and temperature resolution at a global scale are addressed. For this goal only medium term available affordable technology will be considered. The study while limited in scope, will utilize a large scale antenna structure, which is being developed presently as an experimental model. The interface constraints presented by a singel Space Transportation System (STS) flight will be assumed. Methodology consists of the following steps: review of science requirements; analyze effects of these requirements; present basic system engineering considerations and trade-offs related to orbit parameters, number of spacecraft and their lifetime, observation angles, beamwidth, crossover and swath, coverage percentage, beam quality and resolution, instrument quantities, and integration time; bracket the key system characteristics and develop an electromagnetic design of the antenna-passive radiometer system. Several aperture division combinations and feed array concepts are investigated to achieve maximum feasible performacne within the stated STS constraints. B.G.

N86-31084# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Hochfrequenztechnik.
THE X-SAR SCIENCE PLAN
H. OETTL and F. VALDONI (Consiglio Nazionale delle Ricerche, Rome, Italy) Nov. 1985 165 p
(DFVLR-MITT-85-17; ISSN-0176-7739; ETN-86-97451) Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Use of the X-SAR/SIR-C radar for geology, hydrology, oceanography, ice and snow cover, and vegetation remote sensing are discussed. ESA

N86-31092# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
VEGETATION
A. J. SIEBER, F. POSA (Bari Univ., Italy), and M. RICOTTILLI (Consiglio Nazionale delle Ricerche, Rome, Italy) *In its* The X-SAR Science Plan p 133-155 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Economic and technical advantages of X-SAR/SIR-C remote sensing of vegetation and land use are discussed. Investigations for the X-SAR mission are summarized: Radar response as function of biophysical properties of crops; crop type identification; phenological evaluation; vegetation stress conditions; vegetation indexes; rangeland assessment; and synergic effects of combining

optical and SAR data for identifying and characterizing crop cover. ESA

N86-31941*# California Univ., Santa Barbara. Dept. of Geography.
COVER PROJECT AND EARTH RESOURCES RESEARCH TRANSITION Final Technical Report
D. B. BOTKIN and J. E. ESTES, principal investigators 1986 46 p
(Contract NCC9-13)
(NASA-CR-177176; NAS 1.26:177176) Avail: NTIS HC A03/MF A01 CSCL 05B

Results of research in the remote sensing of natural boreal forest vegetation (the COVER project) are summarized. The study objectives were to establish a baseline forest test site; develop transforms of LANDSAT MSS and TM data for forest composition, biomass, leaf area index, and net primary productivity; and perform tasks required for testing hypotheses regarding observed spectral responses to changes in leaf area index in aspen. In addition, the transfer and documentation of data collected in the COVER project (removed from the Johnson Space Center following the discontinuation of Earth resources research at that facility) is described. M.G.

N86-31971# European Space Agency, Paris (France).
CALIBRATION OF MULTISPECTRAL SCANNER (MSS) SATELLITE DATA TO EVALUATE CHANGE IN THE REFLECTION OF CONIFEROUS STOCKS
G. P. FEHLERT Nov. 1985 180 p Original language document was announced as N86-10636
(ESA-TT-938; DFVLR-FB-84-44; ETN-86-97575) Avail: NTIS HC A09/MF A01; original German version available from DFVLR, Cologne, West Germany DM 71

A relative calibration was performed in order to allow a comparative, multitemporal analysis of MSS satellite data and hence the detection of reflectory changes with regard to selected object classes. By applying the method to the class wood, the age of a coniferous stock can be determined, and during the stage of growth distinct age groups show locally differing reflection properties. The latter suggests disorders of the proliferation of young sprouts. This method can be an early indicator for the detection of damaged forest areas. The atmospheric influence on satellite data was determined by a multilayer atmospheric model. ESA

N86-32828*# Environmental Research Inst. of Michigan, Ann Arbor. Applications Div.
A FUELWOOD PLANTATION SITE SELECTION PROCEDURE USING GEOGRAPHIC INFORMATION SYSTEM TECHNOLOGY: A CASE STUDY IN SUPPORT OF THE NASA GLOBAL HABITABILITY PROGRAM Final Report, 1 Feb. 1985 - 30 Jun. 1985
N. E. G. ROLLER, J. E. COLWELL, and A. N. SELLMAN Jul. 1985 39 p
(Contract NASW-3852)
(NASA-CR-179704; NAS 1.26:179704; ERIM-173900-2-F) Avail: NTIS HC A03/MF A01 CSCL 02F

A study undertaken in support of NASA's Global Habitability Program is described. A demonstration of geographic information system (GIS) technology for site evaluation and selection is given. The objective was to locate potential fuelwood plantations within a 50 km radius of Nairobi, Kenya. A model was developed to evaluate site potential based on capability and suitability criteria and implemented using the Environmental Research Institute of Michigan's geographic information system. Author

N86-32829*# Delaware Univ., Newark. College of Marine Studies.
EVALUATION OF SPATIAL, RADIOMETRIC AND SPECTRAL THEMATIC MAPPER PERFORMANCE FOR COASTAL STUDIES Quarterly Status and Technical Progress Report, 1 Jul. - 30 Sep. 1984
V. KLEMAS 1985 4 p
(Contract NAS5-27580)
(NASA-CR-177149; NAS 1.26:177149) Avail: NTIS HC A02/MF A01 CSCL 08B

The main emphasis of the research was to determine what effect different wetland plant canopies would have upon observed reflectance in Thematic Mapper bands. The three major vegetation canopy types (broadleaf, gramineous and leafless) produce unique spectral responses for a similar quantity of live biomass. Biomass estimates computed from spectral data were most similar to biomass estimates determined from harvest data when models developed for a specific canopy were used. In other words, the spectral biomass estimate of a broadleaf canopy was most similar to the harvest biomass estimate when a broadleaf canopy radiance model was used. Work is continuing to more precisely determine regression coefficients for each canopy type and to model the change in the coefficients with various combinations of canopy types. Researchers suspect that textural and spatial considerations can be used to identify canopy types and improve biomass estimates from Thematic Mapper data. Author

N86-32830# European Space Agency, Paris (France).
MICROWAVE REMOTE SENSING APPLIED TO VEGETATION
W. R. BURKE, comp. Jan. 1985 159 p EARSeL Workshop held in Amsterdam, Netherlands, 10-12 Dec. 1984
(ESA-SP-227; ISSN-0379-6566; ETN-86-95054) Avail: NTIS HC A08/MF A01

Two approaches to radar signal processing for remote sensing are reviewed. The first considers the microwave region as just another window to be used in combination with the ones already existing in other wavelength regions. The second tries to solve the problem by fundamental investigations in the interaction between microwaves and remote sensing objects. ESA

N86-32832# Sheffield Univ. (England). Dept. of Geography.
ACTIVE MICROWAVE MAPPING OF VEGETATION
G. M. FOODY *In* ESA Microwave Remote Sensing Applied to Vegetation p 15-23 Jan. 1985
Avail: NTIS HC A08/MF A01

Per pixel and per field sampling methodologies for land cover mapping are compared. As a result of the changing viewing geometry, land cover map accuracy is found to be low and spatially variable. In an area of flat terrain land cover map accuracy is increased by allowing for the variations in viewing geometry by dividing the image into sectors defined by range distance and treating each sector independently. Using SAR 580 data, it is found that the use of tonal and textural information collected on a per field basis for a sectored image gives the highest land cover map accuracy. However, land cover map accuracy remains spatially variable. ESA

N86-32833# Hunting Geology and Geophysics Ltd., Boreham Wood (England).
A REVIEW OF RADAR ANALYSIS OF WOODLAND
P. N. CHURCHILL, A. I. D. HORNE (Forestry Commission, Farnham (England).), and R. KESSLER (Freiburg Univ. (West Germany).) *In* ESA Microwave Remote Sensing Applied to Vegatation p 25-32 Jan. 1985
(Contract ESTEC-5778/83/NS-MS)
Avail: NTIS HC A08/MF A01

The ability of satellite imaging radar to make woodland determination is assessed, and the optimum radar parameters required are reviewed. Imagery and methods used in the analysis of imaging radar data of woodland are discussed. Imaging radar demonstrates great potential in making woodland determinations, but insufficient data exists to ascertain its full potential and to

fully define optimum system parameters for the analysis of woodland. More work is needed to eliminate speckle and to incorporate texture or pattern measures in machine classification. ESA

N86-32839# Freiburg Univ. (West Germany). Abt. Luftbildmessung und Fernerkundung.
SOME PRELIMINARY RESULTS ON LAND USE EVALUATIONS BY TEXTURE ANALYSIS OF SAR-580 DATA OVER THE TEST SITE FREIBURG (WEST GERMANY)
R. KESSLER and R. WALTENSPIEL *In* ESA Microwave Remote Sensing Applied to Vegetation p 85-91 Jan. 1985
Avail: NTIS HC A08/MF A01

Texture investigations of digital SAR-50 data in X-HH are described. Forest and agricultural sites were tested with a texture analysis program which informs about the statistical distribution of radar reflection intensities. The results show textural properties of the sites by demonstrating the statistical variations of backscatter intensity graphs along an adjustable boundary, which is located parallel to the mean intensity value. ESA

N86-32840# Royal Aircraft Establishment, Farnborough (England). National Remote Sensing Centre.
SAR IMAGE SEGMENTATION USING DIGITISED FIELD BOUNDARIES FOR CROP MAPPING AND MONITORING APPLICATIONS
M. G. WOODING *In* ESA Microwave Remote Sensing Applied to Vegetation p 93-98 Jan. 1985
Avail: NTIS HC A08/MF A01

The use of digitized field boundary data to segment images into fields which are treated as separate units for backscatter measurement and image classification in SAR surveys of agricultural regions is discussed. The technique is demonstrated with the analysis of SAR 580 data for the GB6 test site in England. Digitized field boundaries are overlain on SAR 580 images geometrically corrected to fit the UK National Grid. Image analysis includes the preparation of images showing mean backscatter values for individual fields, the measurement of backscatter for different crop types, and the analysis of changes in backscatter on different imaging dates. Relationships between backscatter and ground data are examined in the context of crop mapping and monitoring crop growth. ESA

N86-32841# Wageningen Agricultural Univ. (Netherlands). Dept. of Land Surveying and Remote Sensing.
TEXTURE ANALYSIS OF SLAR IMAGES AS AN AID IN AUTOMATED CLASSIFICATION OF FORESTED AREAS
D. H. HOEKMAN *In* ESA Microwave Remote Sensing Applied to Vegetation p 99-109 Jan. 1985
Avail: NTIS HC A08/MF A01

Experiments to elucidate the usefulness and behavior of statistical texture measures derived from gray level co-occurence and gray level difference counts in forest classification from SLAR imagery were performed. A fine resolution SLAR image of a forest with stands of tree species in the pole phase together with mature beach forests occurring in various spatial structures related to canopy roughness was analyzed. The measures reveal the potential to discriminate these forest structures. An integral classification approach for forests is suggested. ESA

N86-32842# Canada Centre for Remote Sensing, Ottawa (Ontario).
MICROWAVE REMOTE SENSING OF AGRICULTURAL CROPS IN CANADA
J. CIHLAR, R. J. BROWN, and B. GUINDON *In* ESA Microwave Remote Sensing Applied to Vegetation p 113-120 Jan. 1985
Avail: NTIS HC A08/MF A01

Crop classification accuracies achieved with SAR, visible, and IR data; crop and soil parameters affecting SAR images; the procedures for digital SAR image analysis; and the relationship between airborne SAR data and satellite SAR data are discussed. Developments in ground and airborne microwave instrumentation for agricultural studies are presented, and research activities are outlined. ESA

N86-32846# Dundee Univ. (Scotland). Lab. of Physics.
THE PHYSICAL BASIS OF REMOTE SENSING
J. M. ANDERSON *In* ESA Remote Sensing Applications in Civil Engineering p 1-7 Mar. 1985
Avail: NTIS HC A06/MF A01

Remote sensing by passive methods, whereby the surface of interest is the source of the radiation reaching the detector; passive methods whereby the Sun or other natural source provides the radiation reflected towards the detector; and active methods, whereby a magnetron, laser, or other man-made source provides the radiation reflected towards the detector is introduced. The theory of electromagnetic radiation in the visible/near infrared, and thermal infrared regions necessary for passive methods is outlined. Surface effects and detection systems are discussed. ESA

N86-32847# Stirling Univ. (Scotland).
THE PHYSICAL BASIS OF REMOTE SENSING
A. I. WATSON *In* ESA Remote Sensing Applications in Civil Engineerig p 9-13 Mar. 1985
Avail: NTIS HC A06/MF A01

The changes that occur in electromagnetic radiation and matter when they interact, exploited in remote sensing, are described. Emission sources, transmission, reflectance, detectors, remote sensing systems, and system assessment criteria are discussed. ESA

N86-32870# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
SEMI-OPERATIONAL IDENTIFICATION OF AGRICULTURAL CROPS FROM AIRBORNE SLAR DATA
P. BINNENKADE, H. W. J. VANKASTEREN, and D. UENK 26 Mar. 1985 11 p Presented at 11th Intern. Symposium on Machine Processing of Remotely Sensed Data, West Lafayette, Ind., 25-27 Jun. 1985 Previously announced in IAA as A86-37025
(NLR-MP-85030-U; B8665118; ETN-86-97674) Avail: NTIS HC A02/MF A01

Preprocessing, segmentation, and pseudo-hierarchical classification of a multitemporal data set of three test sites for identification of potatoes and other agricultural crops is described. Good discrimination capabilities between crop types, especially potatoes, is achieved. Unique identification of the three major crop types (sugar beets, potatoes and winter wheat) with an accuracy greater than 90% is possible. In one area, this accuracy is obtained when using only the July data set. It appears possible to identify more than one species of winter wheat and potatoes. Oats and barley are difficult to distinguish from other crop types. It is possible to obtain the required results with a high and a low track in July and one other run in May. ESA

N86-32872# Instituut voor Culturrtechniek en Waterhuishouding, Wageningen (Netherlands).
REMOTE SENSING STUDY PROJECT IN OOST-GELDERLANDS (NETHERLANDS) Final Report [REMOTE SENSING STUDIEPROJECT OOST GELDERLAND]
Sep. 1985 65 p In DUTCH
(NOTA-1641; ETN-86-97495) Avail: NTIS HC A04/MF A01

Possibilities of operational applications of remote sensing (RS) recording and processing techniques for agriculture and nature areas were investigated. Information about water consumption of vegetation covering, soil moisture supply, crop production, the composition of natural vegetation, and the occurrence of agricultural crops was obtained in rural areas and peat colonies in the summer. Scanner recorded reflection and heat images and false color photographs were used. A vegetational description and an evapotranspiration map were composed using the automatic processing of digital reflection and heat images. The application of a combination of RS and conventional techniques leads to

better results than the separate use of one of the techniques. ESA

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.

A86-43516#
A CLASSIFICATION FOR URBAN LAND COVERAGE USING AIRBORNE MULTI-SPECTRAL SCANNER IMAGE
A. HOYANO, Y. URANO, Y. MINAMIKAWA, and M. KATO (Kyushu University, Fukuoka, Japan) Kyushu University, Technology Reports (ISSN 0023-2718), vol. 59, Jan. 1986, p. 105-112. In Japanese, with abstract in English.

Aspects of urban land coverage are the most important information for investigating the urban thermal environment. This paper deals with an effective method of classification of land coverage using airborne multispectral scanner images with high visibility of 2 x 2 m ground objects. A pixel-by-pixel maximum likelihood method was used for supervised classification. Three training data files for land coverage categories were compiled with regard to both land coverage and land use and the characteristics of each type of training data were clarified. Clear classification results were obtained among 13 categories which are basic components of urban structure: buildings, pavements, vegetation, etc. Furthermore, the following items were discussed: (1) significant channels of the MSS image, (2) effects of ground visibility of MSS image on classification results, and (3) comparison with other classification methods. Author

A86-45705#
SPACE AGE LESSONS ABOUT OUR ENVIRONMENT
H. FRIEDMAN Aerospace America (ISSN 0740-722X), vol. 24, July 1986, p. 28-30.

A comprehensive discussion is presented on the implications of the complete atmospheric, climatological and vegetation cover data obtained to date by advanced sensor technologies and analysis methods. Attention is given to the reduction of ozone by chlorofluorcarbons and nitrogen oxides, the anthropogenic CO2-based greenhouse-effect warming trend, greenhouse warming consequences for rainfall patterns and continental vegetation cover distributions, and the contribution of methane to the greenhouse effect. Landsat Thematic Mapper and Very High Resolution Radiometer data for these phenomena are now being supplemented by the European SPOT remote sensing satellite. O.C.

A86-46057
DELINEATING PORT-RELATED PROCESSING AND FABRICATION LAND USE NORTHWEST OF PORT BALTIMORE USING A REMOTE SENSING BASED GEOGRAPHIC INFORMATION SYSTEM
T. D. MORELLI (DMA, Hydrographic/Topographic Center, Washington, DC) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 78-87. refs

A86-46062
USE OF THEMATIC MAPPER DATA TO UPDATE THE LAND COVER LAYER IN A DATA BASE FOR ELECTRIC POWER GENERATION FACILITIES
D. A. MILLER, G. M. BAUMER, B. J. TURNER (Pennsylvania State University, University Park), and D. Y. HEIVLY (Pennsylvania Power and Light Co., Allentown) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 128-136.

Landsat-4 TM data were used to generate vegetation/land cover classification maps for the Pennsylvania Power and Light Company. Preprocessing, analysis and display of the digital data was performed by the Office for Remote Sensing of Earth Resources (ORSER) digital image processing system. Final classified maps were produced by applying a Euclidean distance classifier to selected signatures for vegetation and land cover produced using a combination of unsupervised and supervised techniques. Maps created on a scale of 1:24,000 were composited with USGS 7-1/2 minute quadrangle maps, and were compared to existing aerial photographs and Environmental and Land-Use Data System maps. Good geographical precision was found, though the increased spatial resolution of the data significantly increased the spectral variability found in the scene, resulting in difficult classification for urban fringe areas and mixed residential agricultural areas. R.R.

A86-46064
LANDSAT TECHNIQUES DEVELOPMENT FOR AN INDUSTRIAL SITE OF GABUN-PARACALE MINING PROJECT
A. A. NAVARRO (Gabun-Paracale Mining Co., Inc., Manila, Philippines) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 147-151.

In the coming decades of the 20th century, Landsat surveying and mapping will be much needed by developing countries. In the sense that large industrial sites development should be located near the natural resources that they should use for their own raw materials in order to make the availability of this strategic resources for their own industrialization needs. In our own inventorying and raw material needs the geobotanical methods have been used, as well as electroscanning devices or 'footprint' methods by laser beam soil reflectance. And the most simplest is the degree of luminescence coefficient using computational activities in the industrial site pixel to determine the quality of industrial deposits in the mineralized regions for industrial plant locations. Author

A86-46072
SURVEYING AND AUTOMATIC MAPPING OF SAO PAULO STATE, BRAZIL - A GEOGRAPHIC INFORMATION SYSTEM WITH EMPHASIS OF LAND USE
R. S. FILHO, A. C. CAVALLI (TerraFoto S/A, Sao Paulo, Brazil), and H. S. PINTO (Campinas, Universidade Estadual, Brazil) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 229-236. refs

The State of S. Paulo is a region of some 250,000 sq km situated in southeastern Brazil. As a tropical area is shows extreme variation in geographical information, providing government and private campanies with a large amount of data which, despite being available, are not organized or standardized in the greatest part of the existing files. In the development of applied projects in areas of Land Use Monitoring, Production Forecasts, and Field Surveys, etc., a system called 'State System for Geographical Information' is being developed, to concentrate all kinds of geographical data in a data bank of an INTERGRAPH System. The basic information will be recorded as a grid of 1,000,000 points, referred to UTM coordinates, each one being an 'address' for up to 63 levels of data attributes. It is supposed that the ability of the computer for transferring information from a grid to a polygon basis and vice-versa, allied to a sampling model to be used in the field, will result in a fast and cost effective system with very low index of error. Author

A86-46078
DEVELOPMENT OF A PERMIT GEOGRAPHIC INFORMATION SYSTEM FOR COASTAL ZONE MANAGEMENT
J. M. HILL, D. L. EVANS (Louisiana State University, Baton Rouge), and J. B. BLACKMON (Louisiana State, Dept. of Natural Resources, Baton Rouge) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 284-293. refs

A Permit Geographic Information System (PGIS), capable of such functions as multiple map comparison and manipulation, area calculation and tabulation, and textual documentation, is developed for the Louisiana Department of Natural Resources. The system is demonstrated using a modified version of NASA's ELAS, and mapped data sets, consisting of land/water, shoreline length and density, and comparison maps, are in a 50-by-50 meter data cell format. Computer file inputs include Landsat MSS data, mapped data such as environmental habitats and permit locations, and associated textual data, and the final database for coastal Lafourche Parish, Louisiana consists of nine original data maps and eight PGIS-derived maps. Comparisons of maps from over an eight-year period indicate that marsh deterioration is rapidly occurring in the study area. R.R.

A86-46080
A COMPARISON OF THEMATIC MAPPER SIMULATOR AND THEMATIC MAPPER DATA FOR URBAN ENVIRONMENTS
B. N. HAACK (Ball State University, Muncie, IN) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 302-311. refs

Thematic Mapper Simulator (TMS) data collected for the Los Angeles Basin in July, 1980 were digitally examined to assess their utility for urban and near-urban land-cover delimitations. Statistics for twenty-one training sites respresenting eight land-cover types were obtained and examined using transformed divergence calculations for intraclass variability and the best bands for classsification. Thematic Mapper (TM) data collected in December, 1982 were examined using the same training sites and analysis techniques as for the TMS data. The intent of this comparison was to assess the validity of simulator data in determining TM sensor performance. In this study, the TMS and TM data provided very similar results on their ability to delimit urban and near-urban land-covers. Author

A86-46085* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LANDSAT THEMATIC MAPPER WORLD DATA BASE
R. W. LUDWIG, P. M. MASUOKA (NASA, Goddard Space Flight Center, Greenbelt, MD), and L. STUART IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 362-370.

A World Data Base of potential thematic mapper (TM) scenes was developed to aid in acquisition planning. The World Data Base contains geopolitical, geographic and economic regions along with a format that enables users to find the satellite day, sun angle and cloud cover probability for any month of the year. Scenes that have been acquired by TM and have an average cloud cover of 30 percent of less from July 1982 when TM was launched until the Landsat system was taken over by NOAA in September 1984 are also in the World Data Base. Processed data are referenced in maps and data bases at EROS Data Center; however, a large number of acquistions have never been processed and therefore are not accessible. The World Data Base enables the rapid location of scenes and areas with the least effort making it invaluable in TM scheduling. Users of TM data can use the World Data Base to determine if scenes of interest have been acquired, the acquisition date, and if scenes have been processed to computer-compatible tape (CCT). These uses of the World Data Base make it a valuable tool in the acquisition and location of TM scenes. Author

A86-46093
A LANDSAT-GENERATED PREDICTIVE MODEL FOR PREHISTORIC ARCHAEOLOGICAL SITES - AN EXAMPLE FROM DELAWARE'S COASTAL PLAIN
T. J. EVELEIGH (Autometric, Inc., Falls Church, VA) and J. F. CUSTER (Delaware, University, Newark) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 450-459. Research supported by the University of Delaware Research Foundation, National Park Survey, Delaware Department of Transportation, and Arthur Volkman Memorial Fund. refs

The determination of site probability with a logistic regression model that uses an environmental database as the source of independent variables is examined. The development of the database for the model using Landsat imagery of the Delaware coastal plain, specifically the Saint Jones and Murderkill drainages, is described. The training of the model is considered. The application of the model to the prediction of the potential site distribution in the Delaware coastal plain is discussed. It is noted that the Landsat data is useful for mapping of large ecological and environmental zones. I.F.

A86-46100* Utah Univ., Salt Lake City.
A GEOGRAPHIC INFORMATION SYSTEM FOR RESOURCE MANAGERS BASED ON MULTI-LEVEL REMOTE SENSING DATA
D. J. WHEELER and M. K. RIDD (Utah, University, Salt Lake City) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 528-537. Research supported by the Utah Department of Agriculture. Previously announced in STAR as N85-15249.
(Contract NAGW-95)

Procedures followed in developing a test case geographic information system derived primarily from remotely sensed data for the North Cache Soil Conservation District (SCD) in northern Utah are outlined. The North Cache SCD faces serious problems regarding water allocation, flood and geologic hazards, urban encroachment into prime farmland, soil erosion, and wildlife habitat. Four fundamental data planes were initially entered into the geo-referenced data base: (1) land use/land cover information for the agricultural and built-up areas of the valley obtained from various forms of aerial photography; (2) vegetation/land cover in mountains classified digitally from Landsat; (3) geomorphic terrain units derived from aerial photography and soil maps; and (4) digital terrain maps obtained from DMA digital data. The land use/vegetation/land cover information from manual photographic and Landsat interpretation were joined digitally into a single data plane with an integrated legend, and segmented into quadrangle units. These were merged with the digitized geomorphic units and the digital terrain data using a Prime 400 minicomputer. All data planes were geo-referenced to a UTM coordinate grid. Author

A86-46108
TRANSPORTATION APPLICATIONS OF REMOTE SENSING INFORMATION
C. R. FERGUSON (Towne Engineering, Inc.; Connecticut, University, Mansfield) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 642-650. refs

General and engineering remote sensing applications are studied. The use of a land information system or multipurpose cadastres for transportation projects is examined. A land information system is designed to collect, store, manipulate, integrate, and analyze data pertaining to land parcels. Multipurpose cadastres are registers of land parcels containing data ranging from ownership and location to soil type and demographics. The development of property boundary coordinates with a combination of ground surveying and analytical photogrammetric techniques is described. GPS satellite surveying which involves estimating coordinates from recorded satellite signals is analyzed. The

advantages these procedures will provide to the development of transportation systems are discussed. I.F.

A86-48952
REMOTE SENSING AND AN EXPERIMENTAL GEOGRAPHIC INFORMATION SYSTEM FOR ENVIRONMENTAL MONITORING, RESOURCE PLANNING AND MANAGEMENT
J. A. T. YOUNG (Edinburgh, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 741-744.

A86-48955
REMOTE SENSING IN LAND-USE PLANNING - AN APPLICATION IN WEST CENTRAL SCOTLAND USING SPOT-SIMULATION DATA
G. M. BUCHAN (Strathclyde Regional Council, Dept. of Physical Planning, Glasgow, Scotland) and N. K. HUBBARD (Environmental Remote Sensing Applications Centre, Ltd., Livingston, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 767-777. refs

A86-49606#
REMOTE SENSING AS AN AID IN 'SPATIAL PLANNING' [FERNERKUNDUNG ALS HILFSMITTEL IN DER RAEUMLICHEN PLANUNG]
F. ARNOLD (Bundesforschungsanstalt fuer Naturschutz und Landschaftsoekologie, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 8 p. In German.

Planning for which the 'spatial reference plane is the surface of the earth' is considered. The considered planning activities are concerned with the preservation of environment, ecology, and nature. In addition, problems related to a restoration of ecological performance characteristics for man have to be resolved. Such planning activities must be based on knowledge and data regarding the basic processes and phenomena involved. There exists, however, in West Germany an 'information deficit' regarding the information required. Approaches for overcoming this difficulty with the aid of remote sensing are discussed, taking into account also weaknesses regarding the data currently provided by aircraft-borne and satellite-borne equipment. These weaknesses are partly already being eliminated in connection with the development of high-resolution sensors for Landsat IV and the SPOT simulation program. Certain problems regarding the utilization of remote sensing data arise in connection with rising costs. G.R.

A86-49723* New York State Univ., Syracuse.
THE USE OF MULTIDATE MULTICHANNEL RADIANCE DATA IN URBAN FEATURE ANALYSIS
M. J. DUGGIN (New York, State University, Syracuse), R. ROWNTREE (USFS, Northeastern Forest Experiment Station, Syracuse, NY), M. EMMONS (NASA, Goddard Space Flight Center, Greenbelt, MD), N. HUBBARD (ERSAC, Ltd., Livingston, Scotland), A. W. ODELL (Royal Aircraft Establishment, Space Dept., Farnborough, England) et al. Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Aug. 1986, p. 95-105. USFS-supported research. refs
(Contract NAS5-27595)

Two images were obtained from thematic mappers on Landsats 4 and 5 over the Washington, DC area during November 1982 and March 1984. Selected training areas containing different types of urban land use were examined,one area consisting entirely of forest. Mean digital radiance values for each bandpass in each image were examined, and variances, standard deviations, and covariances between bandpasses were calculated. It has been found that two bandpasses caused forested areas to stand out from other land use types, especially for the November 1982 image. In order to evaluate quantitatively the possible utility of the principal components analysis in selected feature extraction, the eigenvectors were evaluated for principal axes rotations which rendered each selected land use type most separable from all other land use types. The evaluated eigenvectors were plotted as a function of land use type, whose order was decided by considering anticipated shadow component and by examining the relative loadings indicative of vegetation for each of the principal components for the different features considered. The analysis was performed for each seven-band image separately and for the two combined images. It was found that by combining the two images, more dramatic land use type separation could be obtained. Author

A86-49766
USE OF SPACE IMAGERY IN STUDIES OF THE EVOLUTION OF PRESENT-DAY LANDSCAPES [PRIMENENIE KOSMICHESKIKH SNIMKOV PRI IZUCHENII RAZVITIIA SOVREMENNYKH LANDSHAFTOV]
E. V. GLUSHKO, IU. G. ERMAKOV, and A. A. SEREBROV (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 21-28. In Russian. refs

The application of periodically obtained space imagery (SI) of large geographic areas to the analysis of landscape evolution processes is discussed. Evolution processes, classified into rhythmic changes in the course of land cover development, dynamic cover changes caused by irreversible transformations of land cover, and evolutionary changes due to replacement of one land cover by another, which are described. As an example, the dynamics of land cover in the Central Hamib Desert is analyzed using SI obtained by Gemini-5 in 1965, Salyut-6 in 1978, and Salyut-7 in 1982. I.S.

A86-50231
CORSICA - REMOTE SENSING, CARTOGRAPHY AND MONITORING OF THE ENVIRONMENT [CORSE - TELEDETECTION SURVEILLANCE DE CARTOGRAPHIE ET L'ENVIRONNEMENT]
P.-Y. REVILLION (Bureau pour le Developpement de la Production Agricole, France) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 20-26. In French.

The uses to which airborne photography and Landsat remote sensing imagery have been put as a prelude to utilizing SPOT imagery for land use planning in Corsica are described. The planning goals are to achieve a balance among the needs of agriculture, urbanization, natural ecologies, and tourism. Airborne studies aided in identifying the required cartographic scales to be 1:100,000 and 1:25,000 for alerts and for monitoring sensitive areas, respectively. Satellite imagery is necessary to obtain relatively frequent multitemporal data on areas which are known or projected to undergo rapid changes due to, e.g., urbanization or forest fires. Landsat imagery has proven detailed enough to distinguish tree types for plots of 1-5 ha, using false color techniques when available contrast is high. The effectiveness of SPOT images was evaluated using an airborne radiometer to simulate the 10 m resolution SPOT images. The simulated SPOT images show promise for monitoring the appearance of even small copses of trees and individual buildings. M.S.K.

A86-50232
THE FIRST APPLICATION OF THE THEMATIC MAPPER OVER ILE-DE-FRANCE - THE ENVIRONMENT [PREMIERE APPLICATION DU THEMATIC MAPPER EN ILE-DE-FRANCE L'ENVIRONNEMENT]
R. DELAVIGNE and C. THIBAULT (Ile-de-France, Institut d'Amenagement et d'Urbanisme, Paris) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 29-34. In French.

Sample imagery and interpretive results are presented from Landsat Thematic Mapper scans of various parcels in the Ile-de-France region. False color images are provided of forested, suburban, agricultural and urban areas. The classification techniques and different bands selected to discern, e.g., trees from soil types from buildings, among various crops, among densities of buildings, and the extent of vegetal ground cover, are described. Measurements were also made of the total biomass in the regions scanned, which consisted of eight areas bordering each other. Although the images illustrate the range of data

available with the second generation sensors on-board Landsat and SPOT, it is noted that significant efforts must continue in developing interpretive techniques if the wealth of information now accessible is to be exploited fully. M.S.K.

A86-50233
SIMULATIONS OF SPOT IMAGERY OF PARIS - CHANGES IN THE URBAN FABRIC [SIMULATIONS SPOT A PARIS - MUTATIONS DU TISSU URBAIN]
A. BALLUT and P. T. NGUYEN Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 35-39. In French.

Urban planning is concerned with guiding the growth of cities in a manner which preserves farmland and natural settings, ensures the quality of urban life, and satisfies economic demands. One of the needs of imagery of urban areas is to track the growth of the various types of buildings, e.g., offices, apartments, etc. This can be accomplished with airborne photography at any date of choice, but the information return is slow and expensive to keep repeating for multitemporal tracking. Remote sensing data from Landsat 4 with a Thematic Mapper have yielded urban images with 30 m x 30 m resolution. SPOT images are to be 20 m x 20 m and 10 m x 10 m for the multispectral and monochromatic bands, respectively. The monochromatic band will provide data on buildings from block to block and permit detailed statistical analyses of the total distribution of land use in cities. The results of a classification simulation for SPOT imagery are presented to demonstrate the capability of obtaining imagery of Paris laid out in a grid with a minimal scale of 1250 sq m. M.S.K.

A86-50234
MULTITEMPORAL IMAGERY OF ATHENS [UNE IMAGE DIACHRONIQUE D'ATHENES]
S. RIMBERT (CNRS, Laboratoire de Cartographie Thematique; Strasbourg I, Universite, France) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 40-44. In French.
(Contract CNES-83-208)

Rapid urban expansion is attended by the shrinkage of surrounding natural or farmed countryside and accompanied by aggressive construction projects. The population of Athens has grown from less than 2 million in 1961 to over 3 million in 1981. However, the most recent topographical map of the area was completed in 1961. Landsat bands 4-7 were employed to generate a new topographical map for a display consisting of 105,000 points. Four multispectral images were acquired in June 1975 and July 1981. The data were analyzed by a method of principal components, which permitted identifying changes that took place in the interval between the two scans. The analysis criteria included developed, bare or green (vegetated) areas, radiometric brightness, and differences between the image pixels on different dates. Sample imagery overlaid on old topographical maps are discussed in historical terms covering two centuries to illustrate the changes that have occurred in Athens in fairly minute detail. M.S.K.

N86-31044# Rochester Univ., N. Y. Lab. for Laser Energetics.
LABORATORY FOR LASER ENERGETICS Annual Report, 10 Oct. 1984 - 30 Sep. 1985
Jan. 1986 232 p
(Contract DE-FC08-85DP-40200)
(DE86-006834; DOE/DP-40200/05) Avail: NTIS HC A11/MF A01

Overviews of the GDL and OMEGA facilities are given. The retrofit of the GDL with liquid crystal polarizers is described. Synchronization of the actively mode-locked and actively Q-switched oscillators is described. Progress in laser fusion includes a theory of electron heat transport, sputter-coating of laser targets, absorption line measurement of the tamper, x-ray conversion for high-Z targets, mass ablation in uv-irradiated targets, uv target designs, stimulated Raman scattering in a collisional homogeneous plasma, and absorption spectroscopy as a diagnostic. DOE

N86-31950# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A PROPOSAL FOR THE DEVELOPMENT OF A LARGE-SCALE TOPOGRAPHIC-CARTOGRAPHIC DATA BASE TAKING THE PLANIMETRIC DATA OF AUTOMATED CADASTRAL MAP (ALK) SYSTEM INTO ACCOUNT [EIN VORSCHLAG ZUM AUFBAU EINER GROSSMASSTAEBIGEN TOPOGRAPHISCH-KARTOGRAPHISCHEN DATENBANK UNTER BESONDERER BERUECKSICHTIGUNG DER GRUNDRISSDATEI DES ALK-SYSTEMS]
D. GRUENREICH *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 p 55-70 1985 In GERMAN; ENGLISH summary
Avail: NTIS HC A09/MF A01

The database system developed in computer-assisted production, revision and use of cadastral maps in digital form is used to establish a large-scale topographic-cartographic data base (1:5,000). Cadastral maps with 70% of the planimetric information of topographic maps are one of the most important sources for the conventional production and revision of the German Basic Map 1:5,000 (DGK 5). A digital data interconnection system between digital cadastral maps (ALK) and the Digital Landscape Model 1:5,000 (DLM 5) is proposed. A graph theory-based procedure for automatic generalization of digital cadastral maps is described. Topographic information which can not be derived from cadastral maps is to be gained using digital photogrammetric procedures and linked to the ALK data. Applications in geosciences, spatial planning, and cartographic generalization for small-scale DLM are shown. ESA

N86-32515# IFC Research, Claygate (England).
STUDY OF INFORMATION DISSEMINATION BY SATELLITE, RIDER 2: CULTURAL SATELLITE CONSORTIUM: WIDENING THE SCOPE Final Report
B. G. CHAMPNESS Paris ESA Aug. 1985 54 p
(Contract ESA-5820/84-NL-DG)
(ESA-CR(P)-2171-VOL-2; ETN-86-97489-VOL-2) Avail: NTIS HC A04/MF A01

The need for a European Cultural Satellite Consortium to manage the participation of educational and cultural organizations in ESA's Olympus satellite program was established. The feasibility of widening its scope, by bringing in medical, health and other public service bodies was examined. Guidelines for its planning and development, drawing on the experience of the Public Service Satellite Consortium, Washington, were drawn up. Ways of strengthening its economic and entrepreneurial base were considered. A set of objectives, a list of major functions, a suggested structure, and suggestions for its management are given. ESA

N86-32854# North East London Polytechnic, Dagenham (England). Dept. of Land Surveying.
OPTICAL AND INFRARED MULTISPECTRAL IMAGERY LAND USE APPLICATIONS 2
R. K. BULLARD *In* ESA Remote Sensing Applications in Civil Engineering p 123-127 Mar. 1985
Avail: NTIS HC A06/MF A01

Applications of visible and infrared remote sensors for land use studies are discussed. Methods of obtaining imagery, need for ground data, establishing the classification, sampling, and reliability are considered. Agricultural land use and its encroachment by urban development are commented upon as are the need to monitor changes including those brought about by civil engineering projects. Derelict land and pollution monitoring by remote sensing are mentioned. ESA

N86-32855# Transport and Road Research Lab., Crowthorne (England). Overseas Unit.
REMOTE SENSING FOR HIGHWAY ENGINEERS
P. J. BEAVEN *In* ESA Remote Sensing Applications in Civil Engineering p 129-137 Mar. 1985
Avail: NTIS HC A06/MF A01

It is shown how highway engineers can interpret remotely sensed imagery for all scales of survey. At reconnaissance scale satellite photographic products are appropriate; for more detailed studies image processors must be used, but for the greatest detail, stereoscopic aerial photographs are essential. Advice on the choice of the appropriate imagery for different surveys and on how the interpretation should be organized is given. The emphasis for highway engineering is on visual interpretation, and it is shown that there are economical ways of obtaining a high quality image using low cost equipment. ESA

N86-32860# National Remote Sensing Agency, Hyderabad (India).
APPLICATION POTENTIAL OF REMOTE SENSING: A CASE FOR NATURAL RESOURCES MANAGEMENT SYSTEM
I. V. MURALIKRISHNA *In* ESA Remote Sensing Applications in Civil Engineering p 169-174 Mar. 1985
Avail: NTIS HC A06/MF A01

The Indian Remote Sensing satellite (IRS-1) program is outlined. A long program of IRS utilization is expected to provide a basic input to technology operationalization. The natural resources management system conceived under IRS utilization is expected to create demand for remotely sensed data and promote acceptance of the technology as a basic tool for resource monitoring and management. The information system required, and application to coastal erosion and environmental monitoring are discussed. ESA

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A86-43261* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
TOPEX ORBIT DETERMINATION BY SOLVING GRAVITY PARAMETERS WITH MULTIPLE ARC DATA
J.-T. WU (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Astrodynamics 1985; Proceedings of the Conference, Vail, CO, August 12-15, 1985. Part 2 . San Diego, CA, Univelt, Inc., 1986, p. 1119-1141. NASA-supported research. refs
(AAS PAPER 85-411)

Multiple arc data from repeated ground track are combined to reduce the error due to gravity field uncertainty in the determination of TOPEX orbit. The TOPEX dynamics is modeled with relatively few gravity parameters to account for the effect of the local gravity field. The gravity parameters are common to all arcs. The estimation algorithm uses the Householder transformation to combine multiple arc data and solve for the gravity parameters. The earth gravity field can be recovered with very modest amount of calculation. Author

A86-43961
THE EVOLVING ALASKA MAPPING PROGRAM
P. D. BROOKS (USGS, National Mapping Div., Anchorage, AK) and T. J. OBRIEN (USGS, National Mapping Div., Denver, CO) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 769-777.

Early developments related to mapping activities in Alaska are examined. An important milestone in the photogrammetric production of Alaska maps was reached when the Geological Survey mapped the Brooks Range in 1956-57. A program concerned with the provision of maps at a scale of 1:63,360 was begun in 1948 to serve both civil and military requirements. The current status of topographic mapping in Alaska is discussed, taking into account the Alaska High-Altitude Aerial Photography Program, 1:25,000-scale topographic maps, 1:63,360-scale topographic maps, a statewide orthophotoquad program, 1:250,000-scale topographic maps, and topographic/bathymetric products. Special products described are related to Landsat image mapping, the Federal Lands Subject to Mineral Restrictions Map, Alaska National Interest Lands Conservation Act maps, and side-looking airborne radar map products. Attention is also given to vegetation and land-cover mapping, small-scale map products, digital data, and information and data services. G.R.

A86-45161
THERMAL STRESSES IN THE OCEANIC LITHOSPHERE - EVIDENCE FROM GEOID ANOMALIES AT FRACTURE ZONES
E. M. PARMENTIER (Brown University, Providence, RI) and W. F. HAXBY (Lamont-Doherty Geological Observatory, Palisades, NY) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 10, 1986, p. 7193-7204. refs
(Contract NSF OCE-85-11011)

To demonstrate that thermal stresses may cause significant geoid anomalies, a theoretical formulation, more general than previous formulations, is outlined for thermal stresses in thin plates. A simple, idealized model is developed for flexure of the lithosphere at fracture zones (FZs) due to thermal stresses, and the resulting geoid anomaly is estimated. The predicted amplitude of the anomaly is large enough to be observed in Seasat altimeter profiles. Geoid profiles across FZs, derived from satellite altimetry, are shown in which the predicted anomaly can be easily recognized. This supports the existence of thermal stresses with a magnitude and depth distribution like that predicted by the model. D.H.

A86-46053
DATA SNOOPING USING OBSERVATIONS AND PARAMETERS WITH CONSTRAINTS
K. JEYAPALAN (Iowa State University of Science and Technology, Ames) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 22-28.

Least squares methods are widely used in photogrammetric and geodetic computations. One problem in the least squares method is assigning a priori weights to different observations and parameters. Another is the detection of noises that are the size of the random errors. The author, using the probability and the conditional probability of the residuals to compute the weigth of the residual, has developed a method of detecting noises and compensating for them in a recursive adjustment procedure. This method was successfully used in the detection of monument movement in an Electronic Distance Measurement Instrument (EDMI) calibration. The method has photogrammetric and geodetic applications. Author

A86-46271
COORDINATE DETERMINATION BY A MULTIPLE-ARM RADIOINTERFEROMETER USING NAVIGATION-GEODESIC SATELLITES [OPREDELENIE KOORDINAT MNOGOPLECHEVYM RADIOINTERFEROMETROM PO NAVIGATSIONNO-GEODEZICHESKIM SPUTNIKAM]
N. A. AZBUKINA, V. A. VASILEV, V. M. ZINENKO, and V. G. PESHEKHONOV Kosmicheskie Issledovaniia (ISSN 0023-4206), vol. 24, May-June 1986, p. 466-468. In Russian.

Reference is made to an earlier study (MacDoran, 1979) in which a method has been proposed for determining the coordinates of ground point by using a multiple-arm radiointerferometer observing four satellites. The method relies on step-by-step survey control, with the maximum distance between a new point and the reference points not exceeding 200 km. It is shown here that the requirement of step-by-step control can be avoided by using 5-6 reference point instead of four. Five reference points should be spaced apart by about 30 deg (3000 km), while the 6th point can be located 2-3 times closer. The mean value of the geometrical

factor is 5-10; the accuracy of the new method is several decimeters less than that of the MacDoran method. V.L.

A86-46608
SEASAT-DERIVED GRAVITY OVER THE MUSICIANS SEAMOUNTS
A. P. FREEDMAN and B. PARSONS (MIT, Cambridge, MA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, July 10, 1986, p. 8325-8340. refs
(Contract N00014-80-C-0273)

Two-dimensional maps of gravity derived from Seasat data for the Musicians seamount province north of Hawaii are compared with gravity predicted from bathymetry of that area using a theoretical admittance. A minimum-curvature interpolation scheme is determined to be the more accurate and cost effective mapping method than other methods that were tried, while gravity obtained by Fourier transforming the geoid produces more reliable gravity maps. The Seasat-derived gravity tends to favor a thin plate with an effective elastic thickness of about 5 km, though the east-west ridges in the south display a smaller signal more consistent with Airy compensation. This variation may be indicative of early fracturing of the lithosphere in the south, or it may be a manifestation of the age difference and early thermal structure across the Murray fracture zone, which separates the seamount province into northern and southern sections. C.D.

N86-28563# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
THE ESTIMATION OF GEOPOTENTIALS BY WAY OF GEOPHYSICAL INVERSE THEORY
M. T. LANE and E. M. GAPOSCHKIN 27 Jan. 1986 33 p
(Contract F19628-85-C-0002)
(AD-A165691; TR-735; ESD-TR-85-279) Avail: NTIS HC A03/MF A01 CSCL 08E

Satellite to satellite tracking data (SST) can be used to measure the geopotential at the satellite altitude. This measurement can be used to estimate the Earth's gravity field at the Earth's surface, the so-called inverse problem. Geophysical inverse theory is applied to this inverse problem, and numerical methods are developed and tested. Geophysical inverse theory is used to map the geopotential from the satellite altitude to a lower surface. Two configurations are explored and the geopotential in a local network is recovered with less than 4% error. GRA

N86-29440# Federal Geodetic Control Committee, Washington, D.C.
INPUT FORMATS AND SPECIFICATIONS OF THE NATIONAL GEODETIC SURVEY DATA BASE. VOLUME 3: GRAVITY CONTROL DATA (REVISED SEPTEMBER 1985)
W. T. DEWHURST Sep. 1985 166 p
(PB86-187010) Avail: NTIS HC A08/MF A01 CSCL 08E

The user's guide to the formats and specifications used within the National Geodetic Survey (NGS) data base is commonly referred to as the Blue Book, and is comprised of three volumes. Gravity control (GRAV) data are discussed. GRA

N86-31095# Defense Mapping Agency Hydrographic and Topographic Center, Washington, D.C.
A COMPARISON OF ADOS (AFRICAN DOPPLER SURVEY) POINT POSITIONING RESULTS FROM VARIOUS SOFTWARES Final Report
T. J. KNOPP 27 Feb. 1986 16 p Presented at the International Geodetic Symposium on Satellite Positioning, Austin, Tex., 28 Apr. - 2 May 1986
(AD-A166840; AD-E950814) Avail: NTIS HC A02/MF A01 CSCL 08E

The African Doppler Survey project (ADOS) is a multi-national effort to establish primary control (via Doppler satellite observations) on the African continent. There are four Computing Centers under the ADOS project which use three different point positioning programs. These programs are: DOPL79, GEODOP V, and ORB-SPP. The differences observed in the computations using the various softwares were recently investigated. This paper presents preliminary results of this study. GRA

N86-31557# Bonn Univ. (West Germany). Geodaetisches Inst.
DEVELOPMENT OF A RECEIVER CONCEPT FOR GEODETIC APPLICATION OF THE NAVSTAR GLOBAL POSITIONING SYSTEM (GPS) SATELLITE NAVIGATION SYSTEM Final Report, Feb. 1985
E. SAUR Bonn Bundesministerium fuer Forschung und Technologie Dec. 1985 25 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
(BMFT-FB-W-85-036; ISSN-0170-1339; ETN-86-97474) Avail: NTIS HC A02/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 5.50

The instrument measurement errors in a GPS receiver (a coherent C/A code cross-correlation receiver with carrier phase measurements and higher process gain, capable of using the P code modulated L2 frequency) are studied. The GPS receiver consists of a ZF amplifier, a mixing frequency preparation unit, and a digital signal processing unit including a code generator, a correlator, a numerical oscillator, and control and evaluation computers. The geodetic GPS receiver is analyzed as regards mobility, human factors engineering, interference, possible connections, and independence from external data sources. The cost effective multiplex scheme is selected for simultaneous measurements of four satellites leading to signal delay reduction. A subminiature rubidium standard is used as a receiver black to avoid loss of accuracy at higher integration times. ESA

N86-31946# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
REPORTS ON CARTOGRAPHY AND GEODESY. SERIES 1: ORIGINAL REPORTS, NUMBER 95 [NACHRICHTEN AUS DEM KARTEN- UND VERMESSUNGSWESEN. REIHE 1: HEFT NR. 95]
1985 200 p In GERMAN; ENGLISH summary Original contains color illustrations Document contains maps as supplement
(ISSN-0469-4236; ETN-86-97479) Avail: NTIS HC A09/MF A01

Research on automated cartography (data acquisition, processing and retrieval) with economical use and feasibility analyses is reported. Development of data bases, user interfaces and interactive graphical systems is described. Image processing and resolution are improved. ESA

N86-32786 Centre National d'Etudes Spatiales, Toulouse (France).
INTERNATIONAL GEOPHYSICS AND SPACE
1985 615 p Partly in ENGLISH and FRENCH Lectures presented at CNES Summer School, Toulouse, France, 2-27 Jul. 1984
(ISBN-2-85428-132-2; ISSN-0766-1002; ETN-86-97644) Avail: CEPADUES, Toulouse, France

Space techniques used in solid Earth studies were discussed. Shape, gravity and magnetic fields, and surface and internal deformation were considered. ESA

N86-32787 Institut de Physique du Globe, Paris (France).
THE GEOMAGNETIC FIELD: DESCRIPTION AND ANALYSIS [LE CHAMP GEOMAGNETIQUE: DESCRIPTION ET ANALYSE]
J. L. LEMOUEL *In* CNES International Geophysics and Space p 17-60 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

Measurements and models of the Earth's magnetic field using spaceborne and ground based techniques are introduced. Crustal anomalies are discussed. Large wavelength anomalies are illustrated. The Magsat satellite system is presented. ESA

N86-32789 Institut de Physique du Globe, Paris (France).
ENERGY SOURCES AND THE THERMAL HISTORY OF THE EARTH [SOURCES D'ENERGIE ET HISTOIRE THERMIQUE DE LA TERRE]
C. JAUPART *In* CNES International Geophysics and Space p 85-109 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

The heat flux of the Earth is introduced and conductive flow and flow through the ocean crust are discussed. Measurement methods, including bathymetry, are explained, and heat transfer traced. The radioactivity of rocks is considered and the concentrations of radioactivity in the mantles are summarized. The thermal balance of the Earth and the thermal evolution of the planet are considered. ESA

N86-32790 Massachusetts Inst. of Tech., Cambridge.
MANTLE CONVECTION AND THE EARTH'S GRAVITY FIELD
B. PARSONS *In* CNES International Geophysics and Space p 111-158 1985
Avail: CEPADUES, Toulouse, France

Observational constraints in geophysics are discussed, and depth extent of convection, and small-scale convection are considered. Laboratory and numerical experiments (planform of convection; stability considerations; aspect ratios; influence of shear flows) are described. The variation of geoid height and ocean floor bathymetry with age (thermal models; isostatic compensation; the depth-age and geoid-age relationships) are introduced. Geoid and depth anomalies and convection (integral expressions; dynamic compensation; effective temperatures; relationship between depth and geoid anomalies) are treated. Small-scale convection (satellite altimetry and bathymetry; instabilities beneath cooling oceanic lithosphere; midocean swells; connection with depth-age and geoid-age relationships) is summarized. ESA

N86-32791 Centre National d'Etudes Spatiales, Toulouse (France).
SATELLITE TRACKING: ITS FIRST CONTRIBUTIONS TO THE KNOWLEDGE OF THE EARTH'S GRAVITATIONAL FIELD AND TO GEOPHYSICS [LA POURSUITE DES SATELLITES; SES PREMIERS APPORTS A LA CONNAISSANCE DU CHAMP GRAVIMETRIQUE TERRESTRE ET A LA GEOPHYSIQUE]
B. LAGO *In its* International Geophysics and Space p 159-199 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

The contribution of techniques developed for tracking satellites to detect discrepancies in the Earth's hydrostatic balance is recalled. Static and dynamic explanations for the imbalance are considered. The flattenning of the geoid detected by satellite geodesy is discussed. Global models of Earth gravitation are introduced. Laboratory experiments; convection equations; and convection in the Earth's mantle are described. ESA

N86-32800 Bureau Gravimetrique International, Toulouse (France).
POTENTIAL MODELS [MODELES DE POTENTIEL]
G. BALMINO *In* CNES International Geophysics and Space p 499-526 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

Global models of the Earth's gravitational field based on spherical harmonics, such as GEM, GRIM, SAO, and NWL, are introduced. Analysis of orbit perturbation and surface data is outlined. The data used and their processing are discussed. It is concluded that knowledge of geopotential is insufficient for accurate satellite trajectory determination, for ocean geoid determination, and for regional geophysical investigations where gravity is only known through trajectory analysis. The situation can be improved by using very low orbit, drag free satellites; by improving satellite altimetry; and by using onboard gravity gradiometers. ESA

N86-32804 Centre National d'Etudes Spatiales, Toulouse (France). Groupe de Recherche de Geodesie Spatiale.
UTILIZATION OF SPACE TECHNIQUES FOR ACCURATE POSITIONING IN GEOPHYSICS [UTILISATION DES TECHNIQUES SPATIALES DE POSITIONNEMENT PRECIS EN GEOPHYSIQUE]
M. LEFEBVRE *In its* International Geophysics and Space p 599-614 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

Radio, laser, Doppler, and interferometric space-based positioning techniques are reviewed. Links between measurement errors and errors in significant physical parameters are discussed. Choice criteria for a system for geophysics are given. ESA

N86-32912*# Texas Univ., Austin. Center for Space Research.
ALTIMETER MEASUREMENTS FOR THE DETERMINATION OF THE EARTH'S GRAVITY FIELD Semiannual Research Progress/Status Report, 18 Mar. - 14 Sep. 1986
B. D. TAPLEY, B. E. SCHUTZ, and C. K. SHUM 25 Sep. 1986 9 p
(Contract NAG5-746)
(NASA-CR-176893; NAS 1.26:176893) Avail: NTIS HC A02/MF A01 CSCL 08N

Progress in the following areas is described: refining altimeter and altimeter crossover measurement models for precise orbit determination and for the solution of the earth's gravity field; performing experiments using altimeter data for the improvement of precise satellite ephemerides; and analyzing an optimal relative data weighting algorithm to combine various data types in the solution of the gravity field. B.G.

04

GEOLOGY AND MINERAL RESOURCES

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

A86-44169
GEOLOGICAL ASSESSMENT OF SIR-B IMAGERY OF THE AMADEUS BASIN, N.T., AUSTRALIA
G. J. LYNNE and G. R. TAYLOR (New South Wales, University, Kensington, Australia) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 575-581. Research supported by the Esso Australia Ltd. refs

When SIR-B imagery of the arid margin of the Simpson Desert of Central Australia is combined with Landsat MSS principal component data, regional geological structures are clearly defined. A variety of sedimentary lithological units are mapped on the basis of outcrop morphology and MSS spectral variations on the color-composite image. Relative backscatter power from SIR-B digital imagery is observed to correlate with surface roughness for a variety of lithological terrains. Author

A86-44170* Cornell Univ., Ithaca, N.Y.
SIR-B RADAR IMAGERY OF VOLCANIC DEPOSITS IN THE ANDES
E. J. FIELDING, W. J. KNOX, JR., and A. L. BLOOM (Cornell University, Ithaca, NY) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 582-589. refs
(Contract JPL-956926; NGT-33-010-801)

Synthetic-aperture radar imagery from the Shuttle Imaging Radar - mission B (SIR-B) was collected in October 1984 over the central Andes between 20 deg S and 24 deg S and also south of 42 deg S. Despite signal-strength problems that drastically reduced the signal-to-noise ratio of the images, volcanic features of both areas show up well. In particular, ignimbrite sheets formed by large explosive eruptions stand out as very strong radar reflectors. High backscatter is apparently caused by erosional relief on the

ignimbrites at scales ranging from the radar wavelength (23 cm for SIR-B) to the 30-200-m scale of quebradas (gullies and canyons). The consistent regional erosional pattern appears unrelated to the emplacement of the ignimbrites, and is probably caused by preferential eolian erosion in the directions of the prevailing wind. Hand-held space photographs, ground observations, and Landsat Thematic Mapper imagery support the interpretation of the ignimbrite radar signature. The Chilean volcano Michinmahuida was imaged by four radar data takes at different incidence angles, which show tectonic, glacial, and volcanic features of that nearly inaccessible and often cloud-covered region. Stereo viewing of radar images from two data takes greatly enhances the geologic interpretation of this rugged area. Author

A86-46061
CORRELATION OF REMOTELY DETECTED MINERALOGY WITH HYDROCARBON PRODUCTION, LISBON VALLEY, UTAH
D. B. SEGAL, M. DEC. RUTH, I. S. MERIN (Earth Satellite Corp., Chevy Chase, MD), H. WATANABE, K. SODA (JAPEX Geoscience Institute, Inc., Tokyo, Japan) et al. IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 115-127. refs

An examination of remotely sensed data and geochemistry correlates specific diagenetic mineral assemblages within the Wingate Formation with hydrocarbon production at Lisbon Valley, Utah. Bleached Wingate exposures were identified using broadband Landsat Multispectral Scanner and airborn Thematic Mapper Simulator data as a result of ferric-iron content and the relative abundance of clay minerals. High-resolution airborn spectroradiometric data, thin sections, and X-ray diffraction indicate that bleached rocks overlying the reservoir at Lisbon Valley contain abundant kaolinite and small amounts of feldspar, while unbleached exposures contain less clay and abundant feldspar. The correlation found between the abundance of clays and apparent hydrocarbon microseepage suggests that the effects of hydrocarbon microseepage may be mapped with broadband sensors. R.R.

A86-46095
UTILIZATION OF LANDSAT DATA IN THE DETECTION OF LINEAMENTS IN THE SOUTH CENTRAL ALBORZ MOUNTAINS OF NORTHERN IRAN
S. BAGHERI (New Jersey Institute of Technology, Newark) and R. W. KIEFER (Wisconsin, University, Madison) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 481-491. refs

This study involves the evaluation of remote sensing technology using Landsat data for the detection of lineaments in the south-central Alborz Mountains of northern Iran. Both visual and computer-enhanced interpretation techniques were employed in this study. One application of remote sensing is to acquire facts about a terrain that can aid in deciphering the underlying geologic structure and ultimately, its tectonic evolution. In depicting terrain, the particular value of remote sensing using Landsat data lies in the small scale synoptic view and uniform aerial coverage provided. The major contribution of Landsat imagery in mineral exploration and seismic activities has been the identification of previously unknown lineaments (faults and fracture systems). Concentrations of lineaments may indicate where the crust is weakest and, therefore, most likely to be mineralized or susceptible to seismic activity. In this study, a correlation was found between lineaments detected in the study area, the zone of weakness characterized by seismic activity, and mineral concentrations (phosphate deposits). Author

A86-46118
DATA ACQUISITION AND APPLICATIONS OF SIDE-LOOKING AIRBORNE RADAR IN THE U.S. GEOLOGICAL SURVEY
J. E. JONES and A. N. KOVER (USGS, National Mapping Div., Reston, VA) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 767-770.

A86-47803*
INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, FOURTH THEMATIC CONFERENCE: REMOTE SENSING FOR EXPLORATION GEOLOGY, SAN FRANCISCO, CA, APRIL 1-4, 1985, PROCEEDINGS. VOLUMES 1 & 2
Symposium organized by the Environmental Research Institute of Michigan; sponsored by ARCO Oil and Gas Co., NASA, and NOAA. Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. Vol. 1, 439 p.; vol. 2, 395 p. For individual items see A86-47804 to A86-47853.

State of the art applications of remote sensing in geological exploration programs are discussed along with research and development activities aimed at increasing the future capabilities of this technology for exploration geology. The topics considered include: technical issues in the state of the art; regional exploration models; remote sensing applications for hydrocarbon exploration; commercialization of remote sensing satellites; and data integration. Also addressed are: remote sensing applications for mineral exploration; geobotanical and environmental remote sensing; image processing techniques and applications; advanced sensors, radar, and airborne systems; and engineering, logistics, and marine applications. C.D.

A86-47804#
COMPARISON OF MAJOR LINEAMENT TRENDS TO SEDIMENTARY ROCK THICKNESSES AND FACIES DISTRIBUTION, POWDER RIVER BASIN, WYOMING
R. W. MARRS (Wyoming, University, Laramie) and R. S. MARTINSEN IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 9-19. refs

Landsat images in the Powder River Basin, Wyoming, have revealed the presence of a prominent set of major northeast-trending lineaments and a smaller set of major northwest-trending lineaments. It was found that patterns of deformation and sedimentation throughout the Paleozic and Mesozoic eras parallel and often closely underlie the trends of these lineaments. The correlations support the concept that these lineaments are the result of periodic readjustments along the basement block boundaries. At least two previously recognized paleostructural uplifts, the Pathfinder Uplift and the Belle Fouche Arch, are bounded by lineaments, suggesting some periods of significant differential movement between crustal blocks. These findings indicate that lineament mapping can be an important tool for understanding and mapping subsurface facies distribution, especially in areas of sparse well control. I.S.

A86-47805#
THE MID-CONTINENT RIFT FRONTIER HYDROCARBON PLAY - A CASE STUDY BASED UPON AN ECONOMICAL APPROACH TO PROSPECT GENERATION
J. D. HERMAN, P. J. ETZLER, M. L. WILSON, and R. K. VINCENT (Geospectra Corp., Ann Arbor, MI) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 21-30. refs

A86-47806#
THE GABON BASIN - ITS REGIONAL SETTING WITH RESPECT TO ONSHORE BASEMENT TECTONIC ELEMENTS AS INTERPRETED FROM SIDE-LOOKING AIRBORNE RADAR IMAGERY
R. R. HERNER (MARS Associates, Inc., Phoenix, AZ) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 31-47. refs

A86-47807#
THE APPLICATION OF SHUTTLE IMAGING RADAR (SIR-B) TO TECTONIC ANALYSIS OF THE CANDELARIA REGION, NEVADA
M. X. BORENGASSER and J. V. TARANIK (Nevada, University, Reno) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 105-111.

The applicability of Shuttle Imaging Radar-B data to structural geology studies was investigated by interpreting the digital data collected over the Candelaria region of western Nevada in October 1984. Some of the tracks, acquired at incidence angles ranging from 59 to 18 deg, crossed one another at nearly right angles in this tectonically anomalous region, from which the Teels Marsh and Rhodes Salt Marsh subscenes were selected. The images in these subscenes were enhanced with Gaussian redistributions, edge enhancements, and false color composites, with the first two methods shown to be most effective in enhancing and displaying linear features. When compared with mapped faults and the results of field examination, most of the linears detected appeared to be unrelated to faulting, although mapped faults in an alluvial fan of the Pilot Mountains, which bound the Rhodes Salt Marsh on the east, coincided with linears produced by subtle, contrasting brightness. Field examination revealed that fault uplift had permitted erosional processes to remove finer clasts and produce small drainages. I.S.

A86-47808*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPACE SHUTTLE RADAR INVESTIGATIONS OF INDONESIA
J. P. FORD (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and F. F. SABINS, JR. (Chevron Oil Field Research Co., La Habra, CA) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 113-122. NASA-supported research.

A preliminary interpretation of structure and lithology from selected Shuttle Imaging Radar-B (SIR-B) images of Borneo, collected in October 1984, is presented. The SIR-B images, obtained at depression angles that ranged from 40 to 50 deg, were interpreted by using the approaches suggested by Sabins (1983). On the basis of radar signatures, six terrain categories; coastal and alluvial plains, and carbonate, clastic, volcanic, and melange, rocks, were defined in east, central, and south Kalimantan, and in the Malaysian state of Sarawak. I.S.

A86-47809*# Dartmouth Coll., Hanover, N.H.
DISCRIMINATION OF LITHOLOGIC UNITS OF THE BASIS OF BOTANICAL ASSOCIATIONS AND LANDSAT TM SPECTRAL DATA IN THE RIDGE AND VALLEY PROVINCE, PENNSYLVANIA
C. V. PRICE, R. W. BIRNIE (Dartmouth College, Hanover, NM), T. L. LOGAN, B. N. ROCK, and J. PARRISH (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 125-140. refs
(Contract JPL-956937)

Data collected on November 2, 1982 by the Landsat 4 Thematic Mapper (TM) over 72 forested sites in the Ridge and Valley province in Pennsylvania were compared with corresponding botanical and site variable field data. The analysis revealed that both the TM and the botanical data sets can be divided into four groups based on lithology and aspect. Lithology, which is clearly the dominant controlling factor in both sets of data, determines elevation and slope. The aspect (essentially north- and south-facing slope) determines the intensity of solar illumination which affects both the moisture available to the vegetation and the intensity of reflected radiance. Each of the four lithologic/aspect units support unique forest associations, clearly separable both on the basis of ground-based 1/10-acre forest association surveys and on the basis of their TM spectral signatures. I.S.

A86-47811#
PHOTOGEOLOGICAL MAPPING LEADS TO BURIED STRUCTURES IN THE MISSISSIPPI EMBAYMENT
P. D. ERICKSON (Petroleum Information Corp., Littleton, CO) and M. R. CARLISLE (Barrick Exploration Co., Golden, CO) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 169-181. refs

An interpreted combination of color aerial photographs, taken over the Mississippi embayment, and Landsat images were utilized for a geomorphic study conducted for the purpose of locating prospective oil fields. The geomorphic evaluation consisted of four basic parts: the drainage and the landform analyses, the fracture patterns analysis, and the phototonal and color analysis. Features delineated in the geomorphic study as possible hydrocarbon traps were compared with seismic data, obtained to define subsurface within the area of major interest, and with the results of a geochemical survey. Geomorphic expressions of hydrocarbon deposits were substantiated by both seismic profiles and geochemical maps. I.S.

A86-47812#
APPLICATION OF STRUCTURES MAPPED FROM LANDSAT IMAGERY TO EXPLORATION FOR STRATIGRAPHIC TRAPS IN THE PARADOX BASIN
I. S. MERIN and R. C. MICHAEL (Earth Satellite Corp., Chevy Chase, MD) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing For Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 183-192. refs

Using an analysis of Landsat imagery of the integrated Paradox Basin, with aeromagnetic and gravity data, structures believed to mark recurrently active basement fractures were mapped. Landsat imagery revealed faults that, in many places, have offsets too small to be detected seismically. This ability to map faults with a small offset may be particularly valuable in the exploration of algal mounds, because small, fault-related, changes in sea floor bathymetry can produce enough local relief to support the development of algal bioherms. I.S.

A86-47813#
DISCRIMINATION OF ROCK TYPES AND ALTERATION ZONES FROM AIRBORNE MSS DATA - THE SAMRAN-SHAYBAN AND MAHD ADH DHAHAB AREAS OF SAUDI ARABIA
W. P. LOUGHLIN (Hunting Geology and Geophysics, Ltd., Borehamwood, England) and M. A. TAWFIQ (Directorate General for Mineral Resources, Jidda, Saudi Arabia) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 207-225. refs

A86-47814#
DISCRIMINATION OF IRON OXIDES AND VEGETATION ANOMALIES WITH THE MEIS NARROW BAND IMAGING SYSTEM
S. J. FRASER, A. A. HUNTINGTON, A. A. GREEN, M. R. STACEY, and G. P. ROBERTS (CSIRO, Div. of Mineral Physics, Sydney, Australia) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 233-253. Research supported by the MacDonald Dettwiler and Associates, Ltd., Hamersley Exploration, Mt. Newman Mining Co., Western Mining Corp., Carpentaria Exploration Co., CSR, Ltd., and Geopeko, Ltd. refs

The radiometric sensitivity of the MEIS-II scanner was utilized for the identification and delineating of goethitic and haematitic iron species, and for the detection of mineral-stressed vegetation. The results of several application studies are documented, and the analysis techniques are described. The iron oxide filter bandpasses were chosen to highlight the goethitic shoulder at 0.64 micron and the broad Fe(3+) absorption feature between 0.85 and 1.00 micron. In the Hamersley Iron Province of western Australia, goethite and haematite have been distinguished spectrally both in open pits and in areas of natural outcrop. At Mary Kathleen in Queensland, the narrow-band iron oxide filter sets have mapped lithological subdivisions not previously recognized and not evident on broad-band images. The vegetation filter bandpasses were chosen to monitor the chlorophyll 'red edge'. At the Washpool vegetation site, considerable spectral variation has been observed. Separating the combined effects of filter 'blue shifts' and species variation from possible shifts to shorter wavelengths of the chlorophyll 'red edge' resulting from metal-stressed vegetation is difficult. Author

A86-47815#
STRUCTURAL AND LITHOLOGICAL MAPPING IN THE WESSEX BASIN OF SOUTHERN ENGLAND USING SEASAT SAR, LANDSAT MSS AND TM DATA
A. D. G. DIXON, T. J. MUNDAY, and S. D. LAKE (Durham, University, England) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 255-264. refs

Optically processed Seasat SAR, MSS and TM and digitally processed Seasat SAR satellite imager was utilized for a geological study of the Wessex Basin of southern England. Many lineaments were found to correspond to major structural elements in the basin, including reactivated basement structures. Analytical comparisons were made between the optical and digital imagery and it was found that each data set revealed important information about the structural development of the basin. Digitally processed Seasat SAR data increased the number of detectable lineaments and interesting results were obtained by operation of the Hue Saturation Intensity transform. The full potential of the remotely sensed data will be realized when used in conjunction with fieldwork and geophysical studies. Author

A86-47816#
MULTISENSOR REMOTE SENSING AS AN EXPLORATION TOOL IN THE COBEQUID MOUNTAINS AREA, NOVA SCOTIA, CANADA
S. D. MELVIN (Gregory Geoscience, Ltd., Ottawa, Canada) and M. S. AKHAVI (Nova Scotia Land Survey Institute, Lawrencetown, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 265-270. refs

A86-47817#
APPLICATION OF A GEOCODED DATABASE FOR GEOLOGICAL INVESTIGATION AND EXPLORATION
M. S. AKHAVI (Nova Scotia Land Survey Institute, Lawrencetown, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 271-277. Research supported by the Department of Energy, Mines, and Resources of Canada. refs

Multispectral scanner and Thematic Mapper imagery of Guysborough County, Nova Scotia were investigated to extract spectral reflectance signature pertinent to the classification of plutonic and metasedimentary rocks. A geocoded database was formed by digitizing, overlaying and registering geological, and biophysical information over a Landsat image. Spectral statistics were obtained from each geologic unit. The result indicates that metasediments are spectrally distinct from plutons. Updating of geologic maps included the detection of lineaments and alteration of some contact lines. The database was utilized to target an exploration area on the basis of the relationship between structural deformation and mineral placement. Author

A86-47818#
APPLICATION OF LANDSAT IMAGERY TO HYDROCARBON EXPLORATION IN THE NIOBRARA FORMATION, DENVER BASIN
I. S. MERIN (Earth Satellite Corp., Chevy Chase, MD) and W. R. MOORE IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 279-287. refs

The Landsat imagery of the Niobrara Formation in the Denver basin was used to map the orientation and distribution of fractures in this basin. The map has revealed numerous northeast-trending faults throughout the basin. Many faults overlie older zones that were reactivated during the Laramide orogenic event, suggesting that these lineaments are previously unrecognized fracture zones. Based on an understanding of the regional tectonics, the theoretical motion of a given fracture through time could be predicted. Using this theoretical data as a guide and integrating the Landsat analysis with subsurface well log data, the fracture systems most favorable for prospecting for fracture production of oil were identified. These predictions are substantiated by the location of several apparently productive Niobara wells along a zone of northeast-trending lineaments. I.S.

A86-47819#
INTERACTIVE DIGITAL IMAGE ANALYSIS OF LANDSAT MSS IMAGES FOR MAPPING HYDROTHERMAL LIMONITE
K. LEE (USGS, Denver; Colorado School of Mines, Golden) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 293-307. refs

The paper describes a technique of interactive digital analysis of Landsat MSS images, which separates hydrothermal limonite from other, more abundant limonite anomalies. Ratio data are transformed to Munsell color coordinates, which numerically describe the colors of the RCT and are interactively viewed on a color monitor, allowing the geologist to numerically characterize hydrothermal and other limonite. Further processing eliminates the 'uninteresting' limonite. Application of this methodology to an MSS image of the Colorado Front Range has eliminated limonite images of red beds, alluvial soils, and bedrock with weathered mafic minerals. For an alpine and tundra region of the San Juan Mountains of southwestern Colorado, screening of surficial deposits, combined with vegetation mapping, produced a hydrothermal limonite map with 29 anomalies, all of which were verified in the field to be associated with hydrothermal alteration.

For the desert of Saudi Arabia, these methods separated out extensive limonitic anomalies caused by eolian sand and alluvium, and led to hydrothermal limonite associated with metallic mineral occurrences. I.S.

A86-47820#
ANALYTICAL TECHNIQUES FOR EXTRACTING GEOLOGIC INFORMATION FROM MULTICHANNEL AIRBORNE SPECTRORADIOMETER AND IMAGING SPECTROMETER DATA
F. A. KRUSE, G. L. RAINES, and K. WATSON (USGS, Denver, CO) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 309-324. refs

Several techniques have been developed for the analysis of mineral deposits data obtained by a new high-resolution multichannel airborne spectroradiometer and NASA's Airborne Imaging Spectrometer. The general techniques consist of normalization of spectra to remove albedo and illumination effects, and calculation of reflectance relative to a standard spectrum to identify the minerals. Among the two normalization methods, normalization to one channel and equal-energy normalization, the latter procedure was found to be less affected by individual absorption features. Relative reflectance spectra are computed by dividing spectra by a standard curve. The standard curves were constructed using two techniques: (1) calculating the simple average of all spectra along the flightline or (2) using the low-order terms of a discrete Fourier series to fit each spectrum along the flight line by employing an FFT method. Although the calculated relative reflectance spectra and images do contain artifacts, introduced by the data manipulation procedures, the use of these techniques makes it possible to identify and plot specific minerals, based on their spectral characteristics. I.S.

A86-47823*# Washington Univ., St. Louis, Mo.
GEOBOTANICAL INFORMATION CONTAINED IN LANDSAT THEMATIC MAPPER IMAGES COVERING SOUTHERN MISSOURI
G. GREEN, R. ARVIDSON, M. SULTAN, and E. GUINNESS (Washington University, Saint Louis, MO) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 371-380. NASA-sponsored research. refs

Landsat Thematic Mapper (TM) data collected in the late summer, fall, and winter of 1982 over forested bedrocks in southeastern Missouri were used in conjunction with forest surveys, field work, aerial photographs, and laboratory analyses to evaluate multispectral and seasonal information from visible and reflected IR data. The forested bedrock included granites, rhyolites, carbonates, and sandstones. High reflectance in band 4 (760-900 nm) in the summer scene corresponds to regions of xeric forest type. The fact that the xeric regions tend to develop flat-topped canopies, as opposed to irregular canopy surfaces of the wetter mesic areas, may partially control the TM response in bands 4, 5 (155-175 nm) and 7 (208-235 nm). The xeric regions correlated with soils having poor water retention capabilities, such as rhyolites and certain carbonate rocks with nonporous residum layers. An opposite relationship between xeric and mesic forest biomass was noted, if the commonly used TM band ratio 4/3 was used as a surrogate biomass measure. The high band 4 response over xeric forests gives anomalously high biomass estimates. I.S.

A86-47824#
REMOTE SENSING AND SURFACE GEOCHEMICAL STUDY OF RAILROAD VALLEY NYE COUNTY, NEVADA
V. T. JONES, S. G. BURTELL (Exploration Technologies, Inc., Houston, TX), R. A. HODGSON (Geological Consulting Services, Jamestown, PA), T. WHELAN, C. MILAN (Woodward Clyde Oceaneering, Houston, TX) et al. IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 1 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 381-389. refs

A remote sensing and soil gas geochemical survey of Railroad Valley, NV was conducted in order to correlate the existing geochemical anomalies with the locations predicted on the basis of the structural model of Foster and Dolley (1979). In addition, the existing geological structures were related to those obtained by interpreting the remote sensing data. Combined interpretation, using SAR, TM, and TDCS-processed TM images, suggests the presence of major fracture lines which define regional fault and fracture systems. Some of the many fracture lines crossing the valley graben confirm the structural divisions identified by Foster and Dolly. There appears to be a reasonable correlation between the mapped features systems, the geochemical anomalies, and the existing oil fields, although any one set of data alone is not sufficient to delineate the fields. I.S.

A86-47825#
THE IRON ABSORPTION INDEX - A COMPARISON OF RATIO-BASED AND BASELINE-BASED TECHNIQUES FOR THE MAPPING OF IRON OXIDES
N. L. MILLER and C. D. ELVIDGE (Stanford University, CA) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 405-415. refs

A baseline has been established in digital number space which represents the iron oxide free condition for Thematic Mapper (TM) bands one and three. Pixels with iron oxide staining fall away from the baseline due to strong absorptions by iron oxides in the spectral region of TM1. An Iron Absorption Index (IAI) has been developed which directly measures the departure of iron stained pixels from this baseline. The IAI has been compared to the commonly applied TM3/TM1 ratio for the assessment of iron straining and been shown to be much less susceptible to rock-soil brightness variations which strongly affect the formulation of ratio values. Author

A86-47826#
APPLICATION OF REMOTE SENSING IN THE EXPLORATION IRON AND MANGANESE DEPOSITS - A CASE STUDY FROM SANDUR, SOUTHERN INDIA
K. S. SHIVAKUMAR, B. SOMASEKAR (Gulbarga University, Sandur, India), and R. NAGARAJAN (Indian Institute of Technology, Bombay, India) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 427-435. refs

Landsat Four band MSS imagery and false color composites were used in the demarcation of the surficial features of Sandur Schist belt, Southern India. Ridges bordering the schist belt exposed of Iron formations, exhibit antiformal and synformal structure. Morphometric analysis of the ridges, show that the iron ore concentrations occur above 850 m on flat topped plateau, while manganese are above 750 m mostly in the conical shaped ridges. Narihalla fault is confined to the schist belt. Author

A86-47827*# Texas Univ. at Dallas, Richardson.
SPACEBORNE RADAR IMAGERY IN REGIONAL GEOLOGIC MAPPING OF THE SIERRA MADRE ORIENTAL, NORTHEASTERN MEXICO - THE USE OF MORPHOSTRATIGRAPHIC UNITS IN MAPPING BY REMOTE SENSING
J. F. LONGORIA and O. H. JIMENEZ (Texas, University, Richardson) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 437-446. refs
(Contract JPL-956430)

A86-47829*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NEW RESULTS FOR GEOLOGIC UNITS MAPPING OF UTAH TEST SITES USING LANDSAT TM DATA
N. M. SHORT (NASA, Goddard Space Flight Center, Greenbelt, MD) and R. MARCELL (Science Applications Research, Inc., Lanham, MD) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 459-470.

This paper continues a study on the accuracy of geological mapping using Landsat Thematic Mapper data (Short, 1984). In June 1976, both the White Mountain alteration zone and the Waterpocket Fold sedimentary rock sites in Utah were surveyed by the Bendix 24-band scanner on a NASA NC-130B aircraft. Mid-June 1984 TM data for these two sites have been processed like the 1976 data to test the quality of simulation of TM data. Principal-components (PC) color composite images for White Mountain show close correspondence to the Bendix PC images. At this site carbonate strata are uniquely discriminated in both Bendix and TM composites that use an inverted PC 3 image. Alunite/kaolinite and hematite/limonite alteration zones developed on volcanic flows are also sharply separated, but iron oxide and silicified zones are less so. The accuracy of rock-units mapping at the Waterpocket Fold site by supervised classification of the June TM data is significantly better, reaching 70 percent in the best case, than for January 1983 data for that site. Author

A86-47830#
MULTI-SEASONAL IMAGERY STUDIES FOR GEOLOGICAL MAPPING AND PROSPECTING IN CULTIVATED TERRAIN OF S.W. ENGLAND
J. M. JAMES and J. M. MOORE (Imperial College of Science and Technology, London, England) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 475-484. Research supported by the Imperial College of Science and Technology. refs

The use of satellite remote-sensing data to characterize geologically an agricultural region in SW England is discussed. The geology and geomorphology of the region are reviewed; the database, comprising Landsat MSS images from all four seasons and optically correlated Seasat SAR images, is described; the image-processing techniques employed (including linear stretching, high-pass filtration, false-color composites, and negative and threshold images) are explained; and sample images are compared with geological maps. It is found that images combining MSS bands 4, 5, and 7 obtained at low sun angles (less than 15 deg) during winter periods with snow cover are most useful in revealing tectonic fabric and lithology, and that SAR images complement winter MSS images due to the eastward direction of the Seasat radar antenna. T.K.

A86-47831#
STRUCTURAL ANALYSIS OF THE CEVENNES (FRANCE) USING LANDSAT, SPACELAB, GEOPHYSICAL AND FIELD DATA
A. BLUSSON (IBM France, S.A., Paris; Paris XI, Universite, Orsay, France) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 487-496. refs

The Cevennes region (southern France) is a geologically well known region. The NE-SW fault-trending zone which crosses the region is of great tectonic interest, considering its position between the Alps and the Pyrenees. A comparative study of Landsat and Spacelab interpretations was associated with geophysical data, existing maps, and field microtectonics measurements. This comparison was qualitatively represented with polar histograms and shows that, in spite of the good quality of the results obtained from Landsat data, the higher quality of Spacelab photographs is an important resource for geological photointerpretation. It is also found that automatic methods provide a good contribution to tectonic studies by remote sensing. Geophysical data give a third dimension to this study. Author

A86-47832#
REMOTE SENSING APPLICATION FOR LOCATING BAUXITE ORE PATS' OF THE EASTERN GHATS OF ANDHRA PRADESH, INDIAN UTILISING GEOBOTANICAL AND ENVIRONMENTAL DATA
R. S. RAO and S. SUDHAKAR (Andhra University, Visakhapatnam, India) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 499-510. Research supported by Andhra University. refs

A86-47833#
LANDSAT THEMATIC MAPPER AND SEASAT SAR DATA FOR MAPPING DESERT ALLUVIAL DEPOSITS
P. M. MERIFIELD (Lamar-Merifield Geologists, Inc., Santa Monica, CA) and W. W. YANG (California, University, Los Angeles) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 521-529. refs

Landsat 4 Thematic Mapper (TM) data used in conjunction with Seasat SAR data are useful in discriminating alluvial deposits in desert regions. A number of images of Chuckwalla Valley in the southeastern Mojave Desert were generated combining selected TM bands and Seasat SAR data. Compositional differences are brought out by a color composite image in which TM band 5 is projected in red and TM band ratios 3/1 and 4/3 are projected in green and blue, respectively. Older alluvial units of different clast size that are coated with desert varnish cannot be separated using Landsat data alone, but the Seasat component permits distinction among varnished surfaces with small variation in surface roughness. Stone pavements in various stages of development, for example, can be distinguished. A useful image was generated by digitally coregistering Seasat SAR data with a TM scene and projecting TM Band 2 in red, TM Band 7 in green, and Seasat SAR in blue. The rougher the surface, the brighter the blue component appears. The greater spatial resolution of the Landsat 4 Thematic Mapper data enables mapping at scales as large as 1:62,500. Field data, including spectral measurements with a Barringer Hand-Held Reflectance Radiometer (HHRR) and roughness measurements with a mechanical profiler, were made to provide a quantitative comparison of the units mappable from the imagery. Author

A86-47834#
INTERPRETATION OF ENHANCED TM DATA FOR MEDIUM-SCALE GEOLOGICAL MAPPING IN GLACIATED FORESTED TERRAINS - ONTARIO CASE STUDY
V. H. SINGHROY, T. J. ELLIS (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada), and D. JANES (Ministry of Northern Affairs, Ontario Geological Survey, Sioux Lookout, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 531-538. refs

A86-47835#
RADAR IMAGE ANALYSIS FOR MAPPING CENTRAL APPALACHIAN CROSS-STRIKE STRUCTURAL DISCONTINUITIES
C. S. SOUTHWORTH (USGS, Reston, VA) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 539-551. refs

Two cross-strike structural discontinuities (CSD's) in the central Appalachians of Virginia and West Virginia have been identified by photointerpretation of side-looking airborne X-band radar images in conjunction with field mapping. CSD's were defined by Wheeler (1980) as structural lineaments or alignments, at high angles to regional strikes, that are recognizable because they disrupt strike-parallel structural, geomorphic, geophysical, sedimentologic, or other patterns. The Mathias (West Virginia) CSD and the Highland County (Virginia) CSD both trend northwest across the northeast-striking Valley and Ridge Province Appalachians and are believed to represent transverse movement of detachment surfaces, possibly over basement block faults. The concentrations of igneous intrusive rocks and the terminations of gas fields associated with the CSD's suggest that they are important in targetting areas for mineral and hydrocarbon exploration. Geologic and geophysical data suggest that the zones have been intermittently active throughout geologic time and that the zones traverse adjacent physiographic provinces. Author

A86-47836#
MICROWAVE RADIOMETRIC DETECTION AND IMAGING OF OIL SPILLS ON THE SEA
S. HASHIMOTO, H. NAKANO, and M. YAMAGUCHI (Ministry of International Trade and Industry, Electrotechnical Laboratory, Amagasaki, Japan) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 557-565. Research sponsored by the Environment Agency of Japan.

Microwave radiometric detection of oil spills could provide useful information on the distribution of oil film thickness which is practically most important in effective oil confinement, control and clean-up operation. To use for experimental investigation of oil spill detection and mapping, a radiometer and imaging system have been developed, which can operate at both X-band and K-band frequencies by replacing the front-end. Through the measurements of oil slicks of several types, good correlation of the measured results and theory has been obtained. The effect of waves or surface roughness effect on the detection of oil were measured using a laboratory tank. The results provide a quantitative estimation of the effect. Several examples of color imageries taken by the above sensor system are also given. Author

A86-47837#
REMOTE SENSING AS AN AID IN PLANNING REGIONAL GEOCHEMICAL SURVEYS IN THE CANADIAN SHIELD
J. A. C. FORTESCUE (Ministry of Northern Affairs, Ontario Geological Survey, Toronto, Canada) and V. H. SINGHROY (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 567-575.

In August 1984, a small limnology/remote sensing study was completed to the south of the Montreal River in the area to the east of Lake Superior, Ontario. The object was to discover if lakes with an acidity of less than a pH of 5.6 could be identified by remote sensing. This relationship was investigated using synchronous limnological, fixed-wing and helicopter mounted remote sensing surveys over the test area. Subsequent interpretation of the data sets collected from the test site indicates that such identifications might be feasible using Landsat 5 Thematic Mapper data. Author

A86-47839#
THE DISCRIMINATION OF POTENTIALLY ECONOMIC PALAEODRAINAGE SYSTEMS IN THE SEDIMENTARY BASINS OF CENTRAL AND WESTERN AUSTRALIA USING NOAA-AVHRR IMAGERY
I. J. TAPLEY (CSIRO, Div. of Groundwater Research, Wembley, Australia) and P. WILSON (CSIRO, Div. of Mineralogy and Geochemistry, Wembley, Australia) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 585-600. refs

A86-47841*# Cornell Univ., Ithaca, N.Y.
LITHOLOGIC DISCRIMINATION OF VOLCANIC AND SEDIMENTARY ROCKS BY SPECTRAL EXAMINATION OF LANDSAT TM DATA FROM THE PUMA, CENTRAL ANDES MOUNTAINS
E. J. FIELDING (Cornell University, Ithaca, NY) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 619-630. refs
(Contract JPL-956926; NSF EAR-81-21816; NASA TASK RE-185)

The Central Andes are widely used as a modern example of noncollisional mountain-building processes. The Puna is a high plateau in the Chilean and Argentine Central Andes extending southward from the altiplano of Bolivia and Peru. Young tectonic and volcanic features are well exposed on the surface of the arid Puna, making them prime targets for the application of high-resolution space imagery such as Shuttle Imaging Radar B and Landsat Thematic Mapper (TM). Two TM scene quadrants from this area are analyzed using interactive color image processing, examination, and automated classification algorithms. The large volumes of these high-resolution datasets require significantly different techniques than have been used previously for the interpretation of Landsat MSS data. Preliminary results include the determination of the radiance spectra of several volcanic and sedimentary rock units and the use of the spectra for automated classification. Structural interpretations have revealed several previously unknown folds in late Tertiary strata, and key zones have been targeted to be investigated in the field. The synoptic view of space imagery is already filling a critical gap between low-resolution geophysical data and traditional geologic field mapping in the reconnaissance study of poorly mapped mountain frontiers such as the Puna. Author

A86-47843#
APPLICATION OF THEMATIC MAPPER DATA FOR HYDROCARBON EXPLORATION IN THE HARDEMAN BASIN OF NORTH TEXAS
V. S. MOORE and R. L. ANDERSON (Satellite Exploration Consultants, Inc., Midland, TX) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 645-653. refs

Exploration in the Hardeman Basin has been difficult because of the small, localized nature of traps and a poorly understood relationship between regional structure and production. This paper demonstrates the effectiveness of Landsat Thematic Mapper (TM) data as an exploration tool in this basin. Regional as well as local structures are defined on TM images as lineaments, tonal anomalies, and topographic anomalies. Anomalies observed over the basin's major structures are best identified on small-scale images. Other smaller more subtle anomalies, such as those formed over bioherms, require large-scale images for identification. An exploration program using information derived from the TM data involves the identification of production trends and the development of models based on anomalies observed over producing structures that can be used to delineate potential prospect areas. Author

A86-47844*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SHUTTLE RADAR IMAGES FOR GEOLOGIC MAPPING IN TROPICAL RAINFOREST
J. P. FORD (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and R. DA CUNHA (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 669-676. NASA-supported research.

Images of forested low-relief terrain in the Amazon basin of Brazil, obtained with airborne imaging radar in the Radambrasil project, are compared with SIR-A and Landsat MSS band-7 images to evaluate their usefulness in constructing geologic maps. Sample images are shown, and it is found that Radam images are more useful in distinguishing drainage patterns and mapping the region distribution of stream channels due to their relatively low depression angles (less than 25 deg as opposed to 43-37 deg for SIR-A), but that SIR-A images give superior discrimination of alluvial forest, where trees stand in water, due to the higher reflectivity of branches and water at the SIR-A wavelength (23.5 cm as opposed to 3 cm for Radam). Alluvial forest is also identified by Landsat band 7. T.K.

A86-47847#
SPECTRAL GEOBOTANY IN GLACIATED ENVIRONMENTS - TEST OVER A MINERALIZED TILL SITE IN NORTHERN ONTARIO
V. H. SINGHROY (Ministry of Natural Resources, Ontario Centre for Remote Sensing, Toronto, Canada), E. SADO (Ministry of Northern Affairs, Ontario Geological Survey, Toronto, Canada), and W. BRUCE (Canada Centre for Remote Sensing, Ottawa) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 701-720. refs

A86-47848#
A CONTINUED STUDY OF THE PATRICK DRAW TEST SITE SWEETWATER COUNTY, WYOMING
D. M. RICHERS (Gulf Research and Development Co., Houston, TX) and C. WEATHERBY (Adrian College, MI) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 723-733. refs

A Landsat-D-Simulator image of the Patrick Draw area, a region with oil and gas fields where microseepage of light hydrocarbon gases from subsurface reservoirs has been observed, is presented and analyzed on the basis of ground-truth data including free, acid-extractable, and disaggregated soil-gas samples; 365-nm-fluorescence measurements on soil samples; and observations of vegetation patterns. Spectral anomalies on the Landsat-Simulator image are found to correspond to areas with high gas seepage and damaged vegetation cover, centered on the main oil/gas production fields; good correlation is also found with the fluorescence data. It is suggested that the spectral anomalies may be due either to the differences in the flora or to differences in the soil itself. T.K.

A86-47849#
MULTIPLE SOURCE DATA PROCESSING FOR REGIONAL GEOLOGIC ANALYSIS
V. CARRERE and P. T. NGUYEN (IBM France, S.A., Paris) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 735-744. refs

A structural analysis of a region in southeastern France is presented. Satellite data (a digital mosaic of five Landsat images and IR data from HCMM), topographic data (DTM), and a digitized gravimetric map are registered and placed in a geocoded data base (Lambert projection). Landsat data are primarily used to detect linear structures and then directionally filtered to enhance the main structural features. The same method is applied to HCMM data, and a first comparison is made to check whether features detected are confirmed, linked, or extended by thermal properties, and to make a first selection between superficial accidents in the sedimentary cover and deeper ones. Correlations with strong gradient limits or elongated inclusions on the gravimetric data give more information on faults affecting the basement. The processed data and their interpretations add pertinent elements to the interpretation of the geodynamic evolution of southeastern France. Author

A86-47850#
TOWARD INTELLIGENT IMAGE PROCESSING FOR GEOLOGICAL APPLICATIONS
M. FENG (Beijing Graduate School, Beijing; Wuhan College of Geology, People's Republic of China) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 745-754. Research sponsored by the National Science Foundation of the People's Republic of China. refs

This paper reports early results of a research project on Landsat-image processing sponsored by the National Science Foundation of China. The goal of the project is to provide China's geological-remote-sensing community with guidelines to more efficiently and effectively use the growing image-processing capacity in China to produce optimum image products to meet their specific requirements. To characterize the information content of a single image (either a band, a ratio, or a principal component) and its significance in geological interpretation, a concept of information ranking is presented. Geologically related spectral information in an image can generally be stratified into three or more ranks or levels. Image enhancement, in a sense, means

selective display of certain ranks of information. While band ratios and linear transformations enhance spectral separation, different ratios and different linear combinations work differently in terms of information ranks. Four examples from different physiographic areas of China are selected to illustrate this important point and its use in selection of image combinations for color compositing.
Author

A86-47851#
SPATIAL RELATIONSHIP OF GOLD OCCURRENCES WITH LINEAMENTS DERIVED FROM LANDSAT AND SEASAT IMAGERY, MEGUMA GROUP, NOVA SCOTIA
G. F. BONHAM-CARTER, A. N. RENCZ (Geological Survey of Canada, Ottawa), and J. R. HARRIS (F.G. Bercha and Associates, Ltd., Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 755-768. refs

A86-47852#
MAPPING STRUCTURE AND RELATED GEOBOTANICAL PHENOMENA USING SEVERAL DATES OF LANDSAT IMAGERY, RAILROAD VALLEY, NEVADA
R. O. GREEN and D. A. ROBERTS (Stanford University, CA) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 771-780. refs

A86-47853#
AIRBORNE THERMAL INFRA-RED LINESCAN IN GEOLOGY
B. C. TANDY and E. AMOS (Clyde Surveys, Ltd., Maidenhead, England) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 783-792.

The use of airborne-IR-scanning data for geological mapping and surveying is discussed and illustrated with sample images, graphs, and diagrams. The fundamental principles of the IR-scanning technique are reviewed; factors determining the IR signatures of geological formations are examined; and applications involving structural control and mineralization, hot thermal mineral indicators, bulk mineral assessment, engineering planning, geothermal energy, and hydrogeology are briefly characterized.
T.K.

A86-48084
RECTANGULAR HARMONIC ANALYSES OF GEOMAGNETIC ANOMALIES DERIVED FROM MAGSAT DATA OVER THE AREA OF THE JAPANESE ISLANDS
I. NAKAGAWA and T. YUKUTAKE (Tokyo, University, Japan) Journal of Geomagnetism and Geoelectricity (ISSN 0022-1392), vol. 37, no. 10, 1985, p. 957-977. refs

A86-48394
GEOLOGICAL REMOTE SENSING - QUO VADIS?
C. WEBER (Bureau de Recherches Geologiques et Minieres, Orleans, France) ITC Journal (ISSN 0303-2434), no. 4, 1985, p. 227-241. refs

The uses of remote sensing techniques in the areas of geological mapping, oil exploration, mineral exploration, and engineering technology are discussed, together with the major directions of research in these areas. Applications of the Landsat MSS imagery, the TM, the Shuttle multispectral infrared radiometer, the SAR, the imaging radars mounted on the SIR-A and SIR-B satellites, and the stereoscopic capability of SPOT are described. Examples are presented concerning the use of the heat capacity mapping mission for petroleum exploration and the use of Landsat MSS data in detecting hydrothermal alterations associated with deposits of copper, gold, and uranium. Advances made in the assessment of natural hazards with the use of remote sensing technology are discussed.
I.S.

A86-49279
GEOMORPHOLOGICAL MANIFESTATION OF OIL- AND GAS-BEARING LOCAL STRUCTURES IN THE ORENBURG DISTRICT ON SPACE IMAGES [GEOMORFOLOGICHESKOE VYRAZHENIE NEFTEGAZOVYKH LOKAL'NYKH STRUKTUR ORENBURGSKOI OBLASTI NA KOSMICHESKIKH SNIMKAKH]
N. N. IAKHIMOVICH (Vsesoiuznyi Nauchno-Issledovatel'skii Geologorazvedochnyi Neftianoi Institut, Orenburg, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 32-38. In Russian. refs

A86-49280
INTERPRETATION OF GEOLOGICAL INDICATORS ON SPACE PHOTOGRAPHS TAKEN IN THE COURSE OF OIL AND GAS EXPLORATIONS IN THE LATITUDINAL STRETCH OF THE OB' RIVER AREA AND ADJACENT TERRITORIES OF WESTERN SIBERIA [GEOINDIKATSIONNOE DESHIFRIROVANIE AEROKOSMICHESKIKH SNIMKOV PRI NEFTEGAZOPOISKOVYKH RABOTAKH V SHIROTNOM PRIOB'E I NA SOPREDEL'NYKH PLOSHCHADIAKH ZAPADNOI SIBIRI]
B. M. GUSHCHIN (Institut Geologii i Razrabotki Goriuchikh Iskopaemykh, Kiev, Ukrainian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 41-49. In Russian.

A86-49315
A STUDY OF THE EFFICIENCY OF SPATIAL DIFFERENTIATION OPERATIONS DURING THE GEOLOGICAL INTERPRETATION OF AERIAL AND SATELLITE PHOTOGRAPHS [ISSLEDOVANIE EFFEKTIVNOSTI ISPOL'ZOVANIIA OPERATSII PROSTRANSTVENNOGO DIFFERENTSIROVANIIA PRI GEOLOGICHESKOM DESHIFRIROVANII AEROKOSMOFOTOSNIMKOV]
R. S. BACHEVSKII, G. I. GASKEVICH, L. I. MURAVSKII, and D. A. IANUTSH IN: Optical processing of images . Leningrad, Izdatel'stvo Nauka, 1985, p. 3-18. In Russian.

A86-49512
AIRPHOTO OBSERVATION OF TRANSCURRENT NEOTECTONICS AT THE NORTHERN EDGE OF THE CARIBBEAN PLATE (CABO FALSO, DOMINICAN REPUBLIC) [OBSERVATION PAR PHOTOGRAPHIES AERIENNES D'UNE NEOTECTONIQUE EN DECROCHEMENT AUX CONFINS SEPTENTRIONAUX DE LA PLAQUE CARAIBE /CABO FALSO, REPUBLIQUE DOMINICAINE/]
B. VAN DEN BERGHE and J. CHOROWICZ (Paris VI, Universite, France) Photo Interpretation (ISSN 0031-8523), vol. 24, Jan.-Feb. 1985, p. 17-21, 23, 25. In French, English, and Spanish.

A86-49605#
STRUCTURAL ANALYSIS ON THE BASIS OF DIGITAL PROCESSED SATELLITE IMAGERY DATA REGARDING THE BASEMENT OF NORTHEAST BAVARIA [STRUKTURANALYSE MIT DIGITAL VERARBEITETEN SATELLITENBILDDATEN IM NORDOSTBAYERISCHEN GRUNDGEBIRGE]
D. KAISER, J. KUHLMANN, L. WAEBER (Saarberg-Interplan Uran GmbH, Saarbruecken, West Germany), and D. SCHLICHTER (DFVLR, Wessling, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 14 p. In German. BMFT-supported research. refs

The project considered in this paper has the objective to develop and test remote sensing techniques for the exploration of uranium vein-type deposits, taking into account a study of representative uranium deposits in Bavaria, West Germany. The new image processing method is to provide a basis for a more rapid recognition of uranium deposits in large areas, giving attention also to a fast evaluation of the economic potential of the deposits. In addition, the new method is to contribute to the aim of an optimized control of the subsequent exploration program. Other aims to be

considered are related to a reduction in specific exploration costs, and the lowering of the technological-economic risk involved in the exploration. It is also expected that the developed methodology can be applied in cases involving geologically comparable areas in other climatic zones. G.R.

A86-49768
USE OF SPACE REMOTE-SENSING DATA FOR GEOLOGICAL STUDIES IN THE TROPICS [OPYT GEOLOGICHESKOGO PRIMENENIIA AEROKOSMICHESKIKH MATERIALOV V TROPICHESKIKH USLOVIIAKH]
V. G. TRIFONOV, I. ORO ALFONSO, and C. PERES PERES (AN SSSR, Geologicheskii Institut, Moscow, USSR; Academia de Ciencias de Cuba, Instituto de Geologia y Paleontologia, Havana) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 38-43. In Russian. refs

Geological structures identified by analyzing remote-sensing images of western Cuba were correlated with features on geological maps compiled (on a 1:250,000 scale) on the basis of a geological survey. The interpreted images were particularly useful in identifying postfolding orogenic structures formed at the second stage of deformation, which were poorly visible on geological maps. Hydrothermal sulfide deposites can be correlated with the interpreted ring structures formed during the same period. I.S.

A86-49769
THE USE OF SPACE PHOTOGRAPHY IN STUDIES OF SEISMICITY [PRIMENENIE KOSMICHESKIKH SNIMKOV PRI IZUCHENII SEISMICHNOSTI]
V. P. LOZIEV and M. S. SAIDOV (Gosudarstvennyi Nauchno-Issledovatel'skii i Proizuodstvennyi Tsentr Priroda, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 50-53. In Russian. refs

The characteristic structural and geomorphological signatures, visible on space images which can identify areas of high seismicity, are described, on the example of a sector of the Alai mountain range. These structures can be recognized on space photographs, being coincident with the areas of dense tectonic fractures that cross zones of seismogenic faults, or with narrowing river valleys. They are emphasized by developing landslides. I.S.

N86-28494# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
THE USE OF SAR SYSTEMS FOR GEOLOGICAL APPLICATIONS
F. JASKOLLA (Ludwig-Maximilians-Universitaet, Munich, West Germany), M. RAST, and J. BODECHTEL *In its* Proceedings of a Workshop on Thematic Applications of SAR Data p 41-50 Dec. 1985
Avail: NTIS HC A06/MF A01

Radar imagery was used for gelogical mapping in Southern Iceland, Bavaria, Italy, and Egypt. Radar data enables an improved identification of lithological units and structural features. Experiments on the information content of simultaneously collected X, C, and L-band data are needed. The application of radargrammetric correction is of great importance. ESA

N86-28557*# Oxford Univ. (England). Dept. of Earth Sciences.
PB ISOTOPIC EVIDENCE FOR EARLY ARCHAEAN CRUST IN SOUTH GREENLAND
P. N. TAYLOR and F. KALSBEEK (Geological Survey of Greenland, Copenhagen, Denmark) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks p 103-106 1986
Avail: NTIS HC A09/MF A01 CSCL 08G

The results of an isotopic remote sensing study focussed on delineating the extent of Early Archean crust north and south of the Nuuk area and in south Greenland is presented. Contamination of the Late Archean Nuk gneisses and equivalents by unradiogenic Pb uniquely characteristic of Amitsoq gneiss was detected as far south as Sermilik about 70 km south of Nuuk and only as far north as the mouth of Godthabsfjord. This study was extended to the southern part of the Archean craton and the adjoining Early Proterozoic Ketilidian orogenic belt where the Pb isotopes suggest several episodes of reworking of older uranium depleted continental crust. The technique of using the Pb isotope character of younger felsic rocks, in this case Late Archean and Early Proterozoic gneisses and granites to sense the age and isotopic character of older components, is a particularly powerful tool for reconstructing the evolutionary growth and development of continental crust. Author

N86-28559*# Atammik, Sukkertoppen (Greenland).
THE ARCHEAN GEOLOGY OF THE GODTHABSFJORD REGION, SOUTHERN WEST GREENLAND (INCLUDES EXCURSION GUIDE)
V. R. MCGREGOR, A. P. NUTMAN (Memorial Univ. of Newfoundland, St. Johns), and C. R. L. FRIEND (Oxford Polytechnic, England) *In* Lunar and Planetary Inst. Workshop on Early Crustal Genesis: The World's Oldest Rocks p 113-169 1986
Avail: NTIS HC A09/MF A01 CSCL 08G

The part of the West Greenland Archean gneiss complex centered around Godthabsfjord and extending from Isukasia in the north to south Faeringehavn is studied. Extensive outcrops of 3800 to 3400 Ma rocks can provide some direct evidence of conditions and processes that operated on the Earth in the early Archean. However, the ways in which primary characteristics have been modified by later deformation, metamorphism, and chemical changes are first taken into account. The rocks exposed are the products of two major phases of accretion of continental crust, at 3800 to 3700 Ma and 3100 to 29 Ma. The main features of these two accretion phases are similar, but careful study of the least modified rocks may reveal differences related to changes in the Earth in the intervening period. The combination of excellent exposure over an extensive area, relatively detailed geological mapping of much of the region, and a considerable volume of isotopic and other geochemical data gives special insights into processes that operated at moderately deep levels of the crust in the Archean. Of particular interest is the effect of late Archean granulite facies metamorphism on early Archean rocks, especially the extent to which isotope systems were disturbed. Similar processes may well have partly or wholly destroyed evidence of more ancient components of other high grade terrains. This account does not attempt to be an exhaustive review of all work carried out on the geology of the region. Rather, it attempts to summarize aspects of the geology and some interest in the context of early crustal genesis. Author

N86-28572# Kanner (Leo) Associates, Redwood City, Calif.
EXCITATION OF ELECTROSTATIC WAVE TURBULENCE IN IONOSPHERE AS ONE EFFECT OF SEISMIC ACTIVITY
M. B. GOKHBERG, I. L. GUFELD, A. V. KUSTOV, V. A. LIPEROVSKII, A. M. BULOSHNIKOV, V. A. PILIPENKO, O. A. POKHOTELOV, and S. L. SHALIMOV 1985 41 p Transl. into ENGLISH of "Vozbuzhdenie Elektrostaticheskoi Volnovoi Turbulentnosti v Ionosfere Kak Odin iz Effektov Seismicheskoi Aktivnosti" Preprint no. 16 Moscow, USSR, 1983
(Contract W-7405-ENG-36)
(TI86-025135; LA-TR-85-62) Avail: NTIS HC A03/MF A01

A possible scenario of the buildup of a chain of geophysical phenomena is proposed associating processes in terra firma in the concluding stage of earthquake presaging and bursts of wave turbulence in the ionosphere observed on satellites. Author

N86-30248# International Centre for Theoretical Physics, Trieste (Italy).
GEM 10B SATELLITE GRAVITY DATA AND NIGERIAN OIL PROSPECTS
S. C. GARDE and W. Y. KIM Nov. 1984 11 p
(DE86-701366; IC-84/202) Avail: NTIS (US Sales Only) HC A02/MF A01

Extension of the hydrocarbon rich Benue depression and the Niger delta basin in the bight of Benin is construed from the gravity data of gravity Earth Model (GEM) 10B Satellite, published

by NASA, Goddard Space Flight Center in 1977. This interpretation is based on the supposition that: 1) the depth of a buried horizontal cylinder can be estimated by the Fourier transform of the vertical gravity field; and 2) the oil horizons of southern Nigeria are basically connected to the separation of South American and African plates. DOE

N86-31088# Technische Univ., Clausthal-Zellerfeld (West Germany). Inst. fuer Geologie und Palaeontologie.
GEOLOGY
P. KRONBERG and P. MURINO (Naples Univ., Italy) *In* DFVLR The X-SAR Science Plan p 43-74 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Experiments to study how spaceborne imaging radar can improve geological mapping capability and capacity are proposed for the X-SAR/SIR-C mission. Complementary data X-SAR-type imagery can provide at regional to global scales as compared to information from Landsat sensors is discussed. Expected information on rocks, soils, and structures is assessed. Effect of radar operating parameters (illumination geometry, frequency, and polarization) on radar backscatter of rock units and surficial deposits in diverse type of terrain (arid, semi-arid, Mediterranean, humid, tropical areas; plains, rolling country, hilly and mountainous terrain) is considered. Test areas to evaluate the application potential of multifrequency, multipolarization, and multi-incidence-angle imagery for regional and global geological mapping projects are suggested. ESA

N86-31158*# Arizona Bureau of Geology and Mineral Technology, Tucson.
CENOZOIC EXTENSION AND MAGMATISM IN ARIZONA
S. J. REYNOLDS and J. E. SPENCER *In* Lunar and Planetary Inst. Papers Presented to the Conference on Heat and Detachment in Crustal Extension on Continents and Planets p 128 - 132 1985
Avail: NTIS HC A08/MF A01 CSCL 08G

The Basin and Range Province of Arizona was the site of two episodes of Cenozoic extension that can be distinguished on the basis of timing, direction and style of extension, and associated magmatism. The first episode of extension occurred during Oligocene to mid-Miocene time and resulted in the formation of low-angle detachment faults, ductile shear zones (metamorphic core complexes), and regional domains of tilted fault blocks. Evidence for extreme middle Tertiary crustal extension in a NE to SW to SW to ENE to WSW direction has been recognized in various parts of the Basin and Range of Arizona, especially in the Lake Mead area and along the belf of metamorphic core complexes that crosses southern Arizona from Parker to Tucson. New geologic mapping and scrutiny of published geologic maps indicates that significant middle Tertiary extension is more widely distributed than previously thought. The state can be subdivided into regional tilt-block domains in which middle Tertiary rocks dip consistently in one direction. The dip direction in any tilt-block domain is generally toward the breakaway of a low-angle detachment fault that underlies the tilt-block domain; we interpret this an indicating that normal faults in the upper plate of a detechment fault are generally synthetic, rather than antithetic, with respect to the detachment fault. Author

N86-31967# Environmental Research Inst. of Michigan, Ann Arbor. Radar Div.
THE USGS (US GEOLOGICAL SURVEY) X-, C-, AND L- BAND SAR DATA COLLECTION PROGRAM Topic Report, Nov. 1983 - Aug. 1985
E. S. KASISCHKE Aug. 1985 121 p
(Contract DI-14-08-0001-21748)
(AD-A168173; ERIM-173000-4-T) Avail: NTIS HC A06/MF A01 CSCL 17I

This report presents the results of data collection program performed for the U.S. Geological Survey. Twenty-two passes of high resolution (3m), multifrequency (X-, C- and L-band) and multipolarization (VV and VH) imagery were collected over five test sites within the North Carolina Digital Project Area. The SAR used for this program was the ERIM/CCRS CV-580 SAR System. This report presents diagrams of the ground swath of each SAR pass, along with representative SAR imagery which illustrates the high quality of the data set. The engineering assessment performed on the SAR imagery is discussed. The optical and digital SAR data products generated for this program are summarized, including the first-order geometric and radiometric corrections applied to the digital data. GRA

N86-31968# Geological Survey, Sioux Falls, S. Dak.
DIGITAL PROCESSING OF LANDSAT TM IMAGES FOR LINEAMENT OCCURRENCE AND SPATIAL FREQUENCY IN SEDIMENTARY ROCKS
G. K. MOORE and D. A. HASTINGS 1986 33 p
(Contract DE-AI05-85OR-21552)
(DE86-009834; DOE/OR-21552/1) Avail: NTIS HC A03/MF A01

This report describes and evaluates procedures for the enhancement and extraction of lineament segments by computer processing of digital Landsat Thematic Mapper data. Nearly all results were obtained by convolution of filter windows in the spatial domain. During the course of the study several new procedures were developed for image enhancement, directional enhancement, and the extraction of edge and line segments from directionally-filtered images. The standard procedure proved satisfactory for an extraction of prominent edges and lines in the Landsat images. Part of the problem is caused by the landscape and illumination characteristics of the selected images, but another part is caused by the fact that many boundaries are gradational and do not fit a simple mathematical description of edges and lines. Because of this problem, extraced segments in shale outcrop areas were not compared with those in other types of sedimentary rocks, and measurements of the spatial frequency of occurrence of these segments have a questionable value. A possible solution to the problems found by this study would be: (1) to use a combination of digital elevation data and digital remotely-sensed data of the same area; and (2) to combine directional enhancement and lineament segment extraction with visual detection, screening, and editing. DOE

N86-32803 Centre National de la Recherche Scientifique, Grenoble (France).
SEISMOLOGICAL DATA ACQUISITION BY SATELLITE [COLLECTE DE DONNEES SISMOLOGIQUES PAR SATELLITE]
G. POUPINET *In its* International Geophysics and Space p 591-598 1985 In FRENCH
Avail: CEPADUES, Toulouse, France

The use of the INTELSAT, GOES, GMS, ARGOS, and Meteosat networks for geophysical data transmission is discussed. The needs of seismological stations incorporated in satellite networks, are assessed, and the SEISPACE network, which transmits seismological data by satellites, is presented. ESA

N86-32856# Strathclyde Univ., Glasgow (Scotland). Dept. of Applied Geology.
REMOTE SENSING OF NATURAL GEOLOGICAL HAZARDS IN THE SITING OF ENGINEERING FACILITIES
C. A. DAVENPORT *In* ESA Remote Sensing Applications in Civil Engineering p 139-142 Mar. 1985
Avail: NTIS HC A06/MF A01

Hazards to civil engineering facilities produced by active surface faulting and volcanism are reviewed, emphasizing site selection and design criteria in nuclear power plant safety studies. Phenomena sought during regional and local site investigations are described and remotely sensed data which can be applied to these investigations are grouped to provide an optimum-input scheme for siting studies. Lineaments, morphotectonics, geological offsets, fault traces, deformation zones and appurtenant landslides are illustrated to provide details of important geological hazards and to document satellite and aerial imagery and photography, radiometry, moving and time-lapse film techniques, and seismological records. ESA

05

OCEANOGRAPHY AND MARINE RESOURCES

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

A86-40316
AIRBORNE LIDAR BATHYMETRY
K. MUIRHEAD and A. P. CRACKNELL (Dundee, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 597-614. Research supported by the Royal Aircraft Establishment. refs

Through an extensive literature review the results of previous lidar investigations in Australia, Canada, Sweden, the U.S.A. and West Germany have been evaluated. Based on these findings estimates are given for the anticipated depth capability, measurement accuracy and operational constraints for a laser system in U.K. waters. Consideration is also given to the possibility of deploying a depth-sounding lidar for non-bathymetric purposes such as depth-resolved turbidity mapping. Author

A86-40318
WHITECAPS AND THE PASSIVE REMOTE SENSING OF THE OCEAN SURFACE
E. C. MONAHAN and I. G. OMUIRCHEARTAIGH (University College, Galway, Ireland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 627-642. refs
(Contract NR PROJECT 211-229; N00014-85-M-0065; N00014-78-G-0052)

Whitecap coverage (W), which influences the apparent microwave brightness temperature and short-wave albedo of the sea surface, is not only a strongly nonlinear function of the 10 m-elevation wind speed (U), but also varies with changes in the stability of the lower atmosphere (i.e. with alterations in the water-air temperature difference Delta-T), and with changes in the surface-sea water temperature (T sub w). Thus wind retrieval algorithms to be applied to open ocean data from whitecap-detecting satellite instruments should ideally be of the form, U(W, Delta-T, T sub w, d), where d is a measure of the effective wind duration. The wind speed associated with the onset of whitecapping, while also varying with Delta-T and T sub w, is typically 3 to 3.5 m/s, not the often quoted 7 m/s. Author

A86-40319
AN ALGORITHM FOR THE RETRIEVAL OF SEDIMENT CONTENT IN TURBID COASTAL WATER FROM CZCS DATA
S. TASSAN and B. STURM (CEC, Joint Research Centre, Ispra, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, May 1986, p. 643-655. refs

The retrieval variable and algorithm for the retrieval of sediment content are developed using numerical simulations and sensitivity analyses. A model for calculating the spectral irradiance reflectance of water as a function of pigment, seston, and yellow substance concentration is presented. The algorithm is applied to the study of Coastal Zone Color Scaner images of the Adriatic Sea in order to evaluate the low sensitivity of the sediment retrieval variable to the radiance value of the atmospheric correction algorithm. Two water types in the northern basin of the Adriatic Sea are identified; the water types have different correlation between sediment and chlorophyll and correspond to coastal zones with different hydrological conditions. The experimental data verifies the predicted low sensitivity of the atmospheric correction algorithm, and it is noted that the procedure is useful in turbid water where sediment and chlorophyll concentrations are uncorrelated. I.F.

A86-40822
AUTOMATIC INTERPRETATION OF WAVE FIELDS FROM SEASAT 1 SAR RADAR DATA [INTERPRETATION AUTOMATIQUE DE CHAMPS DE VAGUES A PARTIR DES DONNEES DU RADAR SAR DE SEASAT 1]
F. CUQ (Ecole Normale Superieure, Montrouge, France) Photo Interpretation (ISSN 0031-8523), vol. 23, July-Aug. 1984, p. 1-4. In English, French, and Spanish.

Based on Seasat 1 images recorded on August 21, 1978 above the Pertuis Breton (France) narrows, sea state parameters are extracted to compute the wavelength at infinite depth and wave field characteristics, with the exception of significant wave height. Data were recorded at the beginning of ebb tide, 1 h after high spring tide with a 1.06 coefficient. The 1024-square pixel subimage, with pixels of 12.5 on one side, was preprocessed using a two-dimensional Fourier transform. A two-channel image was convolved, and parameters are quantified by a survey of mean direction, revealing six principal zones. The period, velocity, angular frequency, number of waves, and group velocity are computed for wavelengths of 100, 110, and 120 m. The method has application to the climatology of sea states, coast wave incidence angle analysis, and coastal drift current direction and speed measurement. Processed Seasat images are included. R.R.

A86-40851*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AAFE RADSCAT 13.9-GHZ MEASUREMENTS AND ANALYSIS - WIND-SPEED SIGNATURE OF THE OCEAN
L. C. SCHROEDER (NASA, Langley Research Center, Hampton, VA), P. R. SCHAFFNER (Research Triangle Institute, Hampton, VA), J. L. MITCHELL (Kentron International, Inc., Hampton, VA), and W. L. JONES (Harris Corp., Melbourne, FL) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-10, Oct. 1985, p. 346-357. refs

The Advanced Applications Flight Experiment Radiometer Scatterometer, or 'AAFE RADSCAT', was developed as a research tool for the evaluation of the use of microwave remote sensors in gathering data on wind speed at the ocean's surface. The most important function of AAFE RADSCAT was to furnish a data base of ocean normalized radar cross section (NRCS) measurements as a function of surface wind vector at 13.9 GHz. The NRCS measurements cover a wide parametric range of incidence and azimuth angles and winds. Attention is presently given to analyses of data from the 26 RADSCAT flights during which the quality of the sensors and the surface wind measurements were felt to be understood; subsets of the data base are used to model the relationship between the Ku-band radar signature and the ocean surface wind vector. O.C.

A86-40852* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DETERMINATION OF SEA ICE MOTION USING DIGITAL SAR IMAGERY
J. C. CURLANDER, B. HOLT, and K. J. HUSSEY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-10, Oct. 1985, p. 358-367. NASA-supported research. refs

Precise, densely sampled maps of ice motion have been derived from digital Seasat SAR imagery, in order to determine the small scale spatial variability of ice formation. The SAR images were processed to remove geometric distortions, and then located to an accuracy of about 100 m by means of a spacecraft orbital data/SAR characteristics algorithm, independently of attitude and ground reference point data. Ice features common to an overlapping pair of images yielded vector plots of ice motion that indicate a high degree of spatial deformation, demonstrating the potential value of spaceborne SAR data. O.C.

A86-40857
THE STATUS OF THE PASSIVE MICROWAVE SENSING OF THE WATERS LAKES, SEAS, AND OCEANS - UNDER THE VARIATION OF THEIR STATE, TEMPERATURE, AND MINERALIZATION (SALINITY): MODELS, EXPERIMENTS, EXAMPLES OF APPLICATION
A. M. SHUTKO (AN SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-10, Oct. 1985, p. 418-437. refs

A86-40858* Applied Science Associates, Inc., Apex, N.C.
THE EFFECT OF MICROWAVE BACKSCATTER UNCERTAINTY ON SATELLITE RADAR ALTIMETER ACCURACY
L. S. MILLER (Applied Science Associates, Inc., Apex, NC) and C. L. PARSONS (NASA, Wallops Flight Center, Wallops Island, VA) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-10, Oct. 1985, p. 438-442. refs

The effect of variations in ocean surface roughness characteristics with upwind/downwind direction, reported by other investigators, is used to compute radar cross section (RCS) and to assess the errors which may arise in present and planned altimeter sensors. Based on an analysis of the rough surface impulse response, the uncertainty between attitude angle and RCS asymmetry is found to cause height errors as large as 12 cm, depending on off-nadir angles and sea state. Additionally, the previously reported data in conjunction with computed facet backscatter are found to produce RCS characteristics at large off-nadir angles which are in better agreement with experimental results than those predicted by physical optics Gaussian theory.
Author

A86-41369
WARM OUTBREAKS OF THE GULF STREAM INTO THE SARGASSO SEA
P. CORNILLON, D. EVANS (Rhode Island, University, Kingston), and W. LARGE (National Center for Atmospheric Research, Boulder, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, May 15, 1986, p. 6583-6596. refs
(Contract N00014-81-C-0062)

The characteristics of warm outbreaks, large bodies of Gulf Stream water with apparent anticyclonic circulation that detach from the Gulf Stream and exist as well-defined entities in the Sargasso Sea, are discussed. A total of 18 separate warm outbreaks observed by satellite from May 1979 to June 1984 are described in terms of their location, circulation, size and orientation, time scales, horizontal displacement, vertical extent, SST differences between warm outbreak and the Sargasso Sea, and frequency of formation. The warm outbreaks are then related to the numerical predictions of 'opposite vortices' by Ikeda and Apel (1981) and to observations of anticyclonic eddies in the Sargasso Sea. C.D.

A86-41371
HOW RADIAL ORBIT ERRORS ARE MAPPED IN ALTIMETRIC SURFACES
P. MAZZEGA (Etablissement Principal du Service Hydrographique et Oceanographique de la Marine, Brest, France) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, May 15, 1986, p. 6609-6628. Research supported by the Institut Francais de Recherche et pour l'Exploitation de la Mer. refs
(Contract CNRS-ATP-84-3253)

The correlation between sea or ice sheet surface topographies and radial orbit errors is examined in the context of space-time sampling of the domain by an orbiting altimeter. Useful properties of the radial orbit errors are derived, and it is shown that the geographical coordinates and the time are independent variables of the error mapped on the earth. Hence, the spatial structure of a given orbit error is entirely deduced from the first satellite's coverage of the earth. The next satellite passes generate what appears as a slow oscillation in time of the spatial structure of the error. Taking the restitution of the sea surface signature from altimetry into consideration, the formulation is completed to provide the full correlation function involved in oceanographic studies and the mapping function of the orbit errors in altimetric surfaces. These ideas are illustrated by applications to the Seasat repeat orbit. C.D.

A86-43600
THE OCEAN SURFACE: WAVE BREAKING, TURBULENT MIXING AND RADIO PROBING; PROCEEDINGS OF THE SYMPOSIUM, TOHOKU UNIVERSITY, SENDAI, JAPAN, JULY 19-25, 1984
Y. TOBA, ED. (Tohoku University, Sendai, Japan) and H. MITSUYASU, ED. (Kyushu University, Fukuoka, Japan) Symposium sponsored by the Intergovernmental Oceanographic Commission, World Meteorological Organization, Ministry of Education, Science and Culture of Japan, et al. Dordrecht, D. Reidel Publishing Co., 1985, 598 p. No individual items are abstracted in this volume.

Various papers on the ocean surface are presented, covering the areas of nonlinear wave dynamics, generation of wind waves, ocean-wave forecasting models, satellite observation of the ocean, and dynamics of the oceanic mixed layer for climate study. Special emphasis is placed on wave breaking as a key process connecting these subjects. These papers provide up-to-date reviews of the state of progress in this field of research. C.D.

A86-43741
AN ANALYTICAL MODEL FOR HF BACKSCATTERED DOPPLER SPECTRUM FOR THE OCEAN SURFACE
S. K. SRIVASTAVA and J. WALSH (Newfoundland, Memorial University, Saint John's, Canada) (IEEE and URSI, Special Session on HF Radar Remote Sensing Techniques, University of British Columbia, Vancouver, Canada, June 18-20, 1985) IEEE Journal of Oceanic Engineering (ISSN 0364-9059), vol. OE-11, April 1986, p. 293-295. Research supported by the Department of National Defence of Canada. refs

A86-43851* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
OVERVIEW OF THE SHUTTLE IMAGING RADAR-B PRELIMINARY SCIENTIFIC RESULTS
C. ELACHI, J. CIMINO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and M. SETTLE (NASA, Washingon, DC; ARCO Oil and Gas Co., Plano, TX) Science (ISSN 0036-8075), vol. 232, June 20, 1986, p. 1511-1516. NASA-supported research. refs

Data collected with the Shuttle Imaging Radar-B (SIR-B) on the October 5, 1985 Shuttle mission are discussed. The design and capabilities of the sensor which operates in a fixed illumination geometry and has incidence angles between 15 and 60 deg with 1 deg increments are described. Problems encountered with the SIR-B during the mission are examined. the The radar stereo imaging capability of the sensor was verified and three-dimensional images of the earth surface were obtained. The oceanography experiments provided significant data on ocean wave and internal wave patterns, oil spills, and ice zones. The geological images revealed that the sensor can evaluate penetration effect in dry soil from buried receivers and the existence of subsurface dry channels in the Egyptian desert was validated. The use of multiincidence angle imaging to classify terrain units and derive vegetation maps and the development of terrain maps are confirmed. I.F.

A86-44012* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 40-50 DAY OSCILLATION AND THE EL NINO/SOUTHERN OSCILLATION - A NEW PERSPECTIVE
K. M. LAU (NASA, Goddard Space Flight Center, Greenbelt, MD) and P. H. CHAN (Applied Research Corp., Landover, MD) American Meteorological Society, Bulletin (ISSN 0003-0007), vol. 67, May 1986, p. 533, 534. refs

The tropical ocean-atmosphere exhibits two prominent modes of low-frequency oscillations, i.e., the '40-50' day oscillation and the El Nino/Southern Oscillation (ENSO). The two phenomena are viewed in the same perspective from 10 years of

satellite-derived out-going-longwave-radiation data. Results reveal some interesting features that may lead to new insights into the understanding of the two phenomena. Author

A86-44165
ON THE ESTIMATION OF WAVE SLOPE- AND HEIGHT-VARIANCE SPECTRA FROM SAR IMAGERY
F. M. MONALDO (Johns Hopkins University, Laurel, MD) and D. R. LYZENGA (Michigan, Environmental Research Institute, Ann Arbor) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 543-551. refs

A procedure is described for using synthetic aperture radar (SAR) imagery to estimate two-dimensional ocean wave slopeand height-variance spectra. The logic underpinning the procedure is based both on the results of the numerical simulation of SAR wave imagery and analytic descriptions of the SAR imaging process. The procedure, when applied to SAR imagery of waves acquired during the recent Shuttle Imaging Radar Mission (SIR-B), is shown to produce spectra that agree with independent measures of both the two-dimensional slopeand height-variance spectra. The implications of these results for future SAR missions aimed at measuring ocean waves are considered. Author

A86-44166
SIR-B OBSERVATIONS OF OCEAN WAVES IN THE NE ATLANTIC
G. E. KEYTE (Royal Aircraft Establishment, Farnborough, England) and J. T. MACKLIN (General Electric Co., PLC, Marconi Research Centre, Chelmsford, England) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 552-558. refs

Synthetic-aperture radar (SAR) imagery from SIR-B was obtained over a deep-water site in the NE Atlantic Ocean. Selected images were Fourier analyzed in order to compare SAR measurements of ocean waves with simultaneous data obtained from wave buoys deployed in the site. The wave heights were not large enough to be detected in the first pass over the site, but larger wave amplitudes were present in two subsequent passes that were almost orthogonal and separated by 6 h. The first of these passes showed a system of waves traveling close to the range direction, and secondary wave systems were present in some spectra. Azimuth-traveling waves were seen clearly on only one of the spectra from the second of these passes. All the spectra had the appearance expected from a linear imaging theory, and no significant discrepancies were found between the SAR and buoy measurements of the wavelengths and directions of the dominant wave systems. However, the difficulty in detection azimuth-traveling waves here may be hard to explain in terms of existing theories, but this is not a firm conclusion because large variations (factors of about 4) in spectral intensity were observed across distances as small as 20 km. This variability means that it is very difficult to determine whether SIR-B was observing the true sea state. Procedures to obtain more accurate tests of sea-imaging theories are discussed. Author

A86-44167
COMPARISON OF SIMULATED AND MEASURED SYNTHETIC APERTURE RADAR IMAGE SPECTRA WITH BUOY-DERIVED OCEAN WAVE SPECTRA DURING THE SHUTTLE IMAGING RADAR B MISSION
W. ALPERS (Bremen, Universitaet, West Germany), C. BRUENING (Max-Planck-Institut fuer Meteorologie, Hamburg, West Germany), and K. RICHTER (Deutsches Hydrographisches Institut, Hamburg, West Germany) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 559-566. refs

During the SIR-B mission over the North Sea, two successful synthetic aperture radar (SAR) data takes with simultaneous buoy measurements of ocean wave spectra have been obtained on October 6 and 8, 1984. On October 6, the SAR imaging of ocean waves was predicted as strongly nonlinear and on October 8 as almost linear. The SIR-B experiment confirmed the theoretical predictions. By applying the SAR imaging model based on velocity bunching theory the SAR image spectra are calculated from the measured ocean wave spectra. These calculated SAR image spectra are compared with the SIR-B derived SAR image spectra and it is shown that both agree quite well. This is considered as a further experimental confirmation for the velocity bunching model that has been proposed for describing SAR imaging of ocean surface waves. Author

A86-44168
SIR-B EXPERIMENTS IN JAPAN - SENSOR CALIBRATION AND OIL POLLUTION DETECTION OVER OCEAN
M. FUJITA, H. MASUKO, S. YOSHIKADO, K. OKAMOTO, H. INOMATA (Ministry of Posts and Telecommunications, Radio Research Laboratories, Koganei, Japan) et al. IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 567-574. refs

Preliminary results of the SIR-B experiments conducted in Japan are reported mainly on the sensor calibration and the oil pollution experiments. No significant result was obtained for the rice crop experiment which was carried out at the same time, mainly due to the late flight of SIR-B. The sensor calibration experiment was eventually reduced to only the evaluation of the imaging characteristics of SIR-B. However, a reasonable relation between the image count and RCS is found, and the resolution analysis by using the corner reflector images gives satisfactory results. A possible cause leading to what are rather overestimates of the resolution is pointed out to be the background clutter. A simulated oil slick area over sea was clearly detected on the SIR-B image, although the incident angle was not so appropriate for the purpose. This result demonstrates the capability of a space-borne synthetic aperture radar for effective surveillance of oil spills over high seas. Author

A86-44368* Universities Space Research Association, Huntsville, Ala.
A SATELLITE PASSIVE 37-GHZ SCATTERING-BASED METHOD FOR MEASURING OCEANIC RAIN RATES
R. W. SPENCER (Universities Space Research Association, Huntsville, AL) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 25, June 1986, p. 754-766. refs
(Contract NAS8-34767)

A combination of theory and measurement is used to develop a scattering-based method for quantitatively measuring rainfall over the ocean from Nimbus-7 Scanning Multichannel Microwave Radiometer (SMMR) 37-GHz observations. This technique takes the observed scattering effects of precipitation on 37-GHz brightness temperatures and applies it to the oceanic environment. It requires an estimate of the effective radiating temperature of the cloudy portion of the atmosphere, and a brightness temperature measurement of the cloud-free ocean surface. These two measurements bound all possible combinations of clear and cloudy conditions within a footprint in terms of bipolarized brightness temperatures. Any satellite-observed brightness temperature T(B) lower than these values is assumed to reflect scattering, which at 37 GHz is only due to precipitation-size hydrometeors. Because the technique involves linear transformation between dual polarized brightness temperature and rain rate, there are no nonlinear 'footprint filling' effects and a unique footprint-averaged rain rate results. It is shown that these SMMR-derived rain rates for five cases of convection over the Gulf of Mexico are closely related to simultaneously derived radar rain rates, having a correlation of 0.90. This technique is then applied to a massive squall line over the Gulf of Mexico, and the resulting rain rate distribution reflects features found in cloud top heights and texture inferred from GOES infrared and visible imagery. Author

A86-44370* Washington Univ., Seattle.
DIURNAL VARIATION OF OUTGOING LONGWAVE RADIATION IN THE TROPICS
D. L. HARTMANN and E. E. RECKER (Washington, University, Seattle) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 25, June 1986, p. 800-812. refs
(Contract NAS1-16462)

The diurnal harmonic in longwave emission in the tropical belt (30 deg N-30 deg S) is estimated from nine years of NOAA polar-orbiting satellite data. The results are compared successfully with Nimbus-7 ERB scanner data and with GOES-West geosynchronous satellite data. An interesting and consistent diurnal variation in longwave emission is found over the regions of intense oceanic convection, such as the ITCZ and SPCZ regions, with a peak-to-peak variation of 6-8 W/sq m and a maximum in the morning (0600-1200 LST). Histogram analysis indicates that this variation is associated with a diurnal variation in convective cloud (about 400 mb). Over regions of very intense convection, a diurnal variation of very high clouds (above 100 mb), which is out of phase with the variations at lower levels in the atmosphere, reduces the magnitude of the diurnal harmonic in longwave emission. It is interesting that histograms based on data averaged over 8-km and 250-km boxes give the same qualitative information about cloud and emission variability. Author

A86-45140
CTD AND VELOCITY SURVEYS OF SEAWARD JETS OFF NORTHERN CALIFORNIA, JULY 1981 AND 1982
P. M. KOSRO and A. HUYER (Oregon State University, Corvallis) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 15, 1986, p. 7680-7690. refs
(Contract NSF OCE-80-14943; NSF OCE-84-10862; NSF OCE-84-10546; N00014-80-C-0440)

The results of two mesoscale surveys conducted near Point Arena, California to determine the structure and circulation associated with tongues of cold surface water extending seaward from the coastal zone are presented. The mesoscale structure of the observed temperature, salinity, density, and current fields are described, the observed features are related to those seen in the satellite images, and the directly measured currents are related to the distributions of water properties and to estimates of the geostrophic flow. The relationship of the observed seaward jets to the southward surface current flowing along the Oregon and northern California coast in summer is discussed. C.D.

A86-45234
EXPERIMENTAL INVESTIGATION OF THREE- AND FOUR-WAVES RESONANCE INTERACTIONS OF SURFACE SEA WAVES [EKSPERIMENTAL'NYE ISSLEDOVANIIA TREKH- I CHETYREKHVOLNOVYKH REZONANSNYKH VZAIMODEISTVII POVERKHNOSTNYKH MORSKIKH VOLN]
I. I. STRIZHKIN and V. I. RALETNEV (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 22, April 1986, p. 412-417. In Russian. refs

A86-45235
SPACE-TIME ANALYSIS OF SEA SURFACE PHOTOGRAPHS [PROSTRANSTVENNO-VREMENNOI ANALIZ FOTOIZOBRAZHENII MORSKOI POVERKHNOSTI]
V. M. BURDIUGOV, S. A. GRODSKII, V. N. KUDRIAVTSEV, and A. A. SUBBOTIN (AN USSR, Morskoi Gidrofizicheskii Institut and Institut Biologii Iuzhnykh Morei, Sevastopol, Ukrainian SSR) Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 22, April 1986, p. 418-426. In Russian. refs

Time-sequenced aerial photographs of the Black Sea in August 1982 are used to estimate the relationship between the space and time scales of sea-surface brightness variations. Bandlike structures observed on the images are interpreted as internal waves on the sea surface. B.J.

A86-45240
INVESTIGATION OF THE DYNAMICS OF MESOSCALE FRONTS ON THE BASIS OF MICROWAVE SENSING OF THE OCEAN [ISSLEDOVANIE DINAMIKI MEZOMASSHTABNYKH FRONTOV PO DANNYM DISTANTSIONNOGO ZONDIROVANIIA OKEANA V SVCH-DIAPAZONE]
A. IU. IVANOV, V. P. NEFEDEV, A. V. SMIRNOV, and V. S. ETKIN (AN SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana (ISSN 0002-3515), vol. 22, April 1986, p. 440-447. In Russian. refs

Remote sensing data collected in the Friz Strait and adjacent regions of the Sea of Okhotsk and the Pacific Ocean in 1982-1983 provide the basis for evaluating geological conditions and wave mass dynamics. The remote sensing images are applied to the study of water and energy exchange, temperature distributions, and hydrometeorological parameters such as wind velocity. Variations in the sea surface roughness are analyzed, and the remote sensing data are compared with ship measurements. I.F.

A86-46331
SEA SURFACE AND DEPTH DETECTION IN THE WRELADS AIRBORNE DEPTH SOUNDER
B. BILLARD and P. J. WILSEN (Department of Defence, Electronics Research Laboratory, Adelaide, Australia) Applied Optics (ISSN 0003-6935), vol. 25, July 1, 1986, p. 2059-2066. Research supported by the Royal Australian Navy. refs

Algorithms are presented which have been developed for the WRELADS airborne depth sounder for the detection and location of sea surface and sea bottom reflections within the waveform of 256 consecutive 2-ns samples of received green light energy. The algorithms must be flexible to cater to the wide range of sea conditions encountered operationally in the WRELADS testing program and simple to cater to the computational intensiveness of this portion of the overall WRELADS data processing and yet have quantifiable reliability and accuracy. A concept of pulse confidence (related to SNR) is developed and shown to be related to the probability that a pulse detected as a sea bottom reflection is valid. Author

A86-46336
REMOTE SENSING OF SCATTERING COEFFICIENT FOR AIRBORNE LASER HYDROGRAPHY
B. BILLARD (Department of Defence, Electronics Research Laboratory, Adelaide, Australia) Applied Optics (ISSN 0003-6935), vol. 25, July 1, 1986, p. 2099-2108. Research supported by the Royal Australian Navy. refs

A method is proposed for using dual fields of view to allow remote sensing of the sea's optical scattering coefficient from a laser-based airborne hydrographic system. The method depends on measurement of the rate of decay of the detected volume backscatter from a pulse of laser energy directed into the ocean and is, therefore, inherently independent of system gain calibration. The method builds on previous Monto Carlo studies of multiple scattering within the ocean bulk. An appropriate choice of fields of view allows determination of the scattering coefficient over a range appropriate to hydrographic interest in coastal waters. Limited data from flights of the WRELADS laser airborne hydrographic system support the applicability of the concept. Author

A86-46479* Florida State Univ., Tallahassee.
ASSIMILATION OF SCATTEROMETER WINDS INTO SURFACE PRESSURE FIELDS USING A VARIATIONAL METHOD
J. HARLAN, JR. and J. J. OBRIEN (Florida State University, Tallahassee) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 20, 1986, p. 7816-7836. NASA-Navy-supported research. refs

A variational formulation was used to assimilate Seasat-A scatterometer (SASS) surface wind measurements near and during a severe storm in the North Atlantic into conventional National Meteorological Center sea level pressure fields. An estimate of the relative vorticity at every point on a grid was calculated using each of these two data sets. A solution to a modified geostrophic stream function is found subject to the constraints that (1) the

relative vorticities calculated from the data agree as closely as possible with the relative vorticities from the variational solution, and that (2) the average kinetic energy is a minimum. Results are obtained which support the idea that averaged satellite data can be treated as synoptic data. Direct substitution rather than a time-weighted insertion made from SASS winds generally resulted in more accurate pressure analyses. In addition, this relatively simple model provides surface pressure fields which agree extremely well with surface truth and the results of other investigators who required additional sources of input data into more complex models. It will be possible to obtain improved wind field maps from future scatterometer pressure fields in mid-latitudes. Author

A86-46677
APPLICATIONS OF MILLIMETER WAVE IMAGING
J. P. HOLLINGER (U.S. Navy, Naval Research Laboratory, Washington, DC) IN: Millimeter wave technology III; Proceedings of the Meeting, Arlington, VA, April 9, 10, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 118-124. refs

The emission, absorption, and transmission of atmospheric constituents and their effects on the choice of observational frequency are briefly discussed. Then, general radiative properties of terrain and ocean surfaces are considered, including the wave effect and the influence of sea foam, oil on the sea surface, and the effects of metal objects and snow fields. Major emphasis is placed on the application of millimeter wave imaging to the all-weather location and measurement of sea ice properties. C.D.

A86-48959
REMOTE SENSING OF COASTAL DISCHARGE SITES USING SPOT-SIMULATION DATA
P. A. DAVIES and J. A. CHARLTON (Dundee, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 815-824. refs
(Contract SERC-GR/C/05236; SERC-GR/C/05274)

A86-48965
SATELLITE IMAGES AND THEIR USE IN THE NUMERICAL MODELLING OF COASTAL PROCESSES
E. TH. BALOPOULOS (National Centre for Marine Research, Athens, Greece), M. B. COLLINS, and A. E. JAMES (Swansea, University College, Wales) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, July 1986, p. 905-919. refs

A86-49276
SURFACE MANIFESTATIONS OF INTERNAL OCEAN WAVES OBSERVED FROM SHIPS AND THE SALYUT-6 SATELLITE [POVERKHNOSTNYE PROIAVLENIIA VNUTRENNIKH VOLN V OKEANE PO NABLIUDENIIAM S ORBITAL'NOI STANTSII 'SALIUT-6' I S KORABLIA]
A. S. KAZMIN (AN SSSR, Institut Okeanologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 7-15. In Russian. refs

New data on the spatial structure of internal waves (IWs) in the Pacific between the coast of Peru and the Galapagos Islands have been derived from shipboard observations and space images. As a rule, the IWs occurred as single packets and exhibited a distinct geographic association with simultaneously observed frontal interfaces. Unlike well-known patterns of IW generation caused by tides on the continental slope, the IWs in the eastern Pacific showed no apparent correlation with the bottom relief. The presence of internal waves, normal to isobaths and to the shoreline, which experience no refraction in shallow water, was observed. I.S.

A86-49277
THE EFFECTS OF SEA WATER TEMPERATURE AND SALINITY ON THE CHARACTERISTICS OF MICROWAVE RADAR SIGNALS [VLIIANIE TEMPERATURY I SOLENOSTI MORSKOI VODY NA KHARAKTERISTIKI RADIOLOKATSIONNOGO SIGNALA SVCH-DIAPAZONA]
IU. V. TEREKHIN and V. V. PUSTOVOITENKO (AN USSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 16-20. In Russian. refs

A 'double-scale model' of a scattering surface, developed by Wright (1968) and Bass et al. (1968, 1972) was used to study the effects of sea-water salinity and the surface temperature on the radar scattering cross section obtained from the data of satellite-borne sidelooking radar. It was found that variations of temperature from 0 to 30 C and variations of salinity from 0 to 40 percent produce no appreciable effect on the radar cross section, and thus can be neglected in interpretations of radar sounding data obtained at small (less than 20 deg) grazing angles, the temperature and salinity changes must sometimes be taken into consideration. I.S.

A86-49278
AN ANALYSIS OF MACROSCALE AND MESOSCALE FEATURES OF OCEAN SURFACE WAVE FIELDS APPEARING ON COSMOS-1500 RADAR IMAGES [ANALIZ MAKRO- I MEZOMASSHTABNYKH OSOBENNOSTEI POLIA VOLNENIIA, PROIAVLIAIUSHCHIKHSIA NA RADIOLOKATSIONNYKH IZOBRAZHENIIAKH S ISZ 'KOSMOS-1500']
L. M. MITNIK (AN SSSR, Tikhookeanskii Okeanologicheskii Institut, Vladivostok, USSR), G. I. DESIATOVA (Dal'nevostochnyi Regional'nyi Tsentr Priema i Obrabotki Sputnikovykh Dannykh, Khabarovsk, USSR), and V. V. KOVBASIUK (Kamchatskoe Territorial'noe Upravlenie po Gidrometeorologii i Kontroliu Prirodnoi Sredy, Petropavlovsk-Kamchatski, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 21-31. In Russian. refs

Images of the northwestern Pacific in the area of the Sea of Okhotsk, obtained by the sidelooking radar aboard Cosmos-1500 in December 1983 and January 1984, are presented. Interpretation of radar image brightness relies on satellite images taken in the visible and the IR spectral ranges, synoptic maps, in situ measurements of wind directions and velocities, and simulated data. Cloud banks, convective cells, and atmospheric fronts appear on the radar images because these formations modulate the speed and direction of the wave-driving wind, and thus the roughness of the sea surface and the magnitude of the specific area of inverse scatter. I.S.

A86-49281
SIMULTANEOUS OPTICAL AND CONTACT STUDIES OF SPATIAL-SPECTRAL CHARACTERISTICS OF SEA WAVES [SINKHRONNYE OPTICHESKIE I KONTAKTNYE ISSLEDOVANIIA PROSTRANSTVENNO-SPEKTRAL'NYKH KHARAKTERISTIK MORSKOGO VOLNENIIA]
V. A. GRUSHIN, IU. A. ILIN, A. A. LAZAREV, E. A. LUPIAN, V. A. MALINNIKOV (AN SSSR, Institut Kosmicheskikh Issledovanii; Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR) et al. Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 57-67. In Russian. refs

The results of simultaneous contact measurements (using a parallel-wire wavemeter) and optical measurements (with airborne photoequipment) of the spatial-spectral characteristics of surface waves and of a stratified near-surface layer of the Caspian Sea are presented. Digital procedures are described for recovering wave-height spectra by the use of two-dimensional spectra of film blackening. Good qualitative and quantitative agreement is shown for frequency spectra measured in situ and one-dimensional spectra recovered from optical observations. I.S.

A86-49283
LEVEL ANALYSIS AND DIGITAL PROCESSING OF SIGNALS RECEIVED FROM THE COSMOS-1500 SIDELOOKING RADAR [ANALIZ UROVNEI I TSIFROVAIA OBRABOTKA RADIOLOKATSIONNYKH SIGNALOV, PRINIMAEMYKH S RADIOLOKATORA BOKOVOGO OBZORA ISZ 'KOSMOS-1500']
B. A. BAUM, S. K. VIATKIN, A. G. GRIBUNIN, V. V. KIRILLOV, and I. M. PEREPELITSKII (Dal'nevostochnyi Regional'nyi Tsentr Priema, Obrabotki i Rasprostraneniia Kosmicheskoi Informatsii, Khabarovsk, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1986, p. 92-95. In Russian. refs

A procedure for the digital processing of sea-surface radar images obtained by the sidelooking radar aboard the Cosmos-1500 satellite is described. The procedure is conducted in two steps: (1) automatic data processing for obtaining visual images and (2) amplification of the image contrasts, using an algorithm which permits variations in the radar-image dynamic range. A statistical correlation has been established between the radar signal levels and surface-wind velocities measured by ship instruments. I.S.

A86-49290
SYNOPTIC VARIABILITY IN THE OCEAN [SINOPTICHESKAIA IZMENCHIVOST' V OKEANE]
V. G. KORT, ED. and E. G. MOROZOV, ED. Moscow, Izdatel'stvo Radio i Sviaz' (Okeanologicheskie Issledovaniia, No. 38). 1985, 68 p. In Russian. No individual items are abstracted in this volume.

Papers are presented on such topics as the formation of the total solar radiation regime in the POLYMODE area; three-dimensional general water circulation in Mare Tirreno; the spatial spectrum of semidiurnal internal waves in the Northwest Pacific. Consideration is also given to a numerical study of seasonal climatic circulation of water in the Mozambique Channel area, solar and atmospheric radiation in the subtropical zone of the North Atlantic, and deep waters of the Atlantic Ocean. B.J.

A86-49685* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WIND-DRIVEN UPWELLING IN THE VICINITY OF CAPE FINISTERRE, SPAIN
C. R. MCLAIN (NASA, Goddard Space Flight Center, Greenbelt, MD), S.-Y. CHAO (Maryland, University, Cambridge), L. P. ATKINSON (Old Dominion University, Norfolk, VA), J. O. BLANTON (Skidaway Institute of Oceanography, Savannah, GA), and F. DE CASTILLEJO (Instituto Espanol de Oceanografia, Malaga, Spain) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, July 15, 1986, p. 8470-8486. NASA-supported research. refs

Observations and numerical simulations of the evolution of upswelling and the resultant coastal circulation in response to two wind events occurring along the Galician coast of Spain during the April 18-26, 1982 period are presented. In situ measurements include shipboard determinations of hydrographic and biological parameters, and wind stress estimates obtained from the ship winds and from surface pressure charts. Sea surface temperature information was derived from NOAA 7 satellite images, and pigment concentration information was acquired from the Nimbus 7 coastal zone color scanner. The indication from the simulations that the greatest upswelling will occur either at Cape Finisterre or along the northern coast was confirmed by observations, and it is suggested that wave disturbances propagate northward along the coast at a speed of 120-160 km/day, and that organic material formed north of Cape Finisterre is advected out to sea northwest of the cape. R.R.

A86-49687
A NUMERICAL STUDY OF THE EFFECTS OF ANOMALOUS NORTH ATLANTIC ATMOSPHERIC CONDITIONS ON THE INFRARED MEASUREMENT OF SEA SURFACE TEMPERATURE FROM SPACE
P. J. MINNETT Journal of Geophysical Research (ISSN 0148-0227), vol. 91, July 15, 1986, p. 8509-8521. refs
(Contract CEC-STI-022-J-C)

Based on 100 marine radiosonde profiles over the NE Atlantic Ocean obtained over a seven-year period for the month of July, a line-by-line radiation transfer model is used to simulate the brightness temperature measured in the atmospheric window between 10 and 13 microns by the high resolution radiometer AVHRR/2 on the NOAA 7 satellite. It is demonstrated that the consequences of humidity anomalies are greater if they occur at pressures of less than 800 mbar, while temperature anomalies have greater effect if they occur in the lower troposphere. Sea surface temperature (SST) retrieval coefficients, optimized for the July conditions, were found to be acccurate, with mean errors of several tenths of a kelvin when previous nonoptimized coefficients were applied to the July conditions. Extremely anomalous atmospheric conditions also yielded mean errors in SST of a few tenths of a kelvin using the optimized coefficients. R.R.

A86-49765
METHODOLOGICAL ASPECTS OF VISUAL OBSERVATIONS OF THE OCEAN WATER COLOR [METODICHESKIE ASPEKTY VIZUAL'NYKH NABLIUDENII TSVETA OKEANSKIKH VOD]
V. P. LEVENTUEV and S. I. POTAICHUK (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Morskogo Rybnogo Khoziaistva i Okeanografii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 17-20. In Russian. refs

The colors of the various areas of the world ocean perceived visually by cosmonauts aboard Salyut-7 were correlated with the color samples of the AC-1000 color atlas and compared with the ocean surface colors measured instrumentally on board ships. For typical ocean scenes observed from space (water background and 'green heterogeneities') there was a tendency to report colors, permissible by the AC-1000 atlas, which were closest to the colors measured experimentally. It is suggested that, after a period of adaptation, the human eye is capable of color discrimination, i.e., of detecting signals like ocean water color in a very noisy environment generated by atmosphere-scattered radiation. I.S.

A86-49770
ASPECTS OF THE USE OF SATELLITE IR DATA IN STUDIES OF WATER AREAS UNDER CLOUD COVER [OSOBENNOSTI ISPOL'ZOVANIIA SPUTNIKOVOI INFORMATSII IK-DIAPAZONA DLIA IZUCHENIIA AKVATORII PRI OBLACHNYKH SITUATSIIAKH]
I. A. BYCHKOVA, S. V. VIKTOROV, and V. G. SMIRNOV (Gosudarstvennyi Okeanograficheskii Institut, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1986, p. 60-66. In Russian. refs

The approach taken in a study of water surface temperatures of periodically overcast water bodies with the use of information obtained from satellite IR data is described. The spatial coherence method of Coakley and Bretherton (1982) was used, after modifying the algorithm by taking into account specific features of a semienclosed water body, such as Baltic Sea. The method was applied to study the upwelling off the southern shore of the Gulf of Finland. After correcting for cloud effects and georeferencing, the correlation coefficient for the results obtained from the satellite IR data and from the data obtained by ship instruments was about 0.95. I.S.

A86-50235
INVENTORY AND ENVIRONMENTAL MANAGEMENT IN THE TROPICAL ZONE TWO EXAMPLES FROM NEW CALEDONIA [INVENTAIRE ET AMENAGEMENT DU MILIEU EN ZONE TROPICALE - DEUX EXEMPLES EN NOUVELLE CALEDONIE]
L. LOUBERSAC (Institut Francais de Recherche pour l'Exploitation de la Mer, Brest, France) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 68-75. In French.

The results of two simulations of SPOT multispectral images of the lagoon on the coast of New Caledonia are discussed. The area simulated is a coastal lagoon offshore from a mangrove swamp, with a coral reef situated 40 km off the coast. The 23,000 sq km lagoon is being considered for development as an aquaculture zone and the adjacent swamp for fish and shrimp processing and tourism. Previous experience in other countries has shown that no more than 20 percent of a mangrove swamp can be developed without adversely affecting the entire swamp. SPOT multispectral images of the two study areas (Teremba and Tetembia) were simulated to evaluate the potential for using the images to quantify the available fish and shrimp tonnage in the lagoon, the extent of mangrove swamp development, and to generate marine charts of the reef. Sample simulated images are provided and analyzed to illustrate the techniques available for using the SPOT imagery to achieve the remote sensing goals of the region. M.S.K.

A86-50272
MARINE APPLICATIONS FOR SATELLITE-DERIVED OCEAN COLOR IMAGERY
D. K. CLARK, H. W. YATES, and J. W. SHERMAN, III (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) Sea Technology (ISSN 0093-3651), Nov. 1985, 6 p.

The Coastal Zone Color Scanner (CZCS) on Nimbus 7, the CZCS data products developed by NOAA and NASA, and some typical commercial and scientific applications are reviewed. Topics examined include the CZCS channels (four visible channels, one NIR channel for land/water discrimination, and one thermal-IR channel for simultaneous surface-temperature estimation), techniques for subtracting atmospheric effects, the discovery (using CZCS images) that some open-sea areas have small but significant concentrations of chlorophyll and phaeopigments, the use of these pigments as natural tracers for studying ocean-current structures, maps developed from CZCS data for use by the fisheries industry, and the potential value of combining Seasat-type altimeter data with CZCS-type color images. Also included is a statement by the NOAA Administrator regarding the possible development of an operational Ocean Color Imager (OCI) to succeed CZCS. It is argued that a private-government partnership such as that created for Landsat should build OCI and develop and sell data products to customers in the petroleum, marine mining, fishing, and shipping industries on a commercial basis. T.K.

N86-28492# Technical Univ. of Denmark, Lyngby. Inst. of Electromagnetics.
SEA ICE PARAMETER RETRIEVAL FROM SAR DATA
H. SKRIVER and P. GUDMANDSEN *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 21-28 Dec. 1985
Avail: NTIS HC A06/MF A01

A pixel-by-pixel classification scheme for sea ice type determination, and a spatial segmentation scheme for studies of sea ice dynamics were investigated. Before these schemes may be applied, the inherent speckle must be reduced, and noncoherent averaging and adaptive filtering (Frost and Lee filters) were applied. The Lee filter seems to give the best results. The performance of the classification method is surprisingly good, with mean classification accuracies of 80%. Three segmentation algorithms were investigated: pyramid segmentation, edge-based segmentation, and region growing, with the second scheme considered to be the best. ESA

N86-28603# Defence Research Information Centre, Orpington (England).
ON THE RECOGNITION OF OCEANIC MOTION IN SATELLITE INFRARED AND RADAR ALTIMETER DATA
P. G. HARDTKE Oct. 1985 18 p Transl. into ENGLISH of Z. fuer Flugwiss. u. Weltraumforsch., v. 98, no. 5, 1984 p 359-364 (DRIC-T-7597; BR97665; ETN-86-97135; AD-B098642L) Avail: Issuing Activity

Data from NOAA 6 and 7 showing variation of sea surface temperature in the North Atlantic are presented. These, together with radar altimeter measurements, are used to determine ocean surface currents. ESA

N86-28604# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
MEASUREMENTS OF INTERNAL WAVES IN THE STRAIT OF GIBRALTAR USING A SHORE-BASED RADAR Final Report
P. E. LAVIOLETTE, T. H. KINDER, and D. W. GREEN, III Jan. 1986 15 p
(AD-A165715; NORDA-118) Avail: NTIS HC A02/MF A01 CSCL 17I

During the period 22 to 24 October 1983, a feasibility study was made on the use of standard shore radars to monitor the temporal and spatial distribution of internal waves. A radar (150 m elevation) situated at Gibraltar was used to monitor the surface manifestations of internal waves in the Strait of Gibraltar during three semidiurnal tidal periods. The eastward progression of internal waves within an arc approximately 19 km from the radar was observed. These observations fill a gap in the evolution of the surface signatures of internal waves between the small-scale view of ship radars and the large-scale view afforded by satellites and the Space Shuttle. Author (GRA)

N86-29443# Delaware Univ., Lewes.
OBJECTIVES OF THE TOGA CONFERENCE
F. WEBSTER *In* WMO International Conference on the TOGA Scientific Program 4 p Sep. 1985
Avail: NTIS MF A01; print copy available at WMO, Geneva

The aims of the Tropical Ocean Global Atmosphere project are to assess knowledge of the interannual variability of the tropical ocean and the global atmosphere and form the scientific basis for a research program. Program objectives are: to determine to what extent the time-dependent behavior of the tropical ocean and global atmosphere system is predictable on time scales of months to years and to understand the mechanism of this behavior; to study the feasibility of modeling the coupled ocean-atmosphere system for predicting its variations on time scales of months to years; and to provide the scientific background for designing an observing and data transmission system for operational prediction if this capability is demonstrated by coupled ocean-atmosphere models. ESA

N86-29447# Hawaii Univ., Honolulu. Dept. of Oceanography.
WATER DISPLACEMENTS DURING 1982-83 AND THE GENESIS OF EL NINO AND THE SOUTHERN OSCILLATION
K. WYRTKI *In* WMO International Conference on the TOGA Scientific Program 10 p Sep. 1985
Avail: NTIS MF A01; print copy available at WMO, Geneva

Sea level response during 1982-83 to the changing wind system is summarized. Water mass displacements during the 1982-83 El Nino are outlined. The genesis of El Nino and the Southern Oscillation is discussed. For the Tropical Ocean Global Atmosphere (TOGA) program, it is argued that in view of the importance of ocean heat storage for the analysis and understanding of climatic cycles, a complete documentation and continuous monitoring of the heat storage field in the ocean is an indispensable prerequisite for research in TOGA. The heat storage field can be best documented by a program of systematic XBT sections from ships of opportunity, supplemented by drifting thermistor chains and by a network of sea level gages. Data from this network should be available in real time so that monthly maps of ocean heat storage can be compiled and made available for analysis. ESA

N86-29450# National Oceanic and Atmospheric Administration, Seattle, Wash. Pacific Marine Environmental Lab.
OBSERVATIONAL STRATEGY FOR TOGA PACIFIC
B. A. TAFT *In* WMO International Conference on the TOGA Scientific Program 11 p Sep. 1985 Sponsored by NOAA Equatorial Pacific Ocean Climate Studies Program
Avail: NTIS MF A01; print copy available at WMO, Geneva

The oceanographic program needed to describe large scale, low frequency variations of key variables for the entire tropical Pacific over a 10yr period is outlined. Measurement of processes which modify the heat content of the upper ocean; ocean model verification; and assimilation of data into predictive models are considered. Use of merchant ships, and moored and drifting thermistor chains to measure the thermal field is suggested. Moored equatorial current measures and surface current measures with drifters are required to study circulation. Sea level can be monitored by existing means. ESA

N86-29454# Laboratoire d'Oceanographie Physique, Paris (France).
OBSERVATIONAL STRATEGY FOR TOGA IN THE TROPICAL INDIAN OCEAN
M. FIEUX *In* WMO International Conference on the TOGA Scientific Program 8 p Sep. 1985
Avail: NTIS MF A01; print copy available at WMO, Geneva

An observational program to study the processes that control sea surface temperature changes and upper ocean heat content on intraseasonal, annual, and interannual time scales and, in particular, to determine the relative importance of advection, upwelling, surface fluxes, and heat storage is proposed for the Indian Ocean. The program includes XBT observations, drifting buoys, direct sea level measurements, satellite data collection and analysis, and a voluntary observing ship meteorological program. ESA

N86-29459# Far Seas Fisheries Research Lab., Shimizu (Japan). Div. of Oceanography and Southern Ocean Resources.
EFFECT OF EL NINO ON FISH MIGRATION AND YIELD IN THE WESTERN PACIFIC OCEAN
H. YAMANAKA *In* WMO International Conference on the TOGA Scientific Program 7 p Sep. 1985
Avail: NTIS MF A01; print copy available at WMO, Geneva

The abnormally cold water temperatures in the western Pacific Ocean caused by the 1982 El Nino event are shown. The relationship between the occurrence of El Nino and changes in the distribution and migration of the Pacific bluefin tuna is discussed. The relationship between El Nino and fluctuations in stocks of the Japanese sardine is considered. Abnormal migration and distribution of fishes and marine mammals around Japan during 1983-84 are analyzed. ESA

N86-29460# Duke Univ. Beaufort, N.C. Marine Lab.
PLANKTON PRODUCTION DURING EL NINO
F. P. CHAVEZ and R. T. BARBER *In* WMO International Conference on the TOGA Scientific Program 9 p Sep. 1985
(Contract NSF OCE-81-10702)
Avail: NTIS MF A01; print copy available at WMO, Geneva

A decrease in primary plankton productivity of 1 gigaton C during the 300-day duration of the 1982-83 El Nino is estimated. The fraction of this anomaly which can be attributed to a decrease in new production is 0.6 gC, but this new production anomaly is approximately equivalent to a predicted degassing anomaly of 0.57 gC. Models which consider degassing from equatorial upwelling as an important contributor to atmospheric carbon dioxide levels should also consider the effects of upwelling on new primary production. ESA

N86-29463# Delaware Univ., Lewes.
THE OVERALL PLAN: A SCIENTIFIC STRATEGY
F. WEBSTER *In* WMO International Conference on the TOGA Scientific Program 5 p Sep. 1985
Avail: NTIS MF A01; print copy available at WMO, Geneva

The aims of the Tropical Ocean Global Atmosphere project are to assess knowledge of the interannual variability of the tropical ocean and the global atmosphere. Program objectives are: to determine to what extent the time-dependent behavior of the tropical ocean and global atmosphere system is predictable on time scales of months to years and to understand the mechanism of this behavior; to study the feasibility of modeling the coupled ocean-atmosphere system for predicting its variations on time scales of months to years; and to provide the scientific background for designing an observing and data transmission system for operational prediction if this capability is demonstrated by coupled ocean-atmosphere models. ESA

N86-29468# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
OBJECTIVE ANALYSIS OF TROPICAL CYCLONE INTENSITY, STRENGTH, AND SIZE USING ROUTINE AIRCRAFT RECONNAISSANCE DATA M.S. Thesis
C. B. STANFIELD May 1986 126 p
(AD-A166417; AFIT/CI/NR-86-28T) Avail: NTIS HC A07/MF A01 CSCL 04B

The feasibility of objectively analyzing routine aircraft reconnaissance data for the purpose of quantifying tropical cyclone intensity, strength, and size is examined. A computer program is developed which may be used in near real time or after the fact to evaluate localized pressure/wind relationships in the tropical cyclone environment. This program compensates for the system motion and the relative position of the point of observation relative to the vortex center location at flight level and at the surface (thus accounting for the vertical tilt of the center). A representative set of data is obtained over a 13 month period for the entire spectrum of storms from tropical depression to super typhoon. These data are used to try to establish empirical pressure/wind relationships and a means of determining effective storm size. It is shown that a program of this nature may be used with gradient wind and pressure gradient relationships to evaluate intensity and strength and to define storm size, provided adequate data are available at sufficient distances from the center. Author (GRA)

N86-29474# World Climate Programme, Geneva (Switzerland).
REPORT OF THE THIRD SESSION OF THE JSC/CCCO WORKING GROUP ON SATELLITE OBSERVING SYSTEMS FOR CLIMATE RESEARCH
Oct. 1985 34 p Session held in Madison, Wisc., 29 Apr. - 2 May 1985
(WCP-105; ETN-86-97071) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Satellite data access; temperature and moisture soundings; geostationary satellite wind vectors; cloud climatology; radiation budget climatology; precipitation climatology; sea surface temperature; global winds; surface wind and wind stress; ocean surface topography and geostrophic component of ocean circulation; sea ice; land surface climatology; air-sea interface fluxes; distribution of chlorophyll and small flux patterns; aerosols; and the global positioning system were discussed. ESA

N86-29475# World Climate Programme, Geneva (Switzerland).
REPORT OF THE THIRD SESSION OF THE JSC/CCCO TOGA SCIENTIFIC STEERING GROUP
Nov. 1985 80 p Session held in La Jolla, Calif., 22-26 Apr. 1985
(WCP-107; ETN-86-97073) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Implementation of observational and data processing activities for the Tropical Oceans and Global Atmosphere (TOGA) program was reviewed. Tropical sea-level; ocean subsurface data; ocean surface circulation; ocean-atmosphere interface fluxes; sea surface temperature; surface wind/wind stress; precipitation; analyses of

atmospheric meteorological parameters for TOGA; ocean modeling; use of real-time products in tropical ocean modeling and dissemination of predictions based on these; TOGA real-time monitoring strategy; and satellite observing systems for TOGA were discussed. ESA

N86-29483# National Weather Service, Honolulu, Hawaii.
TROPICAL CYCLONES, 1984, CENTRAL NORTH PACIFIC
W. AU, A. CHUN, A. INOUYE, L. IWAI, and H. ROSENDAL Mar. 1986 31 p
(PB86-183951; NOAA-TM-NWSTM-PR-30) Avail: NTIS HC A03/MF A01 CSCL 04B

Tropical storms in the Central North Pacific Ocean for 1984 are described and classified. GRA

N86-30297# Scripps Institution of Oceanography, La Jolla, Calif.
THE MAGNETIC EFFECTS OF SHALLOW WATER INTERNAL SOLITONS
A. D. CHAVE Mar. 1986 52 p
(Contract N00014-85-C-0104)
(AD-A165852; SIO-REF-86-7) Avail: NTIS HC A04/MF A01 CSCL 08C

Since internal waves are a common feature of the oceans, there has been some interest in computing their electromagnetic effects in order to assess their role in the oceanic electromagnetic environment. This report extends previous analyses to cover the electromagnetic effects of coastal internal wave packets. While no observations of the electromagnetic fields produced by them have been reported, the large amplitude of shallow water internal waves is expected to induce substantial electromagnetic anomalies. The report is organized into five sections. The next part contains a review of oceanographic observations of internal wave packets from both surface ships and satellite imagery. Section 3 outlines the hydrodynamic theory for nonlinear internal waves. Section 4 contains a derivation of expressions for the electromagnetic fields produced by an isolated internal solution both at the seafloor and above the sea surface. The last part of the report contains a discussion of the theoretical results, including a detailed look at the predicted magnetic field using measured parameters from three well-documented occurrences of internal wave packets. GRA

N86-30728# Aerojet Electrosystems Co., Azusa, Calif.
DESIGN, DEVELOPMENT AND INTEGRATE/INSTALL AN AIRBORNE REMOTE INSTRUMENTATION SYSTEM (AIREYE) Final Report
J. J. BOMMARITO and L. E. SAYLOR Aug. 1985 79 p
(Contract DTCG23-80-C-20012)
(AD-A166755; REPT-7921; USCG-D-27-85) Avail: NTIS HC A05/MF A01 CSCL 01C

A prototype airborne remote instrument system, AIREYE, was developed for the U.S. Coast Guard by Aerojet ElectroSystems Company. This multisensor system permits real-time day/night, all weather detection, mapping and documentation of vessels and pollution at sea. The system was installed aboard a coast Guard Hu-25A Falcon fanjet aircraft and flight tested off the California coast. Surveillance data were obtained from natural oil seeps, known optical and radar targets, routine shipping and targets of opportunity. The AIREYE system consists of a sidelooking radar, infrared/ultraviolet line scanner, active gated television systems, aerial reconnaissance camera and a processor/display recording subsystem with real-time digital image enhancement capability. The system reliably detected and mapped oil seeps and vessel locations for environmental conditions ranging from dense undercast to clear, windspeeds from 0 to greater than 25 knots and from daytime to total darkness. The ability to read a vessel's name and determine deck activity in total darkness was demonstrated. The AIREYE real-time digital enhancement provided detection, recognition and identification of targets of interest when not otherwise possible with unenhanced imagery. Test results demonstrated that the AIREYE system will provide greatly enhanced capability in the U.S. Coast Guard missions of Marine Environmental Protection (MEP), Enforcement of Laws and Treaties and Search and Rescue. Author (GRA)

N86-31063# Battelle Columbus Labs., Ohio.
GAS-ENGINE HEAT PUMP TEST PROCEDURES Topical Report, Oct. 1985 - Feb. 1986
S. G. TALBERT and A. L. RUTZ Apr. 1986 67 p
(Contract GRI-5084-242-1118)
(PB86-201662; GRI-86/0083) Avail: NTIS HC A04/MF A01 CSCL 13A

The purpose is to establish standardized procedures for testing gas engine-driven heat pumps,and to define the various engine heat pump performance factors. The recommended test methods outlined should enable Gas Research Institute to better monitor the several research projects now underway to develop gas engine heat pumps for residential and light commercial use. Altogether, 17 performance test points are described which will be sufficient to describe the heating and cooling performance of a variable speed heat pump over its expected range of outdoor temperatures. The tests include 11 steady-state tests, two part-load tests one defrost test, one auxiliary heater test, and two domestic water heating tests. Equations and procedures also are outlined so that the various heat pump performance factors can be calculated, as well as its expected seasonal and annual performance. GRA

N86-31090# Bremen Univ., (West Germany).
OCEANOGRAPHY
W. ALPERS, K. RICHTER (Deutsches Hydrographisches Inst., Hamburg (West Germany), and P. LOMBARDINI (Consiglio Nazionale delle Ricerche, Turin, Italy) *In* DFVLR The X-SAR Science Plan p 97-110 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Radar imaging of ocean surface phenomena at three different radar frequencies (L, C, and X-band) different polarizations (VV, HH and VH, HV) and different incidence angles by the X-SAR radar is discussed. Objectives of the X-SAR/SIR-C mission include studies of the short wave-current interaction as a function of (Bragg) wave number; the SAR imaging mechanism of long surface waves as a function of radar frequency, polarization, and incidence angle; the excitation threshold of short (Bragg) waves by the wind as a function of wave number and air/sea temperature difference; the damping of short (Bragg) waves by surface films as a function of a wave number, and film material for studying the applicability of spaceborne SARs for oil pollution surveillance; and the distribution of temporal variations of internal waves, eddies, fronts, and bores in the Mediterranean. ESA

N86-31091# Deutsches Hydrographisches Inst., Hamburg (West Germany).
ICE AND SNOW
K. STRUEBING *In* DFVLR The X-SAR Science Plan p 111-131 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Ice and snow observation by the X-SAR/SIR-C mission is outlined. Targets include sea ice and icebergs, ice sheets, ice shelves, glaciers, and snow cover. Parameters to be studied include snow line; edges and boundaries; ice concentration (total and partial); stage of development (ice type, thickness); form (floe size); openings (fractures, leads, polynyas); surface roughness (ridges, rubble fields, rafted ice); and stage of melting (puddles, melt ponds). Test sites, seasonal constraints, technical requirements, and ground truth and airborne campaigns are indicated. ESA

N86-31169# Ohio State Univ., Columbus. Dept. of Geodetic Science and Surveying.
DETAILED GRAVITY ANOMALIES AND SEA SURFACE HEIGHTS DERIVED FROM GEOS-3/SEASAT ALTIMETER DATA
R. H. RAPP Aug. 1985 134 p
(Contract F19628-82-K-0022)
(AD-A166593; OSU/DGSS-365; AFGL-TR-85-0191; SR-9) Avail: NTIS HC A07/MF A01 CSCL 08E

Gravity anomalies and sea surface heights have been computed on a 0.125 deg grid in the ocean areas from a combined Geos-3/Seasat altimeter data set. The basic procedure used least squares collocation estimation where model covariance models were tailored to individual areas through altimeter residual variance scaling. Preliminary tests led to production prediction procedures using a reference model defined by a set of potential coefficients complete to degree 180. Comparisons of the predicted anomalies with ship derived values showed agreements varying from + or - 9 to + or - 30 mgals. No corrections to the altimeter implied sea surface heights were made for sea surface topography effects. The maximum anomaly predicted was 396 mgals near Hawaii and the most negative anomaly was -361 mgals over the Puerto Rican Trench. The 0.125 data set has been used to display the results using color plots, contour maps, and perspective views. The gridded data was used to compute 1 deg x 1 deg and 0.5 x 0.5 deg mean values. 1 deg mean anomalies were compared to terrestrial data where a difference of f + or - 7 mgals was found in comparing 10139 values. GRA

N86-31201# Army Engineer District, Los Angeles, Calif. Coastal Resources Branch.
COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY. SHORELINE MOVEMENT DATA REPORT: PORTUGUESE POINT TO MEXICAN BORDER (1852-1982)
P. F. MAY and B. M. BALDWIN Dec. 1985 172 p
(AD-A166749; CCSTWS-85-10) Avail: NTIS HC A08/MF A01 CSCL 08F

This report describes the results of a cooperative study of shoreline movement conducted as part of the Coast of California Storm and Tidal Waves Study (CCSTWS). The study area comprised the Pacific Ocean coast from Portuguese Point. CA, (Near Los Angeles) south to the United States/Mexico Border, a distance of approximately 125 miles. Changes in shoreline position ranging from as early as 1852 or as late as 1959, up to 1982, are analyzed using survey data from NOAA's National Ocean Service (NOS) and its predecessor, the U.S. Coast and Geodetic Survey. A series of shoreline movement maps for this coastal reach produced by NOS is intended to accompany this report. This report provides a basic data set for use in management and engineering decisions related to the coastal zone. It is designed primarily to describe and partially quantify shoreline movement maps that accompany it. Average yearly land area and shoreline movement rates of change were calculated for each minute of longitude for the area from Portuguese Point south to Anaheim Bay (east-west-trending shoreline), and for each minute of latitude from Anaheim Bay to the U.S./Mexico border (north-south trending shoreline). The sole purpose of this report is to describe and quantify historic shoreline movement. No attempts were made to identify or even speculate on the reasons for these movements. GRA

N86-31202# Army Engineer District, Los Angeles, Calif. Coastal Resources Branch.
COAST OF CALIFORNIA STORM AND TIDAL WAVES STUDY: SOUTHERN CALIFORNIA COASTAL PHOTOGRAPHY AND BEACH PROFILE INDEX
Feb. 1986 140 p
(AD-A166780; CCSTWS-86-2) Avail: NTIS HC A07/MF A01 CSCL 08F

The purpose of this report is to compile an inventory of the aerial photography, ground photos and beach profile data long the Coast of California that are available in the U.S. Army Corps of Engineers, Los Angeles District (LAD; also includes other Federal, State, and local governmental agencies). These photographs and beach profiles were compiled to document dimensions and beach characteristics, historic shoreline changes, effects of storms and structures on the beach, and any significant beach and inlet changes. The information described in this report is available for use and inspection by Government agencies, educational institutions, coastal engineers and other coastal interest groups. GRA

N86-31205# Naval Postgraduate School, Monterey, Calif.
OCEANOGRAPHIC ANALYSIS OF SUN GLINT IMAGES TAKEN ON SPACE SHUTTLE MISSION STS 41-G M.S. Thesis
M. G. FISCHER Mar. 1986 42 p
(AD-A167142) Avail: NTIS HC A03/MF A01 CSCL 14E

A series of four sun glint images taken by the crew of the space shuttle Challenger, mission STS 41-G, on 8 October 1984 were analyzed and compared to NOAA-7 AVHRR infrared images and to bathythermographs of the same area. Evidence of the Almaria Front, a persistant oceanographic feature east of the Alboran Basin, was found on all three data sets, and the efficacy of using sun glint images for the location of acoustically important oceanographic features was supported. A practical use of sun glint photographs taken from low earth orbit was demonstrated and the investigation of its use to help in the employment of acoustic sensors is further justified by this work. Author (GRA)

N86-31942*# Oklahoma Univ., Norman. Cooperative Inst. for Mesoscale Meteorolog. Study.
DEVELOPMENT OF A VARIATIONAL SEASAT DATA ANALYSIS TECHNIQUE Final Report
Y. K. SASAKI, L. P. CHANG, and J. S. GOERSS (Naval Environmental Prediction Research Facility, Monterey, Calif.) Apr. 1986 50 p
(Contract NAG5-289)
(NASA-CR-177175; NAS 1.26:177175) Avail: NTIS HC A03/MF A01 CSCL 05B

Oceans are data-sparse areas in terms of conventional weather observations. The surface pressure field obtained solely by analyzing the conventional weather data is not expected to possess high accuracy. On the other hand, in entering asynoptic data such as satellite-derived temperature soundings into an atmospheric prediction system, an improved surface analysis is crucial for obtaining more accurate weather predictions because the mass distribution of the entire atmosphere will be better represented in the system as a result of the more accurate surface pressure field. In order to obtain improved surface pressure analyses over the oceans, a variational adjustment technique was developed to help blend the densely distributed surface wind data derived from the SEASAT-A radar observations into the sparsely distributed conventional pressure data. A simple marine boundary layer scheme employed in the adjustment technique was discussed. In addition, a few aspects of the current technique were determined by numerical experiments. Author

N86-31965# Naval Ocean Research and Development Activity, Bay St. Louis, Miss.
NORDA ARCTIC DATA COLLECTION, PROCESSING AND INTERPRETATION CAPABILITIES Final Report
D. T. EPPLER and J. D. HAWKINS Sep. 1985 26 p
(AD-A167797; NORDA-129) Avail: NTIS HC A03/MF A01 CSCL 08L

The Special Sensor Microwave/Imager (SSM/I) will provide the Navy with the global capability to measure sea ice, wind speed, water vapor, rain rate, and several other atmospheric parameters. The sea ice retrievals will go a long way toward filling a present gap in analysis data sets. Thus, proper validation of this sensor's abilities is required if the full potential is to be achieved. Naval Ocean Research and Development Activity (NORDA) personnel have access to a number of ground, aircraft, and spaceborne instruments that can contribute to SSM/I sea ice validation efforts. Ice camps, the K-band Radiometric Mapping System (KRMS), and satellite visible and infrared data can all provide a piece of the puzzle when addressing the issue of algorithm performance. It is

essential to include ground, air, and spaceborne resources to tackle the task of validating the sea ice information retrieved from SSM/I data. Not only must we cover large geographic regions synoptically, but we must also be able to discern smaller irregularities found within the SSM/I cell footprints. Only then can we push algorithms to their required limits. GRA

N86-31975# Rome Univ. (Italy). Dipt. di Fisica.
THE RESULTS OF HYDROLOGICAL MEASUREMENTS IN THE SOUTHERN ADRIATIC, THE WEST COAST OF SICILY AND THE VATICAN CAPE, PRELIMINARY REPORT [RAPPORTO PRELIMINARE SUI RISULTATI DELLE MISURE IDROLOGICHE NELL'ADRIATICO MERIDIONALE, NEL GOLFO DI TARANTO, AL LARGO DELLA COSTA ORIENTALE DELLA SICILIA E A CAPO VATICANO]
F. BIGNAMI, G. DIDONFRANCESCO, L. PAMPALONI, and P. SBRICCOLI 28 Mar. 1986 92 p In ITALIAN
(PREPRINT-502; ETN-86-97933) Avail: NTIS HC A05/MF A01

A hydrological campaign was carried out in order to study the deep waters of the Adriatic and Ionic seas. Satellite data indicating the presence of turbulence were to be verified. The vertical profiles of temperatures, salinity, and density were obtained. Ship position was estimated using the Loran C method. The instruments included echo sounding equipment and bathymeters. The detailed data is presented. ESA

N86-32077# World Climate Programme, Geneva (Switzerland). Scientific Committee for Oceanic Research.
WORLD CLIMATE RESEARCH PROGRAM. GENERAL CIRCULATION OF THE SOUTHERN OCEAN: STATUS AND RECOMMENDATIONS FOR RESEARCH, A REPORT BY SCOR WORKING GROUP 74
Oct. 1985 65 p
(WCP-108; WMO/TD-86; ETN-86-97252) Avail: NTIS MF A01; HC at WMO, Geneva, Switzerland

Major gaps in the knowledge of the general circulation of the Southern Ocean, bearing in mind its relevance to biology and climate were identified. Physical and chemical programs to investigate these problems were outlined. Interactions between the Southern Ocean and the subtropics; the Antarctic circumpolar current; the subpolar zone; shelf-slope processes and deep water formation; sea level observations; and air sea ice interaction were discussed. ESA

N86-32081# Rome Univ. (Italy). Dipt. di Fisica.
PRELIMINARY REPORT ON THE HYDROLOGICAL MEASUREMENTS CARRIED OUT IN THE SOUTHERN TYRRHENIAN SEA AND IN THE MESSINA STRAIT [RAPPORTO PRELIMINAIRE SUI RISULTTATI DELLE MISURE IDROLOGICHE ESEGUITE NEL TIRRENO MERIDIONALE E NELLO STRETTO DI MESSINA]
L. CAPITANIO, R. DORAZIO, G. PINO, L. FEDERICO, M. PALELLI, A. PACE, E. SALUSTI, J. SANEMETERIO, E. SIESNI, and E. ZAMBIANCHI 16 Dec. 1985 43 p In ITALIAN
(PREPRINT-489; ETN-86-97923) Avail: NTIS HC A03/MF A01

An oceanographic campaign was carried out to verify satellite observation data. The measurements include temperature, salinity and density profiles. The detailed data is presented. Computer processed data analysis is also presented. ESA

N86-32794 Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
THE OCEANIC LITHOSPHERE: SEISMOLOGY AND TECTONICS
E. A. OKAL *In* CNES International Geophysics and Space p 341-368 1985
Avail: CEPADUES, Toulouse, France

The history of plate tectonics and the contribution of seismology to it are summarized. Seismology and the structure of the oceanic plates; intraplate earthquakes and the state of stress of the oceanic lithosphere; and active tectonism on the oceanic plates are discussed. ESA

N86-32805# Centre National d'Etudes Spatiales, Toulouse (France). Service ARGOS.
THE 10TH ARGOS USERS CONFERENCE
1985 301 p Conference held in Kiel, West Germany, 21-23 May 1985; sponsored in cooperation with Intergovernmental Oceanographic Commission, WMO and Kiel Univ.
(ETN-86-97267) Avail: NTIS HC A14/MF A01

Uses of the ARGOS system in oceanography, meteorology, polar regions, and environmental studies was discussed. ESA

N86-32806# British Columbia Univ., Vancouver. Dept. of Oceanography.
ON THE RELATIONSHIP BETWEEN LONG-TERM DRIFTER TRAJECTORIES AND MEAN SEASONAL DISTRIBUTIONS OF GEOSTROPHIC WIND AND BAROCLINIC OCEAN CURRENT IN THE EASTERN NORTH ATLANTIC
W. J. EMERY, J. STAHLMANN (Kiel Univ., West Germany), and W. KRAUSS *In* CNES The 10th ARGOS Users Conference 27 p 1985
Avail: NTIS HC A14/MF A01

A 4 yr collection of trajectories from 100 satellite tracked drifting buoys in the North Atlantic is analyzed to determine the correspondence of buoy trajectories with mean seasonal distributions of geostrophic wind (sea level atmospheric pressure) and baroclinic ocean current (0/1500 db dynamic topography). Buoy positions were interpolated to 3 hr intervals then averaged over 60 hr and smoothed with a 3-month running mean and separated into winter and summer seasons. Visual comparison between smooth trajectories and winter/summer averages of atmospheric pressure and baroclinic ocean current suggests the stronger influence of the wind field upon the character of long term trajectories compared to that of the baroclinic current. Statistical comparisons between buoy and geostrophic wind speed and direction reveal strong correlations only in the south (10 to 30 N) where seasonal variations of atmospheric pressure are small. In the north (40 to 50 N) overall mean directions agree well, while low correlations are due to interannual changes in the winter sea-level pressure distributions. ESA

N86-32807# Dundee Univ. (Scotland). Physics Lab.
SYSTEM ARGOS, SEA SURFACE TEMPERATURES AND CIRCULATION PATTERNS IN THE NORTHERN ATLANTIC
A. P. CRACKNELL and R. D. CALLISON *In* CNES The 10th ARGOS Users Conference 9 p 1985
Avail: NTIS HC A14/MF A01

The accuracy of TIROS-N satellites AVHRR-derived sea surface temperatures (SST) is discussed. The possibility of using thermal infrared scanner data for studying ocean currents and circulation patterns, with data obtained via System ARGOS, for the North Atlantic is considered. Differences between measured and satellite derived SST are 0.3 to 0.4 K. ESA

N86-32809# Oceanor, Trondheim (Norway).
TECHNICAL EXPERIENCE WITH THE ARGOS SYSTEM FOR TRANSMISSION OF OCEANOGRAPHICAL DATA
S. E. HANSEN *In* CNES The 10th ARGOS Users Conference 11 p 1985
Avail: NTIS HC A14/MF A01

Oceanographical instruments and moorings equipped with ARGOS systems are described. Current meters, waveriders, buoys, and thermistor/salinity strings are presented. Problems with access to the ARGOS data center, and the limited data storage facilities (only 24 hr data are buffered) are mentioned. ESA

N86-32810# Oceanor, Trondheim (Norway).
THE IMPORTANCE OF MEASURING CURRENT, WAVES AND OTHER ENVIRONMENTAL PARAMETERS IN ORDER TO IMPROVE THE CURRENT FORECAST SERVICE
S. E. HANSEN *In* CNES The 10th ARGOS Users Conference 15 p 1985
Avail: NTIS HC A14/MF A01

A current forecasting service to predict occurrences of high velocity current whirls in the Norwegian coastal current was established. It is relatively successful, but has difficulties due to lack of data in real time. Further observation has to be supplied in real time along the Skagerrak coast, and NW of Stavanger. ESA

N86-32811# Kiel Univ. (West Germany). Inst. fuer Meereskunde.
THE CURRENT SYSTEM OF THE NORTH ATLANTIC AS DEDUCED FROM DRIFTING BUOYS
W. KRAUSS *In* CNES The 10th ARGOS Users Conference 24 p 1985
Avail: NTIS HC A14/MF A01

More than 100 buoys were launched in the North Atlantic to analyze the large-scale circulation and the eddy intensities in the northern and eastern part of the North Atlantic. Results reveal a current system which predominantly transports water masses from the area southeast of Flemish Cap to the northeastern North Atlantic. A broad band (1500 km) of eddies is associated with the current; they exchange water masses across the Subarctic Front and yield intensive mixing of subtropical and polar waters. The subtropical anticyclonic gyre appears as an almost separate circulation system. The eastern recirculation of this gyre, however, receives a distinct amount of water from the area between the Azores and the Bay of Biscay. ESA

N86-32813# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
ON BOARD SPECTRAL SEA-STATE: THE SPEAR F BUOY INPUTS TO ERS-1 CALIBRATION AND VALIDATION PHASE
R. EZRATY and G. AYELA *In* CNES The 10th ARGOS Users Conference 16 p 1985
Avail: NTIS HC A14/MF A01

Sea-state measuring buoys built from a waverider sensor and hull into which a dedicated onboard microprocessor computes the omnidirectional sea state spectrum and transmits the results through the ARGOS system are presented. Field tests show that this system of on-board spectral analysis works correctly and can discriminate complex sea state conditions. It can be mounted by any user, with no buoy modification, on existing waveriders. Although developed for a calibration experiment for satellite altimeters, it can be used in coastal areas where the 27 MHz Citizen Band is overcrowded, solving the problem of radio interferences and data integrity. Using the ARGOS system, a high cost dedicated receiving station and a data acquisition and processing systems are no longer needed. ESA

N86-32814# Etablissement d'Etudes et de Recherches Meteorologiques, Brest (France).
THE USE OF SPATIAL TECHNIQUES FOR A BETTER CURRENT SURFACE KNOWLEDGE, WITH APPLICATION TO THE SOUTHERN OCEAN
N. DANIAULT and Y. MENARD (Centre National d'Etudes Spatiales, Toulouse, France) *In* CNES The 10th ARGOS Users Conference 19 p 1985
Avail: NTIS HC A14/MF A01

The eddy kinetic energy distribution in the Southern Ocean was estimated from SEASAT altimeter data and from 192 free drifting buoy trajectories. The ARGOS system was used for positioning of the buoys. A good spatial coherence is found between the results of the two methods. The distribution shows strong eddy kinetic activity near the western boundaries and near topographic features. The ratio between both estimates was very high, with kinetic energy distribution from drifters being three times larger than from the altimeter. The drifters eddy kinetic energy distribution was recomputed and processed through a bandpass filter, giving a better match. Remaining differences are attributed to nonsimultaneity of the two data bases. ESA

N86-32815# Norwegian Meteorological Inst., Blindern.
THE NORWEGIAN METEOROLOGICAL INSTITUTE'S USE OF THE ARGOS SYSTEM
C. K. JENSEN *In* CNES The 10th ARGOS Users Conference 12 p 1985
Avail: NTIS HC A14/MF A01

The use of the ARGOS system technical equipment; the location of stations; advantages and disadvantages of using a local user terminal station, and the collection and control of data are discussed. ESA

N86-32816# Direction de la Meteorologie Nationale, Brest (France).
A DRIFTING BUOY EXPERIMENT AS PART OF COST-43
P. BLOUCH and T. KVINGE (COST-43 Technical Secretariat, Bergen, Norway) *In* CNES The 10th ARGOS Users Conference 11 p 1985
Avail: NTIS HC A14/MF A01

The System of Operational Buoys in the Atlantic program is described. A zone with few observations from ships was chosen. At least two buoys must be maintained drifting at sea and operational in the area at all times throughout a period of at least 3 yr. The buoys must provide meteorological, oceanographic and position data via the ARGOS system. As with FGGE, the observations must include at least air pressure and sea surface temperature. The date must be available in real-time via the Global Telecommunication System of the World Meteorological Organization in the DRIBU code and/or SHIP code. Archived data must be retrievable through ARGOS Service and must be available on request to other COST-43 members. There are no plans to recover the buoys. ESA

N86-32817# Christian Michelsens Institutt for Videnskap og Andsfrihet, Bergen (Norway). Dept. of Science and Technology.
REPORT ON ICE BUOYS IN THE ARCTIC AND THE ANTARCTIC
N. S. NERGAARD *In* CNES The 10th ARGOS Users Conference 19 p 1985
Avail: NTIS HC A14/MF A01

The status of over 20 buoys dropped by parachute onto polar ice is reported. Data from the buoys suggest an average export speed for ice conveyed from the Arctic Ocean by the Transpolar Drift Stream through the Fram Strait of 10 cm/sec, with a variation in the central area of 5 to 70 cm/sec. The buoys are tracked by the ARGOS system. ESA

N86-32818# Bergen Univ. (Norway).
EXPERIENCE AND RESULTS FROM USE OF ARGOS TRACKED BUOYS DURING MIZEX 83 AND 84
B. A. FARRELLY *In* CNES The 10th ARGOS Users Conference 13 p 1985
Avail: NTIS HC A14/MF A01

During the Marginal Ice Zone Experiment, ships, aircraft, and satellites tracked ARGOS buoys on the ice and in the open sea in the Fram Strait. Buoy positions and other information were relayed to the field coordinator to update experiment plans. This proved invaluable for buoy recovery and for giving details of ice movement and ocean currents. Ice kinematics derived from ARGOS buoys and from aircraft remote sensing are presented. Since several of the ice platforms acquiring meteorological and oceanographic data were tracked by ARGOS, the balance of forces on the ice could be estimated. ESA

N86-32820# High Arctic Consulting Ltd., Raahe (Finland).
USE OF AN ARGOS PLATFORM ON AN EXPEDITION TO THE NORTH POLE 1984
M. TERVASKANTO *In* CNES The 10th ARGOS Users Conference 10 p 1985
Avail: NTIS HC A14/MF A01

Use of an ARGOS platform for location, data transfer, and emergency communication during a polar expedition is described. The equipment withstood the rough handling and low temperatures (down to minus 56 C) well mechanically, but displays froze and the PTT occasionally changed all the data bits to ones. ESA

N86-32821# Societe Nationale Elf Acquitaine, Paris (France).
ENVIRONMENTAL AND METEOROLOGICAL DATA ACQUISITION SYSTEM WITH INTEGRATED ARGOS TRANSMITTER: IMPROVEMENT IN SEA STATE FORECAST FOR CRITICAL OFFSHORE OPERATIONS
R. CARTON, S. ANTALOVSKY (SYMINEX, Marseille, France), and D. SEMBRESQ *In* CNES The 10th ARGOS Users Conference 12 p 1985
Avail: NTIS HC A14/MF A01

The use of the Environmental and Meteorological Data Acquisition Systems (EMDAS) equipped with an ARGOS link to increase the reliability of seastate forecasts in offshore areas, thus optimizing the cost and safety of offshore operations is described. In spite of the relatively small amount of information transmitted by ARGOS, several months experience confirms the operational value of the EMDAS-ARGOS system and proves that extensions to other fields (in-service monitoring and others) are possible. However, hardware and software improvements are needed to improve data recovery. ESA

N86-32823# Oregon State Univ., Newport. Hatfield Marine Science Center.
PRELIMINARY TECHNICAL EVALUATION OF AN ARGOS-MONITORED RADIO TAG FOR TRACKING MANATEES
B. MATE, G. RATHBUN (Fish and Wildlife Service, San Simeon, Calif.), R. MERRICK, and J. REED (Fish and Wildlife Service, Gainesville, Fla.) *In* CNES The 10th ARGOS Users Conference 5 p 1985
Avail: NTIS HC A14/MF A01

A radio tagged manatee was released into a river leading to subtropical waters and tracked by satellite. Up to 8 locations a day are reported. The manatee remained in the river system, but is expected to head for the Gulf of Mexico. ESA

N86-32825# National Museum of Natural History, Marseille (France).
BEHAVIOR OF DERMOCHELYS CORIACEA IN CAPTIVITY (ANIMAL CARRYING DUMMY PTT IN PRELIMINARY PHASE OF AN ARGOS EXPERIMENT)
M. DURON-DUFRENNE *In* CNES The 10th ARGOS Users Conference 15 p 1985
Avail: NTIS HC A14/MF A01

The degree to which a turtle would accept the Transat-type ARGOS PTT, and the reliability of the harness securing it to the carapace were tested, using an adult kept in a swimming pool for 36 hr. Its pelagic behavior turns out to be comparable to that in the open sea, the animal appearing unperturbed by the equipment. ESA

N86-32826# Institut Francais de Recherche pour l'Exploitation de la Mer, Nantes (France).
ARGOS AND FISHING
C. LEROY, C. LEROY, and L. MERCIER (CEIS-Espace, Toulouse, France) *In* CNES The 10th ARGOS Users Conference 10 p 1985
Avail: NTIS HC A14/MF A01

The ARGOS system contributions to tuna finding in the NE Atlantic, and shrimp trawling on the Continental Shelf off French Guiana are described. Tuna catch data and environmental measurements transmitted from a shipboard keypad terminal are integrated in a wider aid-to-fish-finding strategy centered on the generation of sea surface temperature maps using thermal infrared imagery. Useful data are then retransmitted to the tuna boats by facsimile. The program to aid shrimp trawling includes use of onboard PTT, and a microcomputer to generate the catch and environment message. ESA

N86-32827# South African Weather Bureau, Pretoria.
THE SOUTH AFRICAN CONTRIBUTION TO TOGA
P. LEROUX *In* CNES The 10th ARGOS Users Conference 3 p 1985
Avail: NTIS HC A14/MF A01

Drifting buoys and automatic weather stations were used in the Tropical Ocean Global Atmosphere program. Information on oceanographic parameters in the South Atlantic and Southern Indian Ocean, and surface and upper air data are collected. ESA

N86-32859# Royal Aircraft Establishment, Farnborough (England).
MONITORING ICEBERG PRODUCTION USING LANDSAT DATA
R. V. BIRNIE (MacAulay Inst. for Soil Research, Aberdeen (Scotland).) and J. M. WILLIAMS *In* ESA Remote Sensing Applications in Civil Engineering p 165-167 Mar. 1985
Avail: NTIS HC A06/MF A01

The use of Landsat MSS data to monitor iceberg production from west Greenland glaciers was studied. The importance of such data to iceberg management in oilfields off Labrador and Newfoundland is underlined. Most of the freshwater icebergs found off eastern Canada originate from west Greenland glacier sources and it is known that on average it takes 2 to 3 yr for icebergs to drift, first north in the west Greenland current, then south through the Davis Straight in the Labrador current. The study suggests that it is possible to do an annual census of iceberg production from the major west Greenland glacier sources to predict ice conditions around drilling sites up to 3 years in advance. ESA

N86-32861# National Remote Sensing Agency, Hyderabad (India).
OPTICAL REMOTE SENSING FOR COASTAL ZONE MANAGEMENT
I. V. MURALIKRISHNA *In* ESA Remote Sensing Appl. in Civil Eng. p 175-191 Mar. 1985
Avail: NTIS HC A06/MF a01

Remote sensing application to engineering problems in coastal zone management in intertropical regions is discussed. Studies of aquatic suspended sediment patchiness and tidal vortices are described. The capability of remotely sensed satellite data to monitor the effects of littoral processes is shown. The utility of proposed sensors is assessed. ESA

N86-32862# National Oceanic and Atmospheric Administration, Washington, D. C. Satellite Applications Lab.
AN EXPERIMENTAL TECHNIQUE FOR PRODUCING MOISTURE CORRECTED IMAGERY FROM 1 KM ADVANCED VERY HIGH RESOLUTION RADIOMETER (AVHRR) DATA
E. MATURI, J. PRITCHARD, and P. CLEMENTE-COLON Jun. 1986 34 p
(NOAA-TM-NESDIS-15) Avail: NTIS HC A03/MF A01

Removal of atmospheric moisture from infrared measurements of the sea surface, allows for better detection of sea surface temperature gradients. A multispectral processing technique is applied to 1 km AVHRR data to correct for moisture. The resulting data is then feature enhanced and converted to imagery. This process and the applications of the moisture corrected imagery are presented. Author

N86-32929# Naval Oceanography Command Center/Joint Typhoon Warning Center, FPO San Francisco, Calif.
FORECAST VERIFICATION AND RECONNAISSANCE DATA FOR SOUTHERN HEMISPHERE TROPICAL CYCLONES Technical Note, 1 Jul. 1982 - 30 Jun. 1984
W. P. WIRFEL and S. A. SANDGATHE Feb. 1986 106 p (AD-A168274; NOCC/JTWC-TN-86-1) Avail: NTIS HC A06/MF A01 CSCL 04B

This report documents tropical cyclones which developed in the South Indian Ocean and South Pacific Ocean from 1 July 1982 to 30 June 1984. It provides composite storm best-tracks, a brief summary of each year's tropical cyclone season, and detailed position and reconnaissance fix data. In addition, this report contains forecast accuracy statistics for Southern Hemisphere tropical cyclones. A total of 55 tropical cyclones reached warning status in the combined Joint Typhoon Warning Center and Naval Western Oceanography Center area of responsibilty between 1 July 1982 and 30 June 1984. Twenty-five attained warning status in the 1982 to 1983 season, with thirty reaching warning status in the 1983 to 1984 season. Intensity estimates for Southern Hemisphere tropical cyclones are derived primarily from satellite imagery evaluation (Dvorak, 1973) and from intensity estimates reported by other regional warning centers. In very rare instances, the intensity estimates are based on surface observational data. Estimates of the minimum sea-level pressure are usually derived from the Atkinson and Holliday (1977) realtionship between the maximum sustained 1-min. surface wind and the minimum sea-level pressure. GRA

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.

A86-40658* South Dakota School of Mines and Technology, Rapid City.
THE AREA-TIME-INTEGRAL TECHNIQUE TO ESTIMATE CONVECTIVE RAIN VOLUMES OVER AREAS APPLIED TO SATELLITE DATA - A PRELIMINARY INVESTIGATION
A. A. DONEAUD, J. R. MILLER, JR., L. R. JOHNSON (South Dakota School of Mines and Technology, Rapid City), T. H. VONDER HAAR, and P. LAYBE (Colorado State University, Fort Collins) IN: Conference on Hydrometeorology, 6th, Indianapolis, IN, October 29-November 1, 1985, Preprints. Boston, MA, American Meteorological Society, 1985, p. 238-245. refs
(Contract NAG5-386)

A86-43445
DRAMATIC EXAMPLES OF THUNDERSTORM TOP WARMING RELATED TO DOWNBURSTS
G. ELLROD (NOAA, Satellite Applications Laboratory, Washington, DC) National Weather Digest (ISSN 0028-0712), vol. 10, May 1985, p. 7-13. refs

Examples of rapid thunderstorm top warming as observed in satellite infrared imagery are related to the occurrence of straightline or downburst wind damage at the surface. The events were observed over the southern United States in early May 1984. Two types of warming patterns were observed: (1) small, circular dark areas embedded within the anvil, and (2) a wedge-shaped darkening area near the upwind portion of the anvil. Both occurred to the rear of the coldest IR tops and locations of surface wind damage. Evaporative cooling is believed to have been a contributor in the latter case. Author

A86-43452* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
OXYGEN BUDGET OF A PERENNIALLY ICE-COVERED ANTARCTIC LAKE
R. A. WHARTON, JR., C. P. MCKAY (NASA, Ames Research Center, Moffett Field, CA), G. M. SIMMONS, JR., and B. C. PARKER (Virginia Polytechnic Institute and State University, Blacksburg) Limnology and Oceanography (ISSN 0024-3590), vol. 31, no. 2, 1986, p. 437-443. refs
(Contract NSF DPP-79-23996; NSF DPP-80-12988)

A bulk O2 budget for Lake Hoare, Antarctica, is presented. Five years of seasonal data show the lake to be persistently supersaturated with O2. Oxygen is carried into the lake in glacial meltstreams and is left behind when this water is removed as ice by ablation and sublimation. A diffusive loss of O2 from the lake through the summer moat is suggested. Measured values of the total O2 in the water column indicate that the time scale of O2 turnover is much longer than a year. Based on these results, it is suggested that the amount of O2 in the water does not change significantly throughout the year and that the lake is also supersaturated with N2. Author

A86-44049
THE ROLE OF REMOTELY SENSED DATA IN STUDIES OF THE THERMAL BAR
J. R. SCHOTT (Rochester Institute of Technology, NY) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 341-358. refs

Sample imagery are presented to illustrate the effectiveness of Heat Capacity Mapping Mission (HCMM) data for monitoring the thermal bar in Lake Ontario. A thermal bar is an area in dimictic lakes in which water areas chilled or warmed in the winter or summer, respectively, stratify without mixing. The phenomenon can vary from location to location in the lake, and has a significant impact on the turbidity and bacteria content and distribution within the lake and on the diffusion of pollutants. The HCMM data were used to generate isothermal maps which were compared with color aerophotography images. Actual lake surface temperatures were derived from the satellite data, which was useful for interpreting Landsat data of the same area. It is concluded that higher resolution, more frequent IR data would be effective at tracking the location and evolution of thermal bar features in large bodies of water. M.S.K.

A86-44174*# Geological Survey, Flagstaff, Ariz.
PALEODRAINAGES OF THE EASTERN SAHARA - THE RADAR RIVERS REVISITED (SIR-A/B IMPLICATIONS FOR A MID-TERTIARY TRANS-AFRICAN DRAINAGE SYSTEM)
J. F. MCCAULEY, C. S. BREED, G. G. SCHABER (USGS, Flagstaff, AZ), W. P. MCHUGH (GAI Cousultants, Inc., Pittsburgh, PA), C. C. HAYNES (Arizona, University, Tucson) et al. IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 624-648. NASA-Army-supported research. refs

The images obtained by the Shuttle Imaging Radar (SIR)-A and -B systems over the southwestern Egypt and northwestern Sudan were coregistered with the Landsat images and the existing maps to aid in extrapolations of the buried paleodrainages ('radar rivers'), first discovered by SIR-A. Field observations explain the radar responses of three types of radar rivers, RR-1 (broad, aggraded valleys filled with alluvium), RR-2 (braided channels inset in the RR-1 valleys), and RR-3 (narrow, long, bedrock-incised channels). A generalized model of the radar rivers, based on field studies and regional geologic relations, shows inferred changes in river regimen since the large valleys were established during the later Paleogene-early Neogene. It is suggested that a former Trans-African master stream system may have flowed from headwaters in the Red Sea Hills southwestward across North Africa, discharging into the Atlantic at the Paleo-Niger delta, prior to the Neogene domal uplifts and building of volcanic edifices across the paths of these ancient watercourses. I.S.

A86-45175
JAPAN'S CS (SAKURA) COMMUNICATIONS SATELLITE EXPERIMENTS. VI E - COMMUNICATIONS EXPERIMENTS: EXPERIMENTS ON MEASURES AGAINST RAIN ATTENUATION
K. KOSAKA, Y. SUZUKI (Ministry of Posts and Telecommunications, Radio Research Laboratories, Koganei, Japan), I. NISHIYAMA (Ministry of Posts and Telecommunications, Kashima Space Research Center, Japan), T. KOHRI, and S.-I. EGAMI (Nippon Telegraph and Telephone Public Corp., Electrical Communications Laboratories, Yokosuka, Japan) IEEE Transactions on Aerospace and Electronic Systems (ISSN 0018-9251), vol. AES-22, May 1986, p. 302-309.

The following three techniques for measuring rain attenuation in 30/20 GHz satellite links are evaluated: (1) transmission power control, (2) site diversity, and (3) frequency band switching. With regard to transmission power control methods, uplink power control methods and up/downlink power control methods were examined. A closed-loop control technique incorporating up/downlink control was found to provide the most accuracy. For site-diversity methods, it was found that a better link quality was obtained when received signals were combined and the FEC technique was used. A frequency band switching technique was applied to a TDMA system; the 30/20 and 6/4 GHz bands were used simultaneously and transmitting frame formats changed according to the rain attenuation of the 30/20 GHz band. K.K.

A86-45289
RAIN ATTENUATION SUCCESSIVE FADE DURATIONS AND TIME INTERVALS BETWEEN FADES IN A SATELLITE-EARTH LINK
E. MATRICCIANI and M. MAURI (CNR, Centro di Studio per le Telecommunicazioni Spaziali; Milano, Politecnico, Milan, Italy) Electronics Letters (ISSN 0013-5194), vol. 22, June 5, 1986, p. 656-658.

Long-term attenuation data at 11.6 GHz, obtained in a Sirio link, are analyzed to provide information on the joint statistics between successive fade durations within a rain event (intrafade) and between different rain events (interfade). The results show that successive fade durations and the interfade or intrafade intervals are approximately statistically independent. Within the same rain event, interfades and fade durations longer than 10 s are statistically identical. These data may be important for planning adaptive systems and for devising prediction models of the dynamic behavior of rain attenuation. Author

A86-45378
THE USE OF SPACE REMOTE-SENSING DATA TO STUDY MASS TRANSFER IN GLACIER SYSTEMS [ISPOL'ZOVANIE MATERIALOV KOSMICHESKOI S'EMKI DLIA IZUCHENIIA MASSOOBMENA LEDNIKOVYKH SISTEM]
G. A. NOSENKO Geodeziia i Kartografiia (ISSN 0016-7126), May 1986, p. 26-31. In Russian. refs

A set of analytical-phototriangulation programs has been developed at the Priroda center for the investigation of mass transfer in glacier systems on the basis of space remote-sensing data. An appropriate block diagram is presented, and the effectiveness of the proposed approach is confirmed using data from glaciological experiments carried out during 1978-1983 with the Salyut 6 and 7 stations, and Cosmos satellites. B.J.

A86-45775
OBSERVATIONS OF THE SUSPENDED MATTER DISTRIBUTION DYNAMICS IN THE ELBE ESTUARY FROM TIME SERIES AERIAL PHOTOGRAPHS
R. DOERFFER (GKSS-Forschungszentrum Geesthacht, GmbH, West Germany) Internationale Revue der Gesamten Hydrobiologie (ISSN 0020-9309), vol. 70, no. 1, 1985, p. 127-150. refs

Series of aerial photographs taken with an interval of 6 minutes were used to study the dynamics of the suspended matter distribution in a 1 km section of the Elbe Estuary. The observations show heterogeneous distribution patterns which are different at each phase of the tidal cycle. The comparison with the bathymetry indicates that the distribution is mainly a function of the river bed topography, which modifies the local current structure. The surface distribution in the fairway region is especially determined by the ship traffic. Author

A86-46070
LAND USE AND LAND COVER MAPPING OF ZHUJIANG DELTA, CHINA, WITH LANDSAT DATA BY MANUAL AND COMPUTER-ASSISTED METHODS
C. P. LO (Georgia, University, Athens) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 212-221. Research supported by the University of Hong Kong. refs

A86-46073
AERIAL MONITORING OF EROSIONAL CHARACTERISTICS TO IMPROVE FLOOD CONTROL AND SEDIMENT MANAGEMENT - THE MOUNT ST. HELENS EXAMPLE
C. L. ROSENFELD, M. R. PARSONS (Oregon State University, Corvallis), and M. L. PEARSON (U.S. Army, Military Academy, West Point, NY) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 237-242.

A86-46091
A SAMPLING APPROACH TO IRRIGATED ACREAGE DETERMINATION IN THE GREEN RIVER BASIN OF WYOMING
J. P. VERDIN (U.S. Bureau of Reclamation, Denver, CO), C. M. HAY (Colorado State University, Fort Collins), and M. T. OGRADY (Wyoming Water Development Commission, Cheyenne) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 421-442. refs

Sharing a need for up-to-date irrigated acreage data, the State of Wyoming and the Bureau of Reclamation jointly undertook a program of inventory and technique development in the Green River Basin, a major subbasin of the Colorado River System. A census of irrigated and phreatophyte acreages was obtained from 1982 aerial photography with manual interpretation techniques. Recognizing that the value of these acreages would decreasse with time, a remote sensing aided inventory design, employing satellite imagery and sampling theory, was investigated as a means of obtaining more frequent and less costly acreage estimates than with a full census. Using data available from the adjacent Bear River Basin, a pilot study was performed to assess the efficiency and sensitivity of a two-step stratification and sampling approach. The findings of this study indicate that 95 percent accuracy could be obtained in the Green River Basin with full Landsat coverage and manual photointerpretation over only 51 percent of the irrigated area, at about one third the cost of a full census by aerial photography. Author

A86-46094* Cornell Univ., Ithaca, N.Y.
USE OF INDUCED FLUORESCENCE MEASUREMENTS TO ASSESS ALUMINUM-ORGANIC INTERACTIONS IN ACIDIFIED LAKES
A. VODACEK and W. D. PHILPOT (Cornell University, Ithaca, NY) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 460-469. refs
(Contract NGT-33-010-800)

The application of laser fluorosensing to the tracing of metals in acid lakes is proposed. The effects of the metals on the dissolving organic carbon (DOC) fluorescence is studied using laboratory mixed water samples and natural water samples from Hamilton and Big Moose Lakes in New York. The operation of the laser fluorosensing system employed in the experiment is described. The DOC fluorescence was quenched by Al, Cu, and Fe, and the relation between pH and the quenching rate is examined. The humic substances fluorescence spectra are analyzed to estimate the concentrations of DOC in water and the relative concentration of Al. The interference problems caused by chemical competition

between metal ions and ligands, and changes in the background DOC fluorescence are discussed. It is noted that an airborne laser fluorescence is useful for detecting elevated concentrations of metals. I.F.

A86-46096
LANDSAT STUDIES OF SURFACE WATER OF LAKE CHICOT, ARKANSAS
J. C. RITCHIE (USDA, Agricultural Research Service, Beltsville, MD), F. R. SCHIEBE (USDA, Agricultural Research Service, Durant, OK), and C. M. COOPER (USDA, Agricultural Research Service, Oxford, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 492-498. refs

The development of a system that uses Landsat MSS data for monitoring agricultural impoundments for suspended sediments is examined. Landsat MSS images of Lake Chicot, AK obtained from July 1976-November 1979 are analyzed. Ground measurements of total solids, suspended solids, and chlorophyll a in surface water were collected; the total solids ranged from 117-908 mg/liter, the suspended solids from 1-828 mg/liter, and chlorophyll a from 2-113 mg/cu m. The radiance and reflectance data and ground measurements are compared. Radiance and reflectance in MSS band 6 displayed the strongest correlation with total and suspended solids and band 5 corresponded with cholorophyll a. The data reveal that the wavelengths in the MSS band 6 region are most applicable for estimating suspended sediments. I.F.

A86-46116
A NEW APPLICATION OF THE NIMBUS-7 CZCS - DELINEATION OF THE 1983 PARANA RIVER FLOOD IN SOUTH AMERICA
D. R. WIESNET and M. DEUTSCH (Satellite Hydrology Associates, Falls Church, VA) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 746-754. Research supported by the Organization of American States. refs

The application of the Nimbus 7 satellite's Coastal Zone Color Scanner (CZCS) to flood mapping and post-flood delineation is proposed. The capabilities of the CZCS, which views the earth, sea, and land surface in six spectral bands with a resolution of 825 m are described. CZCS images of the 1983 Parana River Basin floods were analyzed using the VICOM digital image processor. It is observed from the CZCS data that the optimum band for drainage delineation is band 5, accurate details of the drainage are depicted on the CZCS images, and flood plain delineation and flood-hazard-area delineation are possible at a scale of 1:3,000,000 with high accuracy. I.F.

A86-48396
GEO INFORMATION SYSTEMS FOR LAND USE ZONING AND WATERSHED MANAGEMENT
A. M. J. MEIJERINK (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 4, 1985, p. 283-287.

A program for the development of an integrated information system designed to collect and process data for the planning of the development and conservation of natural resources within a watershed area is described. Landsat band-7 images of the Komaring and Ogan river basins in southern Sumatra were evaluated. The program includes development of a user-friendly input system, the data base and a query language, mapping methods and coding systems for meteorology/climate and social/economic aspects of the regions, methods for modeling crop yield, hydrology, erosion, and conservation, systems for interaction with the watershed management, and monitoring systems. I.S.

A86-48957
THE USE OF SPOT-SIMULATED IMAGERY IN HYDROLOGICAL MAPPING
T. R. E. CHIDLEY (Aston, University, Birmingham, England) and R. S. DRAYTON (University College, Cardiff, Wales) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, June 1986, p. 791-799. refs

The fine spatial resolution offered by the SPOT system promises great improvements in the mapping of surface water and drainage networks. Simulated SPOT imagery of sites covering a variety of landscape units in Wales were examined. Identification of streams on the basis of spatial characteristics alone was found to be inefficient, and the use of thematic information was found beneficial. Strategies for interactive image enhancement are discussed, and the results of a visual interpretation of standard photoproducts are presented. The results of the interpretation of simulated SPOT data are compared with results of an interpretation of Landsat MSS data. Author

A86-48960
PIXEL-MIXING EFFECTS AND THEIR SIGNIFICANCE TO IDENTIFYING SNOW CONDITION FROM LANDSAT MSS DATA
R. V. BIRNIE (Macaulay Institute for Soil Research, Aberdeen, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, July 1986, p. 845-853. Research supported by the Highlands and Islands Development Board. refs

Radiometric measurements on snow in Landsat MSS wavebands have shown a correlation between snow condition and the ratio of green/infrared (band 4/band 7) wavebands. Systematic changes from wet dense snow at low altitudes to dry less dense snow at higher altitudes should be revealed by a decrease in the intensity ratio band 4/band 7 with altitude. However, analysis of spring Landsat MSS images for the Cairngorm Mountains shows that the intensity ratio band 4/band 7 actually increases with altitude. A mixed-pixel hypothesis is invoked to account for this pattern. The results suggest that only in areas where the snow cover is continuous can information on snow condition be reliably obtained from Landsat MSS data. Author

A86-49482
APPLICATION OF THERMAL INFRARED REMOTE SENSING IN WATER MANAGEMENT OF HUMID AND ARID AREAS
G. J. A. NIEUWENHUIS and M. MENENTI (Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen, Netherlands) Geocarto International, no. 1, 1986, p. 35-46. refs

Regional evapotranspiration can be estimated with the equilibrium surface temperature and surface reflectance, both of which can be measured with scanning radiometers from airplanes or satellites. In case of vegetation covered soils information about the availability of soil moisture in the root zone can be obtained with the vegetation itself. For bare soil conditions the surface temperature variation in space and time supplies information about evaporation losses and apparent surface thermal admittance. In this paper the applicability of remotely sensed thermal images for vegetation covered and bare soil conditions is demonstrated by presenting some results of investigations in the Netherlands and Libya. In humid areas like the Netherlands in the near future the application of remote sensing will be mainly based on scanning techniques from airplanes. Satellite systems are of great importance in studying the water management in arid areas. Author

A86-49510
THE TURBIDITY OF MOUNT ST. MICHAEL BAY (FRANCE), FROM A SPOT SIMULATION [LES TURBIDITES DE LA BAIE DU MONT-SAINT-MICHEL (FRANCE), A PARTIR D'UNE SIMULATION SPOT]
R. ZBINDEN (Ecole Normale Superieure, Montrouge, France) Photo Interpretation (ISSN 0031-8523), vol. 24, Jan.-Feb. 1985, p. 1-5, 7. In French, English, and Spanish.

Aerophotographic images were obtained of Mount St. Michael Bay for comparisons with ground truth data and simulated SPOT images scene. The effort was part of the calibration of SPOT images, in this case for monitoring river sedimentation, coastal

processes, and the effects of human activities. The ground truth studies included sampling suspended particulates to determine the composition, dry weights and sizes, and the areal distributions within the bay. The data were used to color-code the simulated SPOT images for regions of decreasing turbidity. The in-situ data showed that the images only revealed the surface particulate densities, which could change significantly with depth. Turbidity fronts could be identified, as could regions which did not suffer intrusion, a factor which makes the SPOT data valuable for coastal zone management. M.S.K.

A86-49647
A CASE STUDY EVALUATION OF SATELLITE-DERIVED RAINFALL ESTIMATES
G. A. FIELD (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Conference on Hydrometeorology, 6th, Indianapolis, IN, October 29-November 1, 1985, Preprints. Boston, MA, American Meteorological Society, 1985, p. 298-304. Research supported by the University of Wisconsin. refs

An evaluation of satellite rainfall estimates of the 32.5-41 deg N and 86-101 deg W region obtained between July 20 and July 21, 1981, and computed using the Scofield-Oliver Convective Rainfall Estimation Technique on the University of Wisconsin Man-Computer Interactive Data Access System, is presented. Comparison with over 300 rainfall observations revealed accuracies to within 30 percent in magnitude, and 10-20 miles in location. Discrepancies are discussed, and the importance of the density of observations when attempting to verify on a grid point for grid point basis is demonstrated. R.R.

A86-49648
OPERATIONAL APPLICATION OF THE NESDIS EXTRATROPICAL CYCLONE PRECIPITATION ESTIMATION TECHNIQUE TO WEST COAST WINTER STORMS
S. J. KUSSELSON (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Conference on Hydrometeorology, 6th, Indianapolis, IN, October 29-November 1, 1985, Preprints. Boston, MA, American Meteorological Society, 1985, p. 310-315. refs

Two operationally analyzed winter storm events which produced heavy precipitation in Oregon and California are discussed. It is shown how the Synoptic Analysis Branch (SAB) of the National Environmental, Satellite, Data and Information Service (NESDIS) used satellite imagery to locate and track the heavy precipitation. Infrared and surface maps of the storms are shown, and the SAB's operational precipitation estimates are compared with observed reports. C.D.

A86-49649
SATELLITE-DERIVED RAINFALL ESTIMATES AND SHORT-RANGE FORECAST IMPLICATIONS FOR AN INTENSE HEAVY RAIN EVENT IN THE SPRING OF 1984
D. CLARK (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: Conference on Hydrometeorology, 6th, Indianapolis, IN, October 29-November 1, 1985, Preprints. Boston, MA, American Meteorological Society, 1985, p. 216-220.

N86-28493# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
TOWARDS A SAR SYSTEM FOR SNOW AND LAND ICE APPLICATIONS
H. ROTT, G. DOMIK (Vexcell Corp., Boulder, Colo.), C. MAETZLER (Bern Univ. Switzerland), and H. MILLER (Alfred-Wegener-Inst. for Polar Research, Bremerhaven, West Germany) *In* ESA Proceedings of a Workshop on Thematic Applications of SAR DATA p 29-39 Dec. 1985
Avail: NTIS HC A06/MF A01

The characteristics of a SAR system for snow and land ice monitoring and possible applications are considered. Characteristics of backscattering from snow and ice are discussed. Examples for radar image simulations which provide information on required antenna look angle and spatial resolution for snow cover monitoring are given. Preliminary specifications for a SAR system for snow and land ice monitoring are outlined. ESA

N86-28502# Innsbruck Univ. (Austria). Inst. fuer Meteorologie und Geophysik.
STUDY ON USE AND CHARACTERISTICS OF SAR FOR LAND SNOW AND ICE APPLICATIONS Final Report
H. ROTT, G. DOMIK, C. MAETZLER, H. MILLER, and K. G. LENHART Paris ESA May 1985 164 p
(Contract ESA-5441/83-D-IM(SC))
(REPT-1(1985); ESA-CR(P)-2168; ESA-86-96867) Avail: NTIS HC A08/MF A01

Synthetic aperture radar systems for snow and land ice monitoring were investigated to define a land observation satellite mission. Applications and requirements for remote sensing of land cryosphere parameters are discussed. The physical background on scattering from snow and ice is discussed and results of backscattering measurements are compared with other investigations. Examples for spaceborne and airborne SAR data on snow and glaciers are provided and information for the interpretation of the radar image data is given. Synthetic radar images were generated for two test areas with different topography to define the optimum antenna look angle. Simulations based on real SAR data provided information on spatial resolution and signal to noise ratio. Promising applications and preliminary specifications for a SAR system on land cryosphere monitoring are presented. ESA

N86-28597# Electronic Techniques, Inc., Fort Collins, Colo.
SCPP (SIERRA COOPERATIVE PILOT PROJECT) METEROLOGICAL AND STATISTICAL SUPPORT, VOLUME 1 Interim Progress Report, 1 Sep. 1984 - 31 Aug. 1985
A. W. HUGGINS, J. O. RHEA, G. L. HEMMER, A. P. KUCIAUSKAS, and C. J. WILCOX Oct. 1985 250 p Sponsored by Bureau of Reclamation
(PB86-189404) Avail: NTIS HC A11/MF A01 CSCL 04B

Field operations and data collection procedures for the Sierra Cooperative Pilot Project (SCPP) forecast office, radar and rawinsondes are described. A series of analyses by ETI and NAWC scientists is presented. Seeding effects in radar data are described for convective clouds seeded with CO2 and AgI. The passage of certain radar echoes was found to be associated with lowering cloud top and an increase in supercooled liquid water (SLW) at Kingvale. In conjunction with satellite data such correspondence may be used to help predict the occurrence of clouds suitable for seeding experiments. GRA

N86-29293*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF RAINFALL OVER NORTHERN PERU DURING EL NINO: A PCDS APPLICATION
R. GOLDBERG and G. TISNADO (Instituto Nacional de Investigacion de Transportes (Peru).) *In its* Proceedings of the Second Pilot Climate Data System Workshop 23 p 1986
Avail: NTIS HC A12/MF A01 CSCL 04B

In an examination of GOES satellite data during the 1982 through 1983 El Nino period, the appearance of lee wave cloud patterns was revealed. A correlation was hypothesized relating an anomalous easterly flow across the Andes with the appearance of these wave patterns and with the subsequent onset of intense rainfall. The cloud patterns are belived to be associated with the El Nino period and could be viewed as precursors to significant changes in weather patterns. The ultimate goal of the researchers will be the ability to predict occurrences of rainstorms associated with the appearance of lee waves and related cloud patterns as harbingers of destruction caused by flooding, huaycos, and other catastrophic consequences of heavy and abnormal rainfall. Rainfall data from about 70 stations in northern Peru from 1980 through 1984 were formatted to be utilized within the Pilot Climate Data System (PCDS). This time period includes the 1982 through 1983 El Nino period. As an example of the approach, a well-pronounced lee wave pattern was shown from a GOES satellite image of April

4, 1983. The ground truth data were then displayed via the PCDS to graphically demonstrate the increase in intensity and areal distribution of rainfall in the northern Peruvian area in the next 4 to 5 days. Author

N86-31089# Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (West Germany).
HYDROLOGY
W. KRUCK and P. PAMPALONI (Consiglio Nazionale delle Ricerche, Florence, Italy) *In* DFVLR The X-SAR Science Plan p 75-95 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Hydrological parameters that can be studied by spaceborne imaging radar are listed. Test sites for X-SAR/SIR-C mission remote sensing of precipitation and surface runoff; ground water, evaporation, and evapotranspiration; and soil moisture, and surface and radar penetration parameters are proposed. ESA

N86-31943*# National Marine Fisheries Service, Miami, Fla.
UTILIZING REMOTE SENSING OF THEMATIC MAPPER DATA TO IMPROVE OUR UNDERSTANDING OF ESTUARINE PROCESSES AND THEIR INFLUENCE ON THE PRODUCTIVITY OF ESTUARINE-DEPENDENT FISHERIES Semiannual Progress Report
J. A. BROWDER, L. N. MAY, JR. (Louisiana State Univ., Baton Rouge), A. ROSENTHAL, R. H. BAUMANN, and J. G. GOSSELINK 10 Jun. 1986 66 p Sponsored by NASA (NASA-CR-177177; NAS 1.26:177177; SAPR-2) Avail: NTIS HC A04/MF A01 CSCL 08G

LANDSAT thematic mapper (TM) data are being used to refine and validate a stochastic spatial computer model to be applied to coastal resource management problems in Louisiana. Two major aspects of the research are: (1) the measurement of area of land (or emergent vegetation) and water and the length of the interface between land and water in TM imagery of selected coastal wetlands (sample marshes); and (2) the comparison of spatial patterns of land and water in the sample marshes of the imagery to that in marshes simulated by a computer model. In addition to activities in these two areas, the potential use of a published autocorrelation statistic is analyzed. Author

N86-31952# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
AUTOMATIC INTERPOLATION OF ISOLINES FROM AN IRREGULAR WATERLINE DIGITAL TERRAIN MODEL (DGM) THROUGH TRIANGULATION NETWORK [AUTOMATISCHE ABLEITUNG VON ISOLINIEN AUS EINEM UNREGELMAESSIGEN WASSERLINIEN-DGM UEBER DREIECKSVERMASCHUNG]
I. KRUSE *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 p 91-99 1985 In GERMAN; ENGLISH summary
Avail: NTIS HC A09/MF A01

A computer-based waterline procedure was extended to represent drying tidal flat area aerial photographs in digital and analog forms. The triangulation network transforms waterlines into isolines after data homogeneization. The procedure can be applied to process and represent digitized elevation lines. ESA

N86-31956# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CALCULATION AND REPRESENTATIONS OF ELEVATION CHANGES IN A TIDAL FLAT AREA FROM DIGITAL TERRAIN MODELS [BERECHNUNG UND DARSTELLUNG VON HOEHENVERAENDERUNGEN IM WATT AUS DIGITALEN GELAENDEMODELLEN]
H. ROSENGARTEN *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 p 125-133 1985 In GERMAN; ENGLISH summary Original contains color illustrations
Avail: NTIS HC A09/MF A01

The tidal flat areas along the German North Sea coast subjected to large changes by the influence of tide and extreme meteorological conditions are studied to protect man against sea intrusions and hazards. The tidal flat areas are studied using electronic tachymetry, photogrammetry with water line procedures, hydrographic measurements and through aerial photograhy. The data are stored in a data bank and used to calculate elevation changes in tidal flat areas and improve the information on topographic maps. The cartographic representation of elevation changes is described. Map production through increased automation of the partial processes in map design and in reproduction can be economically applied. ESA

N86-32071# Royal Netherlands Meteorological Inst., De Bilt. Afdeling Fysische Meteorologie.
OBSERVATIONS OF SURFACE WATER TEMPERATURE IN THE NETHERLANDS FROM 1860: THE TEMPERATURE REGIME AND THE CHANGES IN IT
P. C. T. VANDERHOEVEN 1985 114 p In DUTCH; ENGLISH summary
(KNMI-WR-85-6; B8662754; ISSN-0169-1651; ETN-86-97731)
Avail: NTIS HC A06/MF A01

The results of different analyses of water temperature observations in the Netherlands covering 2500 station-years are presented. The winter water temperature was observed by IR satellite photos. The history of the station network is depicted. The water movements which are essential to understand the regime of water temperatures are discussed. The relation between all available 10 yr water temperature averages is described. Peculiarities of the annual water temperature are shown by Lissajous figures. Annual averages were analyzed by comparing their deviations with respect to the standard. ESA

N86-32072# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Physik der Atmosphaere.
A BISPECTRAL METHOD FOR THE HEIGHT DETERMINATION OF ICE CLOUDS
W. POLLINGER and P. WENDLING Dec. 1985 52 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-03; ISSN-0171-1342; ETN-86-97586) Avail: NTIS HC A04/MF A01; DFVLR, Cologn, West Germany DM 36.50

A bispectral method for the height determination of optically thin ice clouds from satellite measurements at two adjacent points of an ice cloud layer was developed. Using 2 wavelengths in the spectral range of the water vapor band at 6.3 microns and in the window range at 11 microns, a transcendental equation was derived under the assumption that both points of the cloud have the same temperature but different optical thickness. The solution of the transcendental equation yields the cloud temperature, and the height via the temperature profile which must be known. The effect of the water vapor above the cloud is corrected for using a radiation transfer model. ESA

N86-32857# Dundee Univ. (Scotland). Dept. of Geology.
GRADIENTS OF CHANGE IN THE ESTUARINE ENVIRONMENTS OF THE TAY
J. MCMANUS *In* ESA Remote Sensing Applications in Civil Engineering p 143-149 Mar. 1985
Avail: NTIS HC A06/MF A01

The hydrology and structure of the Tay estuary (Scotland) were studied to assess remote sensing methods and technology. Results show that estuarine waters provide gradients of water surface, salinity, temperature and suspended sediment concentrations. Intertidal flats show systematic variations of grain size with coarse sands in channel margins and fine muds beside marshes. ESA

N86-32858# Norwegian Water Resources and Electricity Board, Oslo.
SNOW AND ICE
G. OESTREM *In* ESA Remote Sensing Applications in Civil Engineering p 151-163 Mar. 1985
Avail: NTIS HC A06/MF A01

A method which uses data from polar orbiting satellites to monitor snow cover in Norway was developed. Winter snow cover

is of great economic importance in Norway because the meltwater accounts for a substantial part or annual inflow into reservoirs for hydroelectric power production(more than 99% of all electricity production). Snow surveys made by traditional methods are costly and labor intensive. Airborne gamma methods are also used, and a radio-echo method proves useful for glacier thickness measurements. A snow stick can be used for monitoring snowpack variations, and real-time data transmission can be made in the ARGOS system. General sea ice conditions can be reported by the NIMBUS microwave radiometer, whereas more detailed ice-edge mapping can be made from NOAA-IR data. ESA

N86-32871# Rijkswaterstaat, The Hague (Netherlands). Projectgroep Remote Sensing IJsselmeergebied.
REMOTE SENSING AND WATER QUALITY IN THE IJSSELMEER (NETHERLANDS) AREA [REMOTE SENSING EN WATERKWALITEIT IN HET IJSSELMEERGEBIED]
Jan. 1985 25 p In DUTCH
(MDLK-R-8537; ETN-86-97493) Avail: NTIS HC A02/MF A01

Possible contributions of Landsat multispectral scanner recording to the determination of a quantitatively spatial image of algae and silt, and relations between these and other parameters (e.g., transparence) were investigated. The relation between the feeding behavior of cormorants and RS observable differences of the water surface were examined as the birds seem to choose their feeding areas on the basis of optical water information. Valuable information concerning the spatial variation of optically observable matters and processes, e.g., chlorophyl, suspending dust, humus acids, transparence, temperature, and stream phenomena can be obtained. The results offer sufficient perspectives for further water quality investigations. ESA

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A86-40824
INTERPRETATION OF MULTITEMPORAL LANDSAT MSS DATA USING SUPERVISED AND UNSUPERVISED METHODS
J. LICHTENEGGER (ESA, Frascati, Italy) and KL. SEIDEL (Zuerich, Eidgenoessische Technische Hochschule, Zurich, Switzerland) Photo Interpretation (ISSN 0031-8523), vol. 23, July-Aug. 1984, p. 21-24. In English, French, and Spanish. refs

The degree of accuracy and detail of multitemporal data sets using supervised classification methods for updating land use maps is examined for Landsat data of Grosses Moos, Switzerland, obtained throughout the 1976 growing season. A stepwise linear discrimination analysis supervised classification routine is performed, and all occurring land use categories were mapped. A ground truth control map was produced for selected large areas, and for the 14 different land use categories present in the area, comparison with monotemporal percentages showed a gain in accuracy. Principal component analysis was applied as a preprocessing step to create images for conventional visual interpretation. The complete area pixel aggregate is used to derive common principal components, and special principal components are calculated from the training sets used previously for supervised classification. R.R.

A86-40833* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
CHARACTERISTICS OF THE SIR-A SYSTEM AND IMAGES [CARACTERISTIQUES DU SYSTEME ET DES IMAGES SIR-A]
PH. REBILLARD (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Photo Interpretation (ISSN 0031-8523), vol. 23, Jan.-Feb. 1984, p. 4-17, 19, 21 (18 ff.). In French, English, and Spanish.

Sample images obtained with the Shuttle Imaging Radar A (SIR-A) are presented, along with design and performance features of the SIR-A, Seasat and Landsat images of the same scenes for comparison purposes. The SIR-A functions at the L-band 25 cm at a frequency of 1278 GHz with a spectral bandwidth of 6 MHz. The images were taken at an angle of 47 deg and furnished a resolution of 40 m from an altitude of 259 km. The images covered a ground swath 50 km wide. The images are provided to assist in the development of effective techniques for interpreting radar imagery. The SIR-A instrument is a precursor of another imaging device which will be flown around Venus. The images provided include sections of France, Sardinia and Algeria. M.S.K.

A86-42016* Kansas Univ. Center for Research, Inc., Lawrence.
MAXIMUM LIKELIHOOD CLASSIFICATION OF SYNTHETIC APERTURE RADAR IMAGERY
V. S. FROST and L. S. YUROVSKY (University of Kansas Center for Research, Inc., Lawrence) Computer Vision, Graphics, and Image Processing (ISSN 0734-189X), vol. 32, Dec. 1985, p. 291-313. refs
(Contract NAGW-381)

Classification of synthetic aperture radar (SAR) images has important applications in geology, agriculture, and the military. A statistical model for SAR images is reviewed and a maximum likelihood classification algorithm developed for the classification of agricultural fields based on the model. It is first assumed that the target feature information is known a priori. The performance of the algorithm is then evaluated in terms of the probability of incorrect classification. A technique is also presented to extract the needed feature information from a SAR image; then both the feature extraction and the maximum likelihood classification algorithms are tested on a SEASAT-A SAR image. Author

A86-43963
ENHANCING LANDSAT DATA ACQUIRED UNDER VERY LOW ILLUMINATION
J. M. MILLER and G. J. BURGER (Alaska, University, Fairbanks) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 801-807. refs

The potential utility of MSS images with sun elevation-angles between minus 4 deg and plus 10 deg during the winters of 1984-85 and 1985-86 using Landsat-4 and -5 data acquired by the Alaskan Quick-Look system have been examined. When band 1 and band 2 sensors have been switched to the high-gain mode, it is shown that it is possible to delineate open leads in sea ice with a sun angle of minus 4 deg by stretching the 0 to 4 range of digital numbers to the full contrast of a photographic image. Land features can be imaged down to 0 deg, showing (snow covered) forests or brush contrasted with barren tundra. Dune deposits on the order of 20 feet in height are visible, and snow cover and ice characteristics on large lakes can be determined. It is concluded that one should not discount the value of Landsat data acquired with solar angles below 10 deg. Some natural features actually are enhanced by low incident-angles of illumination. Author

A86-43965* Alaska Univ., Fairbanks.
APPLICATION OF PHOTOGRAMMETRY TO THE STUDY OF VOLCANO-GLACIER INTERACTIONS ON MOUNT WRANGELL, ALASKA
C. S. BENSON (Alaska, University, Fairbanks) and A. B. FOLLETT (North Pacific Aerial Surveys, Inc., Anchorage, AK) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 52, June 1986, p. 813-827. Research supported by the Alaska Council on Science and Technology, Alaska Department of Natural Resources, National Park Service, Explorers Club of New York, and Arctic Institute of North America. refs
(Contract NSF EAR-75-21506; NSF EAR-77-15166; NAG9-9)

Most Alaskan volcanoes are glacier covered and provide excellent opportunities to study interactions between glaciers and volcanoes. The present paper is concerned with such a study, taking into account the Mt. Wrangell (4317 m) which is the northernmost active volcano (solfatara activity) on the Pacific Rim (62 deg N; 144 deg W). While the first photographs on the summit of Mt. Wrangell were published more than 75 years ago, research there began in 1953 and 1954. Satellite images reveal activity at the summit of Mt. Wrangell. However, the resolution is not sufficient for conducting important measurements regarding ice volume losses. For this reason, vertical aerial photographs of the summit were obtained, and a field trip to the summit was conducted. Aspects of photogrammetry are discussed, taking into account questions of ground control, aerial photography, topographic mapping, digital cross sections, and orthophotos. G.R.

A86-44046
THE INFLUENCE OF GEOGRAPHY ON LOCAL ENVIRONMENT AS INFERRED FROM NIGHT THERMAL INFRARED IMAGERY
H. GOSSMANN (Freiburg, Universitaet, Freiburg im Breisgau, West Germany) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 249-275. refs

Results are presented from efforts by the Freiburg remote sensing group in processing and interpreting thermal IR images acquired by the Heat Capacity Mapping Mission (HCMM) spacecraft. Geometric corrections were applied to the images to obtain maps of the Federal Republic of Germany on a scale of 1:2 million, which were then enlarged to a scale of 1:200,000. The mesoscale images over mountainous terrain were detailed enough to discern cold valleys, warm slopes, and cold elevations. The distinctions were lost on higher resolution scales. Sample images are also discussed from forests, land-use and heat island (small villages) studies. The results support the realization of imaging systems with resolutions exceeding the 600 m resolution available with the HCMM. M.S.K.

A86-44050
HCMM SATELLITE DATA CALIBRATION AND ATMOSPHERIC CORRECTIONS
P. REINIGER (CEC, Joint Research Centre, Ispra, Italy) Remote Sensing Reviews (ISSN 0275-7257), vol. 1, pt. 2, 1986, p. 359-381. refs

Techniques developed for atmospheric corrections and calibration of the Heat Capacity Mapping Mission (HCMM) spacecraft thermal IR sensor are described. A radiative transfer equation was devised to account for atmospheric attenuation in terms of the temperature, vapor pressure and mass absorption coefficient. The WINDOW model was then defined to calibrate the surface temperature measured by the HCMM with the correction factor over the 10.5-12.5 microns interval. Correction factors were also obtained with ground truth data on grassland, a pine forest, and several water surfaces. Comparative data are provided from the NOAA-5 and TIROS-N sensors for the same areas. The correction factors followed the same trend for all the sensors. M.S.K.

A86-44154* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SIR-B - THE SECOND SHUTTLE IMAGING RADAR EXPERIMENT
J. CIMINO, C. ELACHI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and M. SETTLE (ARCO Oil and Gas Co., Plano, TX) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 445-452. NASA-supported research. refs

On October 5, 1984, the second Shuttle Imaging Radar (SIR-B) was launched into orbit aboard the Space Shuttle Challenger. SIR-B is part of an evolutionary radar program designed to progressively develop a multifrequency, multipolarization synthetic aperture radar with a variable earth-imaging geometry. The SIR-B instrument is an upgraded version of SIR-A, with the additional capability of tilting the antenna mechanically to acquire imagery at variable incidence angles ranging from 15 to 60 deg. The variable look angle capability provided a means of acquiring multiple incidence angle imagery over specific targets on successive days of the mission. These data are being used to classify surface features by their backscatter signatures as a function of incidence angle and for topographic mapping. In addition to the antenna tilt capability, a digital data-handling system was added to increase the dynamic range, the resolution was improved by a factor of two over SIR-A, and a calibration subsystem was added to improve the radiometric accuracy of the data. The mission had a number of problems, including loss of the primary digital data path between the Shuttle and the ground. In spite of these problems, approximately 20 percent of the planned digital data were collected over the 8-day Shuttle mission corresponding to an areal coverage of about 6.4 million sq km. Author

A86-44156*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATED MATCHING OF PAIRS OF SIR-B IMAGES FOR ELEVATION MAPPING
H. K. RAMAPRIYAN, J. P. STRONG, C. W. MURRAY, JR. (NASA, Goddard Space Flight Center, Greenbelt, MD), and Y. HUNG (Maryland, University, College Park) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 462-472. refs

During the SIR-B mission in October 1984, a significant number of overlapping synthetic aperture radar (SAR) images of various ground areas was collected. This has offered the first opportunity to perform stereo analyses on images from space that cover large ground areas to determine elevation information. This paper presents the preliminary results of an investigation to obtain elevation data from stereo pairs of SIR-B images. First, the accuracy with which elevation information can be derived from SIR-B image pairs is evaluated theoretically. It is shown that elevation accuracy is a function of the slant range resolution, the incidence angles with which the stereo pair is obtained, the accuracies in spacecraft state estimation, and determination of corresponding pixels in the stereo pair. Next, a hierarchical method is developed to match the corresponding pixels. This method involves iterative removal of local distortions and correlations of pairs of local neighborhoods in the two images. Since it is necessary to perform the matching at every pixel in the image, it is very computationally intensive. Therefore, it has been implemented on the Massively Parallel Processor (MPP) at the Goddard Space Flight Center (GSFC). The MPP's speed permits two iterations of this technique to operate on a pair of 512 x 512 images within 7 s. Results of applying this algorithm of SIR-B images of Mount Shasta, CA, are shown. The matching algorithm performs well in regions of the image with significant features. An approximate elevation image derived from the matching process corresponds to published topographic map data, except for certain obvious discontinuities. Author

A86-44158* Vexcell Corp., Boulder, Colo.
MULTIPLE INCIDENCE ANGLE SIR-B EXPERIMENT OVER ARGENTINA STEREO-RADARGRAMMETRIC ANALYSIS
F. LEBERL, G. DOMIK (Vexcel Corp., Boulder, CO), J. RAGGAM (Graz, Technische Universitaet, Austria), J. CIMINO, and M. KOBRICK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 482-491. refs
(Contract JPL-957363; NAS7-100)

Four overlapping Shuttle Imaging Radar-B (SIR-B) radar images were obtained across southern Argentina; these form a total of six stereo models with intersection angles ranging from 5 to 23 deg. This data set is uniquely suited for experimental evaluation of some basic assumptions on stereo-radargrammetry. Each stereo model was measured on a specially programmed photogrammetric analytical plotter; the resulting coordinates of ground points were compared with those from maps. It is concluded that accuracies are lower than expected at the larger stereo-intersection angles, amounting to about + or 60 m in each coordinate direction. This might be explained by limitations of the quality of stereofusion caused by look angle differences and specular point migration, backscatter differences due to different incidence angles, differences in azimuth directions, and image noise and speckle.
Author

A86-44159* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MULTIPLE INCIDENCE ANGLE SIR-B EXPERIMENT OVER ARGENTINA GENERATION OF SECONDARY IMAGE PRODUCTS
G. DOMIK, F. LEBERL (Vexcel Corp., Boulder, CO), and J. CIMINO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 492-497. refs
(Contract JPL-957363; NAS7-100)

Original radar images may be geometrically and radio metrically distorted. This may be a particular problem when multiple angle imagery is analyzed and there is topographic relief in the area of interest. This paper describes a set of techniques designed to combine a multiple angle radar data set with a digital terrain elevation model, to generate a set of new images called secondary image products. These new images are geometrically rectified radar ortho-images radiometrically rectified images, and stereo ortho-images. These secondary images can then reliably be used for thematic interpretation.
Author

A86-44173*# Geological Survey, Flagstaff, Ariz.
SHUTTLE IMAGING RADAR - PHYSICAL CONTROLS ON SIGNAL PENETRATION AND SUBSURFACE SCATTERING IN THE EASTERN SAHARA
G. G. SCHABER, J. F. MCCAULEY, C. S. BREED (USGS, Flagstaff, AZ), and G. R. OLHOEFT (USGS, Denver, CO) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-24, July 1986, p. 603-623. refs
(Contract NASA ORDER W-08760; NASA ORDER W-15788)

Interpretation of Shuttle Imaging Radar-A (SIR-A) images by McCauley et al. (1982) dramatically changed previous concepts of the role that fluvial processes have played over the past 10,000 to 30 million years in shaping this now extremely flat, featureless, and hyperarid landscape. In the present paper, the near-surface stratigraphy, the electrical properties of materials, and the types of radar interfaces found to be responsible for different classes of SIR-A tonal response are summarized. The dominant factors related to efficient microwave signal penetration into the sediment blanket include (1) favorable distribution of particle sizes, (2) extremely low moisture content and (3) reduced geometric scattering at the SIR-A frequency (1.3 GHz). The depth of signal penetration that results in a recorded backscatter, here called 'radar imaging depth', was documented in the field to be a maximum of 1.5 m, or 0.25 of the calculated 'skin depth', for the sediment blanket. Radar imaging depth is estimated to be between 2 and 3 m for active sand dune materials. Diverse permittivity interfaces and volume scatterers within the shallow subsurface are responsible for most of the observed backscatter not directly attributable to grazing outcrops. Calcium carbonate nodules and rhizoliths concentrated in sandy alluvium of Pleistocene age south of Safsaf oasis in south Egypt provide effective contrast in premittivity and thus act as volume scatterers that enhance SIR-A portrayal of younger inset stream channels.
Author

A86-45196
MULTISPECTRAL DIGITAL IMAGE CLASSIFICATION BY THE SEPARATING HYPERPLANES METHOD [KLASSIFIZIERUNG MULTISPEKTRALER DIGITALBILDER MIT DER METHODE DER TRENNENDEN HYPERFLAECHEN]
S. L. EKENOBI (Lagos, University, Nigeria) Bildmessung und Luftbildwesen (ISSN 0006-2421), vol. 54, Jan. 1986, p. 23-29. In German. refs

The assumptiton of the Gaussian distribution for the classification data is a weakness of most land-use classification algorithms. This paper deals with a new algorithm which employs linear hyperplanes as discriminators, and does not assume any statistical properties for the classification data; hence the elimination of the situation which makes statistically stronger categories more important than the others in the classification process.
Author

A86-45519
GROUND CONTROL AND THE SPOT MISSION [LES MOYENS SOL DE CONTROLE ET DE MISSION DE SPOT]
G. CALES (CNES, Toulouse, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 27-31. In French.

SPOT satellite ground control stations are located near Toulouse, in Guiana, in South Africa and in Sweden. The links are maintained on the 2 GHz S band. Payload programming, stationkeeping and image processing functions are distributed among the various control stations, which are connected in real-time over telephone links. Two mainframe computers are dedicated to the control and payload programming functions and a third is in 1.2 million lines of FORTRAN code which are used for orbit control, stationkeeping and housekeeping, and observational functions. Nighttime operations at the control stations are generally devoted to receiving, recording, archiving and disseminating data gathered by the SPOT sensors during passages over sunlit regions. Daytime functions include selecting targets to view and preparing and issuing commands to the satellite. Observational sequences are usually prepared in a weekly format for transmission to the satellite. Block diagrams are provided for the command and control links of the ground control system.
Author

A86-45520
SPOT RECEIVING STATIONS AND THE ASSOCIATED CENTERS FOR ARCHIVING AND PRETREATING DATA [LES STATIONS DE RECEPTION SPOT ET LES CENTRES D'ARCHIVAGE ET DE PRETRAITEMENTS ASSOCIES]
H. CARN (Societe Europeenne de Propulsion, Puteaux, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 33-36. In French.

SPOT satellite data is transmitted at rates of 50 Mbit/sec to the growing ground receiving station network. Each station is or is being equipped to receive, store and treat the data to meet the quality specifications and client requirements. The ground stations use 9 m antennas for data reception on the 8 GHz band, with each receiving period lasting up to an hour. Received data are demodulated and synchronized, then stored on magnetic tape at a density of 6,250 bits/inch. A center for Image Rectification has the responsibilities of removing noise from the data, cataloging images acquired each day, correcting for radiometric and geometric distortions, and producing the requested images. Image correction procedures are automated to handle the 36 million points of each image.
M.S.K.

A86-45521
THE ORGANIZATION OF THE SERVICE FOR DISSEMINATION OF SPOT IMAGES [ORGANISATION DU SERVICE DE DIFFUSION DES IMAGES SPOT]
G. BRACHET and A. FONTANEL (SPOT Image, S.A., Toulouse, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 37-46. In French.

The SPOT organization is run as a private corporation which is in the process of establishing worldwide centers for marketing and providing the products of SPOT imaging activities. Ground data reception stations are being or have been constructed in several countries to provide real-time imagery of scenes covering the areas within 2500 km of the respective stations. Accords have thus far been signed with Canada, Bangladesh, India, China, and Saudi Arabia to establish stations in those countries. Two established stations are dedicated data archival stations, each handling 700 images (unprocessed) per day, treating 70 with level 1 corrections, and 10-20 images with geographic labeling. Block diagrams are furnished of the SPOT organizational network for receiving, recording, archiving, treating, marketing and disseminating the SPOT images, and for accessing the organization to learn of the services that are available and acquiring imagery. The imagery can either comprise processed images produced in a photographic form or can include information which is not part of the SPOT system per se. M.S.K.

A86-45522
SPOT TERMINOLOGY [LA TERMINOLOGIE SPOT]
R. ZAHARIA (CNES, Division Sciences de la Terre et Applications, Paris, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 49-57. In French and English.

A glossary of significant terms has been developed in order to facilitate the use of SPOT imaging capabilities by commercial markets. The glossary provides acronyms and terms in both french and english, and communicates the performance and instrumental capabilities of the SPOT sensors and their applications. Nearly 50 annotated terms and definitions are presented, representing an Oct.30, 1985 update. A Committee has been established for periodically reviewing the contents and issuing revisions. The entire existing Glossary is provided. M.S.K.

A86-45523
THE SPECIFICATIONS AND IN-FLIGHT VERIFICATION OF THE CHARACTERISTICS OF SPOT IMAGES [SPECIFICATIONS ET VERIFICATION EN VOL DES CARACTERISTIQUES DES IMAGES SPOT]
G. BEGNI (CNES, Toulouse, France), R. ZAHARIA (CNES, Paris, France), and J. DEFER Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 59-66. In French. refs

The analytical forms and procedures employed for in-flight calibration of the SPOT sensors to ensure that the images met predefined radiometric (RQ) and geometric quality (GQ) criteria are summarized. The RQ was defined on the basis of the capability of faithfully reproducing the measured radiances. The recorded spectra were analytically compared to reference spectra for the various scenes. Account was taken of the noise components of any given scene, the possibilities of error introduced by the processing algorithms (which assumed gaussian distributions for the spectra), and the cumulative effects of noise on the imagery. A solar sensor was used for comparative calibration of the spectral measurements. Various GQ geometric specifications were built and programmed into the equipment, including 0.1 pixel resolution. Calibration efforts included determination of the positioning accuracy relative to the orbital altitude, the spacecraft attitude, the sensor timing and image time labeling. GQ calibration consisted of identifying scene pixel locations to within 500 m, establishing the scene object length mesurements to within 0.001 in two perpendicular directions, comparing and reconciling signals from different spectral bands from the same scene, and verifying the algorithms for quantifying the within-scene altimetric relief. M.S.K.

A86-45524
POTENTIAL APPLICATIONS OF SPOT IMAGERY FOR TOPOGRAPHIC AND NUMERICAL CARTOGRAPHY [LE POTENTIEL DES IMAGES SPOT POUR LA CARTOGRAPHIE TOPOGRAPHIQUE ET NUMERIQUE]
A. BAUDOIN (Institut Geographique National, Saint-Mande, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 67-78. In French. refs

Much of the surface of the earth has either not been mapped or has been mapped at scales of 1:250,000 or higher. The SPOT satellite, with a monochromatic imaging capability of 10 m resolution, can provide maps at scales of 1:100,000 and sufficient data to improve existing maps to resolutions of 1:50,000 or 1:100,000. SPOT images are similar in detail to those available from medium resolution airborne photography, which can supply control point images for generating medium scale maps using SPOT images. These in turn are processed to obtain photographic results that can be interpolated into maps that could include topographic and land use data, roads, and vegetal categorization. Existing maps can be revised and augmented to encompass such information as industrial zones, power lines, land use categories, etc. These applications, because of the periodicity of SPOT passage over the same points of the earth, are of interest due to the frequent opportunities to update the resulting data for a given area, as well as the capability to store, analyze and manipulate the data numerically. M.S.K.

A86-45525
EVOLUTION OF THE SPOT SYSTEM BEYOND 1990 - SPOT 3 AND 4 [EVOLUTION DU SYSTEME SPOT AU-DELA DE 1990 - SPOT 3 ET 4]
M. TRAIZET (CNES, Paris, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 87-89. In French.

A decision, announced in 1985, has been made to pursue development of SPOT 3 and 4 spacecraft as successors to the SPOT 1 and 2 spacecraft of the 1980s. The efforts are in part spurred by a recent surge in the number of countries with remote sensing programs and the number of earth stations with the capabilities of receiving and processing satellite imagery. The SPOT imagery market could benefit from users who wish access to a continuity of imagery, and by markets which periodically require imagery, such as for crop or land use monitoring. The agricultural markets are expected to show the greatest increase in demand. The improvements intended for the SPOT 3 and 4 spacecraft include lifetimes of 4 yr each, compared to 2 yr lifetimes of SPOT 1 and 2 spacecraft. A specialized sensor will be developed for vegetation mapping with a 100 deg field of view and a resolution of 1 km. The orbit of the new SPOT satellites, the first to be launched at the end of 1990, will allow new imagery of selected areas every 3-4 days. M.S.K.

A86-46059
COMPAR - A COMPUTERIZED TECHNIQUE FOR THE IN-DEPTH COMPARISON OF REMOTELY SENSED DATA
R. G. CONGALTON and A. M. B. REKAS (U.S. Army, Engineer Waterways Experiment Station, Vicksburg, MS) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 98-106. refs

A U.S. Army Engineer Waterways Experiment Station (WES) automated procedure, COMPAR, is developed for the detailed comparison of remotely sensed data with a corresponding verified reference data set. The input data consists of a geometrically uncorrected classified image, control points that are identifiable on both the image and the standard map, and the standard data set in a square grid array format. The full information content of the image data is preserved for classification purposes by performing the resampling of the image data to the grid size and

geographic positioning of the standard, after the image is classified. The WES comparison method produces standard error matrices, an accuracy matrix, a reliability matrix, and a distribution matrix. The class, shape, and number of grids for each polygon on the standard map are compared to the actual number of grids falling into each class for the corresponding polygon in the classsified image. R.R.

A86-46071
ORTHOPHOTOMAPPING PRODUCTION WITH AN AUTOMATIC SYSTEM AT 1/5000 MAP SCALE
L. ALBERICH (Catalunya, Institut Cartografic, Barcelona, Spain) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 222-228.

A high-production four-year orthophotomapping project over a large area and at 1/5000 map scale is described. Flight lines used an 80 percent longitudinal and 45 percent lateral overlap, and the 1/22000 photo scale was found to be optimum. A more dedicated flight has allowed the reduction in cost of the editing process, and use of the Wild ACI analytical plotter for aerotriangulation has eliminated preparation for the orthophoto process. After the absolute orientation epipolar lines of the stereo pair are computed, and approximate matched areas are scanned parallelly to the base line, the Gestalt-IV photomapper system is applied to determine horizontal parallels which are used to rectify the photoimage. The use of the automatic on-line correlation procedure has minimized the time spent on collecting height data. R.R.

A86-46077
STEREO IMAGE TRANSFER SYSTEM WITH FAST DIGITAL VIDEO PROCESSORS AND MERGED GRAPHICS DISPLAY
R. R. REAL and Y. FUJIMOTO (National Research Council of Canada, Div. of Physics, Ottawa) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 272-283. refs

A stereo video image system under development is described for measurement, interpretation and other operations upon static or dynamic 3-D scenes or their photographic representation. Image processing algorithms to be implemented are real-time spatial filtering, histogramming, correlation, image matching and intensity feature estimation. These are to be merged with a display system that supports graphics, alphanumerics and color. Trends in fast digital image processors are also discussed. Author

A86-46102
COMPARISON OF CUBIC-CONVOLUTION INTERPOLATION AND LEAST-SQUARES RESTORATION FOR RESAMPLING LANDSAT MSS IMAGERY
L. S. KALMAN (Technicolor Government Services, Inc., Sioux Falls, SD) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 546-556. refs
(Contract USGS-14-08-0001-20129)

Two methods for resampling Landsat MSS data, cubic-convolution interpolation and least-squares restoration, are analyzed. The geometrical registering and resampling of Landsat MSS images from the Washington, D.C. area and Needles, CA, using the two methods are described. The methods are compared in terms of pixel values, frequency content, image statistics, and visual clarity. It is observed that the restoration method provides sharper images with greater information content than the cubic-convolution interpolation. I.F.

A86-46103
AN EVALUATION OF A NEW STATISTICAL APPROACH TO TRADITIONAL LINEAR DESTRIPING
M. E. RICHARDS (Technicolor Government Services, Inc., Sioux Falls, SD) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 557-563.
(Contract USGS-14-08-0001-20129)

Multiple-detector scanning systems exhibit striping patterns caused by non-uniform calibration and the analog to digital quantization process. Traditional linear destriping is the adjustment of detector gain and bias with values computed from the individual mean and standard deviation detector statistics and the same statistics for the entire image. A newly proposed statistical approach to destriping retains the floating point values from the linear function and incorporates a two-dimensional randomly generated binary table to control the conversion from floating point to integer values, rather than using a traditional truncation conversion method. Landsat multispectral scanner (MSS) data acquired on June 2, 1973, were processed with both the traditional and the statistical destriping techniques. The traditional linear destriping did not suppress striping completely, since it applied the same destriping matching function to a given detector input value. The statistical approach was more successful at attenuating striping as it changed the output pixel value from applying of the destriping function, according to the probability of its fractional part. Author

A86-46107
MAXIMIZING COLOR CONTRAST AND REALISM IN COLOR PLOTTER RENDITIONS OF LANDSAT DIGITAL IMAGERY
D. L. PLONDKE (Cities Service Oil and Gas Corp., Tulsa, OK) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 637-641.

A86-46109
ON THE ANALYSIS OF AERIAL SCENES
C. A. HARLOW, R. W. CONNERS, R. VASQUEZ-ESPINOSA, and C. NG (Louisiana State University, Baton Rouge) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 651-660. refs
(Contract DAAG23-82-K-0189)

A hierarchical computer vision system which utilizes models of objects that may appear in the aerial scene is investigated. These objects are generic objects that may appear at any level of detail or resolution in the scene and are the nodes in the hierarchical representation of the scene. The existence of operators to extract image cues for nodes at any level in the hierarchy enables one to have a data driven system as opposed to a top-down or bottom-up analysis system. A substantial effort has been directed toward defining operators and system has been developed for defining measures which characterize perceptual properties. Preliminary investigations on aerial scenes indicate the system is useful in characterizing patterns that appear in aerial scenes. Author

A86-46113
SCALE DETERMINATION ON VERTICAL AERIAL PHOTOGRAPHS
J. J. ULLIMAN (Idaho, University, Moscow) and M. L. HOPPUS (Lockheed Image Analysis Laboratory, Las Vegas, NV) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 689-698. refs

Two methods for determining scale on vertical aerial photographs are suggested in lieu of common practices. For mountainous terrain, the use of 'point scale' (i.e., the exact scale at a particular elevation) which is derived using the aircraft altitude variable rather than 'line scale' or 'average scale', which is normally determined by measuring a photo and map distance, is proposed. A 'photo distance ratio' method of determining scale especially

for large photo scales, special project work, and where there are no maps available is presented. Author

A86-46115
SYSTEM CALIBRATION AND SELF-CALIBRATION WITH FULL-CONTROLLED VERTICAL AERIAL PHOTOGRAPHY
H. ZIEMANN (National Research Council of Canada, Div. of Physics, Ottawa) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 736-745.

Six small blocks of vertical aerial photographs taken with two different cameras simultaneously over three different testfields were used to perform first a system calibration and then several self-calibrations using different sets of parameters in a bundle adjustment program. The investigation points to differences in the effectiveness of the used self-calibration parameter sets in regard to their ability to handle image deformation and image distortion. Author

A86-46120
THE DIGITIZATION AND MACHINE PROCESSING OF AERIAL PHOTOGRAPHY TO FACILITATE DETECTION OF CHANGES IN ISLAND LOCATIONS AND SIDE CHANNELS
A. J. BRUZEWICZ (U.S. Army, Planning Div., Rock Island, IL) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 803-808.

A86-46477
A SIMPLE BIDIRECTIONAL REFLECTANCE MODEL FOR TERRESTRIAL SURFACES
B. PINTY and D. RAMOND (Clermont-Ferrand II, Universite; Observatoire de Physique du Globe, Aubiere, France) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 20, 1986, p. 7803-7808. refs

A simple bidirectional reflectance model is derived for terrestrial surfaces. This model uses photometric relationships together with data from the Nimbus 7 Earth Radiation Budget (ERB) Experiment. It is shown that the model provides a good description of bidirectional patterns derived from satellite observations for two classes of broad uniform surfaces, namely, land and desert. The dependence of the derived albedo model on solar zenith angle is also studied and compared with several observations made at the surface of the earth. Despite the simplicity of the approach, the proposed bidirectional reflectance model might be useful for several applications in satellite remote sensing. Author

A86-46607
BAND-LIMITED GLOBAL SCALAR MAGNETIC ANOMALY MAP OF THE EARTH DERIVED FROM MAGSAT DATA
J. ARKANI-HAMED and D. W. STRANGWAY (Toronto, University, Ontario, Canada) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, July 10, 1986, p. 8193-8203. NSERC-supported research. refs

The magnetometer satellite (Magsat) data are separated into two distinct sets: the dawn and the dusk sets. The two sets are analyzed independently because of the dawn-dusk asymmetry of the external magnetic field components of the data. Two scalar magnetic anomaly maps, the dawn and the dusk maps, are derived using the spherical harmonic expressions of the respective data set. The significant correlation of the two maps in the harmonic range of 18-41 indicates the repeatability of the Magsat data in these harmonics. The shortest repeatable wavelength is about 920 km. A band-limited global scalar magnetic anomaly map is derived at about 410 km altitude by arithmetic averaging of the dawn and the dusk maps. The map is then downward continued to about 10 km altitude. The downward continued magnetic anomalies are relatively more localized. The main features of the anomalies are as follows: (1) Continents have relatively stronger magnetic anomalies than oceans, especially the younger oceans, (2) many circum-Pacific subduction zones have magnetic signatures, and (3) there is no overall correlation between anomalies and major shields. Author

A86-46718
IMAGE QUALITY: AN OVERVIEW; PROCEEDINGS OF THE MEETING, ARLINGTON, VA, APRIL 9, 10, 1985
E. M. GRANGER, ED. (Eastman Kodak Co., Rochester, NY) and L. R. BAKER, ED. (Sira, Ltd., Chislehurst, England) Meeting sponsored by SPIE and Sira, Ltd. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 549), 1985, 172 p. For individual items see A86-46719 to A86-46725.
(SPIE-549)

Various papers on image quality are presented. The subjects discussed include: image quality considerations in transform coding, psychophysical approach to image quality, a decision theory approach to tone reproduction, Fourier analysis of image raggedness, lens performance assessment by image quality criteria, results of preliminary work on objective MRTD measurement, resolution requirements for binarization of line art, and problems of the visual display in flight simulation. Also addressed are: emittance in thermal imaging applications, optical performance requirements for thermal imaging lenses, dynamic motion measurement using digital TV speckle interferometry, quality assurance for borescopes, versatile projector test device, operational MTF for Landsat Thematic Mapper, operational use of color perception to enhance satellite image quality, theoretical bases and measurement of the MTF of integrated image sensors, measurement of the MTF of thermal and other video systems, and underflight calibration of the Landsat Thematic Mapper. C.D.

A86-46725
UNDERFLIGHT CALIBRATION OF THE LANDSAT THEMATIC MAPPER
J. R. SCHOTT (Rochester Institute of Technology, NY) IN: Image quality: An overview; Proceedings of the Meeting, Arlington, VA, April 9, 10, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 157-161. refs

An approach for evaluation of the Radiometric Quality of Landsat 4/5 Thematic Mapper Band 6 data is presented. The approacn involves comparison of measured surface temperature with surface temperature predicted from observed satellite radiances propagated to the ground using the LOWTRAN 5A model. The atmospheric propagation data and surface temperatures are also compared with atmospheric propagation measurements and surface temperatures measured during an aircraft underlight of the satellite. Author

A86-46727
ADVANCES IN LANDSAT IMAGE PROCESSING AND MAPPING
R. BERNSTEIN and W. A. HANSON (IBM Palo Alto Scientific Center, CA) IN: Sensor design using computer tools II; Proceedings of the Meeting, Arlington, VA, April 11, 12, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 12-23. refs

A Landsat image processing procedure and a system for its implementation have been developed in order to iteratively correct the geometry of image data and to merge the data with auxiliary graphical data. The system allows for both the manual selection of ground control points that establish the geometric correction parameters, and for an automatic determination of mapping parameters on the basis of operator definition of the desired cartographic location. Attention is given to the results of experiments conducted with such data sources as Landsat Thematic Mapper data, geophysical gravity data, and digital line graph cartographic data. O.C.

A86-47840#
ON THE IMPROVEMENT OF SAR IMAGE INTERPRETABILITY USING SPECTRAL MULTI-LOOKING AND SPATIAL FILTERING
T. HIROSE and J. HARRIS (F.G. Bercha and Associates, Ltd., Ottawa, Canada) IN: International Symposium on Remote Sensing of Environment, Fourth Thematic Conference: Remote Sensing for Exploration Geology, San Francisco, CA, April 1-4, 1985, Proceedings. Volume 2 . Ann Arbor, MI, Environmental Research Institute of Michigan, 1986, p. 601-617. Research supported by the RADARSAT Project Office. refs

Although synthetic aperture radar (SAR) data has been shown to provide information for both reconnaisance and detailed geologic mapping, inherent speckle noise has been reported to detract from its interpretability. Two common techniques used to reduce speckle are multi-looking of the complex signal and spatial filtering. The first purpose of this study is to investigate the effect of combining these techniques for improving image interpretability. One and four look simulated target models and real Seasat SAR imagery have been spatially filtered with varying window sizes. A pairwise test is performed on both datasets in addition to geological interpretation of the Seasat data to obtain qualitative results. Secondly, the affect of image scale on image preference is evaluated using three sets of scales for one and four look Seasat data. Results indicate that the preferred imagery depends on the target type, and spatial filtering of the original SAR data marginally improves interpretability. Moreover, scale is shown to play a role in image preference. Author

A86-47913#
AN ALGORITHM FOR THE COMPUTATION OF COVERAGE AREA BY EARTH OBSERVING SATELLITES
E. HAYES (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) IN: Astrodynamics Conference, Williamsburg, VA, August 18-20, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p. 121-126.
(AIAA PAPER 86-2067)

This paper describes an algorithm which was developed to compute earth coverage area as seen by a constellation of satellites. Coverage is a parameter by which the efficiency and robustness of a constellation may be evaluated, and is an important mission requirement of many space systems. The algorithm for the computation of exact coverage area is based upon set theory, vector operations, and spherical trigonometry. The position of a satellite may be completely defined by a position vector and the coverage circle radius is a function of satellite altitude. Therefore, given that the angle of the field of view is known, complete information on the location and size of a coverage circle is contained in a single position vector. Author

A86-48964
NOAA AVHRR IMAGE REFERENCING
D. HO and A. ASEM (IBM France, S.A., France) International Journal of Remote Sensing (ISSN 0143-1161), vol. 7, July 1986, p. 895-904. refs

A simple and fast algorithm for image referencing of NOAA AVHRR (Advanced Very High Resolution Radiometer) data has been derived to facilitate the identification of geographic coordinates corresponding to any pixel on an NOAA image and vice versa. The procedure assumes a spherical earth and circular orbit and takes into account the effects due to the earth's rotation and oblateness and the scan skew. Inputs to the procedure are the ascending nodal longitude and time, the time of the first scan line and one ground control point (GCP). The effects of an ellipsoid earth and an elliptical orbit are corrected by using the GCP to adjust the spacecraft altitude and inclination angle. No detailed emphemeris data are required. The average rms errors, obtained by comparison with independent sets of well-distributed GCPs for each image, are about 2 pixels and 2 lines or 3 km displacement. Results from the procedure are illustrated by the rectification of NOAA images over France. Author

A86-49601#
REMOTE SENSING DATA AS BASIS OF SYNTHETIC BIOCLIMATIC MAPS [FERNERKUNDUNGSDATEN ALS GRUNDLAGE VON SYNTHETISCHEN BIOKLIMAKARTEN]
G. MENZ and M. SCHEER (Freiburg, Universitaet, Freiburg im Breisgau, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublik Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 12 p. In German. refs

The synthetic bioclimatic maps, obtained as a result of bioclimatic analyses and evaluations, can now be very significantly improved with the aid of a new method. This method utilizes as a basis remote sensing data and digital supplementary data. The achieved improvement is related to an enhancement of the accuracy of the computed bioclimatic values and considerations of availability. Possibilities and limitations regarding an application of satellite data in bioclimatic problems are discussed, taking into account the characteristics of a number of satellites which are suited for applications in climatology. Attention is given to aspects of data management in a geographical information system (GIS), relations between the heat production of the human body and climatological parameters, thermal climatological relations for a section in the southwest of Germany, and land use and altitude data. G.R.

A86-49610#
RESULTS OF THE PRACTICAL APPLICATION OF REMOTE SENSING IN THE FEDERAL INSTITUTE FOR EARTH SCIENCES AND RAW MATERIALS [ERGEBNISSE PRAKTISCHER ANWENDUNG DER FERNERKUNDUNG IN DER BUNDESANSTALT FUER GEOWISSENSCHAFTEN UND ROHSTOFFE /BGR/]
D. BANNERT (Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hanover, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 9 p. In German. refs

The institute considered in the present paper, which, according to its German name, has the acronym BGR, is concerned with the evaluation of aerial photographs, and the acquisition, production, and evaluation of satellite imagery. In addition, the institute provides advice in matters related to the acquisition and utilization of remote sensing data, and conducts investigations regarding the possibility to use remote sensing data, in particular, satellite data. In a number of different areas of the earth, the BGR performs studies with respect to the occurrence of mineral and hydrocarbon deposits, the presence of groundwater, and the optimization of soil utilization. A number of examples are selected with the objective to illustrate the nature of the work conducted by the BGR. The areas involved are located in arid, semiarid, and humid tropical regions. The reported projects are based on the utilization of Landsat-Multispectral-Scanner (MSS) and Thematic Mapper (TM) data. G.R.

A86-49722
ORDERING OF TIME-DIFFERENCE DATA FROM MULTISPECTRAL IMAGERY
P. SWITZER and S. E. INGEBRITSEN (Stanford University, CA) Remote Sensing of Environment (ISSN 0034-4257), vol. 20, Aug. 1986, p. 85-94. refs
(Contract NSF MCS-81-09584)

The goal of this investigation is to exhibit multispectral time-difference data in factored form so as to emphasize signal differences, assumed to be spatially structured, and isolate noise, which is assumed to be spatially unstructured. The method used is a variant of the MAF procedure (min/max autocorrelation factors), a general purpose technique which extracts p orthogonal linear combinations or factors of the p-variate data which have maximal to minimal spatial autocorrelation. The application of MAF to time-difference imagery is discussed, and three examples are presented. The first two examples were generated from Landsat MSS image pairs and the third from Daedalus airborne scanner imagery. Author

A86-50236
MOCA - AN INTERACTIVE SYSTEM FOR DATA INTEGRATION AND DECISION ASSISTANCE [MOCA - UN SYSTEME INTERACTIF D'INTEGRATION DES DONNEES ET D'AIDE A LA DECISION]
T.-T. CAO and M. HUMBERT (Bureau de Recherches Geologiques et Minieres, Orleans, France) Metropolis (ISSN 0224-1250), no. 70-71, 4th Quarter, 1985, p. 82-88. In French. refs

A cartographic modeling program (MOCA) written in Assembler is presented for quasi-expert analysis of topographical maps generated with multispectral remote sensing imagery. The program was developed to assist in land use planning, and is designed to aid in decisions on the development of image areas on the bases of the lithology, water drainage, and topography of scenes scanned. The data in the MOCA images permit engineers and developers to identify suitable regions for various types of development, e.g., commercial, industrial, residential, etc. MOCA permits queries as to the feasibility of specific types of development in a given subregion. The type of development and area are indicated and MOCA ranks the choice on a scale from poor to excellent for the type of development considered. The program is currently confined to use with images that have already been thematically mapped. M.S.K.

N86-28488# European Space Agency, Paris (France).
PROCEEDINGS OF A WORKSHOP ON THEMATIC APPLICATIONS OF SAR DATA
D. GUYENNE, comp. and O. MELITA, comp. Dec. 1985 106 p Workshop held in Frascati, Italy, 9-11 Sep. 1985
(ESA-SP-257; ISSN-0379-6566; ESA-86-96853) Avail: NTIS HC A06/MF A01

Applications of SAR data to agriculture, forestry, ice reporting, snow monitoring, and geological surveys were discussed. ESA

N86-28489# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
SELECTED APPROACHES TO THEMATIC SAR STUDIES
J. P. GUIGNARD *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 5-6 Dec. 1985
Avail: NTIS HC A06/MF A01

Studies aimed at establishing what SAR system parameters (e.g., frequency, angle of incidence, polarization) are most suited to thematic applications are introduced. Studies aimed at defining optimal information extraction schemes by assessing the statistical properties of required parameters and developing decision tools (e.g., Bayes estimators, maximum likelihood estimators) for automatic derivation of quantitative values related to geophysical phenomena, from SAR images are outlined. Studies of analysis tools of interest for any application, such as radargrammetry (correction of the geometry of the SAR images) and extraction of land features (e.g., roads, buildings) are discussed. ESA

N86-28496# Technische Univ., Graz (Austria). Inst. for Image Processing and Computer Graphics.
RADARGRAMMETRIC ASPECTS OF SAR DATA EVALUATION
J. RAGGAM, G. TRIEBNIG, M. F. BUCHROITHNER, G. DOMIK (Vexcell Corp., Boulder, Colo.), and F. W. LEBERL *In* ESA Proceedings of a Workshop on Thematic Applications of SAR Data p 57-64 Dec. 1985
Avail: NTIS HC A06/MF A01

Radargrammetric image analysis is discussed, emphasizing applicability for geology and land snow and ice mapping. The results of these application studies lead to conclusions for radar satellite missions. A method to create digital elevation models from radar stereo-images is outlined. Radar stereo viewability is considered. ESA

N86-28602# National Weather Service, Salt Lake City, Utah.
RADID (RADAR DISPLAY DEVICE) INTERPRETATION GUIDELINES
R. G. PAPPAS Mar. 1986 35 p
(PB86-177680; NOAA-TM-NWS-WR-195) Avail: NTIS HC A03/MF A01 CSCL 04B

Interpretative guidelines for users of radar remoting systems are given. The focus is upon the benefits and inherent limitations of this approach to weather radar data communication and display, and radar interpretation, particularly unique problems in the Western United States. This set of guidelines applies principally to Radar Display Device (RADID) displays but will also be useful for Radar Remote Weather Display System (RRWDS) and commercial color radar remote users. RRWDS consists of two primary components - a digitizer on a radar for generating VIP-level data and a display system which includes a separate processor. RADID is a display device only. RADID can access data from RRWDS and commercial digitizers. RRWDS displays can only access data from RRWDS digitizers. GRA

N86-29181 Technische Univ., Hanover (West Germany).
INVESTIGATIONS OF SYSTEMATIC IMAGE DEFECTS NOT TAKEN INTO ACCOUNT IN AEROTRIANGULATION [UNTERSUCHUNG NICHT BERUECKSICHTIGTER SYSTEMATISCHER BILDFEHLER BEI AEROTRIANGULATIONEN]
K. JACOBSEN *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 65-71 1985 In GERMAN
Avail: Issuing Activity

The procedures for investigation of residual systematic image defects in calculation of the residue mean values and in covariance analysis of block adjustment with or without self-calibration are described. The investigations are performed on a computer system with programs for bundle block adjustment. The differences between the mathematical model of central perspective and film geometry are due to self-calibration of additional parameters in a bundle block adjustment. ESA

N86-29202# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
IMAGE DATA COMPRESSION WITH SPLINE APPROXIMATION AND SEGMENTATION
J. J. RENES and P. J. DEPAGTER 24 Apr. 1984 12 p Presented at Benelux Information Theory Conference, Aalten, Netherlands, 24-25 May 1985
(Contract NIVR-1874)
(NLR-MP-84043-U; B8660422; ETN-86-97505; AD-B098996L)
Avail: NTIS HC A02/MF A01

An image data compression algorithm based on spline approximation and image segmentation is described. Coding of segmented images is outlined. An image produced by a CDC Cyber 170-855 system is shown. ESA

N86-29287*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
ISCCP REDUCED RESOLUTION SATELLITE RADIANCE DATA
W. ROSSOW *In* NASA. Goddard Space Flight Center Proceedings of the Second Pilot Climate Data System Workshop 23 p 1986
Avail: NTIS HC A12/MF A01 CSCL 04B

The International Satellite Cloud Climatology Project (ISCCP) is the first active project of the World Climate Research Program. It is a multinational data collection project focused on collecting a data set that will improve the ability to predict and/or simulate the radiative effects of clouds on climate. For specified cloud parameters, the goals are to archieve values for 3-hour periods over the whole globe for 5 years at 30 km resolution. The task of collecting and processing radiance data from both geosynchronous and polar orbiting satellites began in July 1983. A diagram was shown illustrating the flow of data from the transmitting satellites to the various receiving institutions that handle it. The various stages of processing were then explained in detail, emphasizing

Level B3-normalized, reformatted, reduced raw satellite data. The reduction of data by sampling is an essential step in the flow. By the time the ISCCP data reaches the Global Processing Center at Goddard Institute for Space Studies (GISS), the volume has been reduced by a factor of 1000. The Pilot Climate Data System (PLDS) will provide access to the ISCCP data set. It should prove to be one of the cleanest satellite data sets because it will have been through three filters--that of the operational agency, the Global Processing Center, and the PCDS. The ISCCP data set also includes other correlative data sets delivered in compatible format. Author

N86-30246# Army Engineer Topographic Labs., Fort Belvoir, Va.
IMPLEMENTATION OF MAP-TO-IMAGE-CORRESPONDENCE FOR SYNTHETIC APERTURE RADAR IMAGE ANALYSIS
G. E. LUKES and J. H. RAGGAM 1985 11 p
(AD-A166791; ETL-R-082) Avail: NTIS HC A02/MF A01 CSCL 08B

Radargrammetric techniques, developed to support stereo mensuration and data capture from synthetic aperture radar (SAR) imagery, have been extended to enable map-to-image correspondence for computer-assisted radar image analysis. This mechanism projects existing digital map data into the image space of a new SAR image rigorously accounting for the sensor imaging geometry and terrain configuration. Prerequisites for SAR map-to-image correspondence include (1) an analytical sensor model, (2) recovery of the image acquisition parameters and (3) three-dimensional (3d) digital map data. Analytical radar mapping techniques address the first two issues. Suitable 3d planimetric map data can be compiled directly from stereo photography using analytical plotters or indirectly using elevation data interpolated from digital elevation models to augment conventional two-dimensional map data derived from manuscripts. The approach is illustrated by selected examples from a case study conducted for a test area near Frieburg, West Germany. Here, 3d digital data for transportation and landcover maps were assembled from cartographic sources using plan metric augmentation. GRA

N86-31096# Argonne National Lab., Ill.
DISTRIBUTED GEOGRAPHIC MAPPING USING A CENTRALIZED DISSPLA-BASED MAPPING SYSTEM AND AUTOCAD PC SOFTWARE
M. SNIDER 1986 7 p Presented at the ISSCO Week, New Orleans, La., 10 Mar. 1986
(Contract W-31-109-ENG-38)
(DE86-009184; CONF-860363-2) Avail: NTIS HC A02/MF A01

This paper describes procedures devised for transferring mapped information between a DISSPLA-based geographic mapping system on a centralized computer and an AUTOCAD system on a PC. The centralized mapping system is used as a repository for the large map data bases and to provide capabilities for drawing maps on various output devices including graphics terminals. The map data from any map drawn on the centralized system can be down-loaded to the PC. AUTOCAD is then used to view and edit the map and to add information. Final maps can be drawn using the AUTOCAD software or the AUTOCAD files can be sent to the centralized system to be included in the central data bases. These procedures allow us to take advantage of DISSPLA software, data management facilities, and graphical analytic functions available on the central system, while using the more interactive features available in AUTOCAD for viewing, entering, and editing the data. DOE

N86-31957# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
BRIEF REPORT ON DESIGN AND IMPLEMENTATION OF A DATA BANK CORE SYSTEM [KURZBERICH UEBER ENTWURF UND IMPLEMENTIERUNG EINES DATENBANKKERNSYSTEMS]
H. J. SCHEK *In its* Reports on Cartography and Geodesy. Series 1: Original reports, No. 95 p 135-141 1985 In GERMAN; ENGLISH summary
Avail: NTIS HC A09/MF A01

The applicability of a modular data bank system to digital geoscientific mapping is studied. The data bank components forming the cartography interface basis have a layered architecture. The architecture of a geodatabank core system consists of a catalog manager, a geodata manager, data recovery, a version manager, a complex record manager, a permanent storage unit and a buffer. The modular data bank core system can be used for geoscientific applications. ESA

N86-31961# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THREE-DIMENSIONAL VIEWS OF CARTOGRAMS IN DIGITAL RASTER MODE [SCHEINPLASTISCHE DARSTELLUNGEN VON KARTOGRAMMEN IN DIGITALEN RASTERMODUS]
W. WEBER *In its* Reports on Cartography and Geodesy. Series 1: Original Reports, No. 95 p 175-189 1985 In GERMAN; ENGLISH summary
Avail: NTIS HC A09/MF A01

A digital raster method for producing three-dimensional views of cartograms (choropleth maps) and layered maps of real or thematic mountainous regions (continuous phenomena) is outlined. The three-dimensional view is achieved either by (a) oblique parallel projections of imagined prisms (cylinders) or stepped cones of different height onto a vertical plane taking hidden areas into consideration (hidden-surface removal) or (b) by producing a stereo mate to the parallel projection from (a). System (a) consists in successively moving up the thematic areas or hypsometric layers to their final level while erasing previously generated elements of representation. In this procedure an algorithm operating on a hierarchic basis can save much computing time. The stereo mate according to (b) is formed by repeating the process after slightly changing the given direction of view. ESA

N86-31972# Institut National Polytechnique, Toulouse (France).
INTEGRATION OF THE TOPOGRAPHY IN TELEDETECTION IMAGE DATA PROCESSING Ph.D. Thesis [INTEGRATION DU RELIEF AU TRAITEMENT D'IMAGES DE TELEDETECTION]
C. PROY 1986 188 p In FRENCH
(Contract ATP-84/CNES/1259)
(ETN-86-97652) Avail: NTIS HC A09/MF A01

A method of topographic data acquisition from charts and the analysis of the signal produced by a target in mountainous country are discussed. A simulation procedure was carried out and applied to two Pyrenees regions. In the processed data a better equilibrium of shadow and light is found. It is shown that additional corrections related to aerosols in the atmosphere and surface characteristics are necessary. ESA

N86-31974# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
IMAGE QUALITY CRITERIA WITH EMPHASIS ON CRITERIA FOR REMOTE SENSING IMAGERY
J. C. A. VANDERLUBBE 1 Mar. 1984 94 p Sponsored by Netherlands Agency for Aerospace Programs
(NLR-TR-84040-U; ETN-86-98034) Avail: NTIS HC A05/MF A01

A guide for the measurement of image quality is presented. Common approaches to image quality assessment plus less considered aspects of image quality texture and edge quality are treated. ESA

N86-31977# Wageningen Agricultural Univ. (Netherlands). Dept. of Soil Science and Geology.
INTRODUCTION TO THE INTERPRETATION OF REMOTE SENSING DATA
M. A. MULDERS and D. LEGGER Jan. 1985 27 p
(ETN-86-98067) Avail: NTIS HC A03/MF A01

Aerial photography and other remote sensing techniques; true and false color photography; photointerpretation; map legends; and derivation of soil maps from aerial photointerpretation maps are introduced. ESA

N86-32834# Technische Hogeschool, Delft (Netherlands). Dept. of Electrical Engineering.
MULTIPLE-INPUT SEGMENTATION ALGORITHM FOR SLAR-IMAGERY
J. J. GERBRANDS *In* ESA Microwave Remote Sensing Applied to Vegetation p 35-39 Jan. 1985
Avail: NTIS HC A08/MF A01

An algorithm for automated segmentation of radar imagery of crops is outlined. The procedure is based on a sequential split-and-merge approach which allows for the simultaneous segmentation of multitemporal or multiangular views of the same scene, yielding one segmentation plan. The criteria for merging, splitting or grouping the tentative regions are based on the random scatterer model for natural backgrounds. Results are acceptable, but interactive tuning of the parameters requires considerable experience and run time for a 512 x 256 pixel scene is 50 min. ESA

N86-32848# Dundee Univ. (Scotland).
DATA RECEPTION
P. E. BAYLIS *In* ESA Remote Sensing Applications in Civil Engineering p 15-18 Mar. 1985
Avail: NTIS HC A06/MF A01

Principles of remote sensing satellite image data acquisition, transmission, ground reception, and archiving are summarized. Satellite orbits, Earth scanning techniques, data rates, data frames, codes and bandwidth, radio links, telemetry receivers, data storage, and hard copy production are discussed. ESA

N86-32853# University Coll., London (England).
SPACE CARTOGRAPHY
I. J. DOWMAN *In* ESA Remote Sensing Applications in Civil Engineering p 97-121 Mar. 1985
Avail: NTIS HC A06/MF A01

Means whereby information on a satellite image can be transferred to a map at a suitable scale so that the size or area of the features can be determined; the relative position of the features can be found; information obtained at different times and with different sensors can be compared; and the position of features in a national reference system can be found are discussed. Image rectification is explained using Landsat scanner imagery and radar. Height measurement is shown using space photography and SPOT imagery. ESA

N86-32863*# California Univ., Santa Barbara.
REMOTE SENSING INFORMATION SCIENCES RESEARCH GROUP, SANTA BARBARA INFORMATION SCIENCES RESEARCH GROUP, YEAR 3 Final Report
J. E. ESTES, T. SMITH, and J. L. STAR 5 Jan. 1986 87 p
(Contract NAGW-455)
(NASA-CR-179769; NAS 1.26:179769) Avail: NTIS HC A05/MF A01 CSCL 05B

Research continues to focus on improving the type, quantity, and quality of information which can be derived from remotely sensed data. The focus is on remote sensing and application for the Earth Observing System (Eos) and Space Station, including associated polar and co-orbiting platforms. The remote sensing research activities are being expanded, integrated, and extended into the areas of global science, georeferenced information systems, machine assissted information extraction from image data, and artificial intelligence. The accomplishments in these areas are examined.

N86-32866*# California Univ., Santa Barbara.
PILOT LAND DATA SYSTEM
J. L. STAR and J. E. ESTES *In its* Remote Sensing Information Sciences Research Group, Santa Barbara Information Sciences Research Group, year 3 4 p 5 Jan. 1986
Avail: NTIS HC A05/MF A01 CSCL 05B

The Pilot Land Data System (PLDS) is a multi-institutional effort directed towards solving the data access and management needs of scientists studying the land surface. Some of the hardware and software, which are now available, are reviewed. B.G.

N86-32867*# California Univ., Santa Barbara.
RESEARCH UNDERTAKEN AND PROPOSED DIRECTIONS FOR THE COMING YEAR OF THE INFORMATION SYSTEM RESEARCH GROUP Final Summary Report, 1 May 1985 - 30 Apr. 1986
J. E. ESTES and J. L. STAR *In its* Remote Sensing Information Sciences Research Group, Santa Barbara Information Sciences Research Group, year 3 43 p 5 Jan. 1986
Avail: NTIS HC A05/MF A01 CSCL 05B

The basic understanding of the role of information systems technologies and artificial intelligence techniques in the integration, manipulation, and analysis of remotely sensed data for global scale studies is examined. B.G.

N86-32868# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MCT/INPE LANDSAT SYSTEM: REPORT OF ACTIVITIES FROM SEPTEMBER 1, 1985 TO MARCH 31, 1986
J. L. DEBARROSAGUIRRE and S. DEPAULAPEREIRA Jun. 1986 24 p Presented at the LGSOWG and LDDMWG Meetings, Rome, Italy, Jun. 1986
(INPE-3927-PRE/960) Avail: NTIS HC A02/MF A01

The current status of the Brazilian LANDSAT facilities operated by INPE and the results achieved during the period from September 1, 1985 to March 31, 1986 are described. Author

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A86-40584#
THE POLAR PLATFORM OF THE SPACE STATION - A PERMANENT FACILITY FOR METEOROLOGICAL, OCEANOGRAPHIC, AND LAND OBSERVATIONS
E. L. HEACOCK, D. B. MILLER, and S. R. SCHNEIDER (NOAA, National Environmental Satellite, Data and Information Service, Washington, DC) IN: Space Systems Technology Conference, San Diego, CA, June 9-12, 1986, Technical Papers . New York, American Institute of Aeronautics and Astronautics, 1986, p. 49-59. refs
(AIAA PAPER 86-1174)

The design and capabilities of NASA's Space Station Polar Platform are studied. NOAA's TIROS-N (ATN) spacecraft is the current operational polar-orbiting environmental satellite and it contains sounding, imaging, data collection, and space environment monitoring equipment. The instruments from previous missions for observation of the earth's atmosphere, meteorology, oceans, and land are described. The integration of research instruments, such as the atmospheric and meteorological remote sensing assembly, solar-terrestrial environment sensing assembly, oceanic remote sensing assembly, land remote sensing assembly, data collection and platform location, and satellite-aided search and rescue, into the operational capabilities of the Polar Platform is examined. Current and proposed international contributions to the design and development of the Polar Platform are discussed. I.F.

A86-41286* RCA Advanced Technology Labs., Moorestown, N.J.
SHORTWAVE INFRARED 512 X 2 LINE SENSOR FOR EARTH RESOURCES APPLICATIONS
J. R. TOWER, L. E. PELLON, B. M. MCCARTHY (RCA Advanced Technology Laboratories, Moorestown, NJ), H. ELABD, A. G. MOLDOVAN, W. F. KOSONOCKY (RCA Laboratories, Princeton, NJ), J. E. KALSHOVEN, JR., and D. TOM (NASA, Goddard Space Flight Center, Greenbelt, MD) IEEE Transactions on Electron Devices (ISSN 0018-9383), vol. ED-32, Aug. 1985, p. 1574-1583. refs
(Contract NAS5-27800)

As part of the NASA remote-sensing Multispectral Linear Array Program, an edge-buttable 512 x 2 IRCCD line image sensor with 30-micron Pd2Si Schottky-barrier detectors is developed for operation with passive cooling at 120 K in the 1.1-2.5 micron short infrared band. On-chip CCD multiplexers provide one video output for each 512 detector band. The monolithic silicon line imager performance at a 4-ms optical integration time includes a signal-to-noise ratio of 241 for irradiance of 7.2 microwatts/sq cm at 1.65 microns wavelength, a 5000 dynamic range, a modulation transfer function, greater than 60 percent at the Nyquist frequency, and an 18-milliwatt imager chip total power dissipation. Blemish-free images with three percent nonuniformity under illumination and nonlinearity of 1.25 percent are obtained. A five SWIR imager hybrid focal plane was constructed, demonstrating the feasibility of arrays with only a two-detector loss at each joint. R.R.

A86-41885
STUDY OF MULTIFUNCTION IMAGING AND HIGH-EFFICIENCY DATA PROCESSING SYSTEM FOR REMOTE SENSING
R. KUWANO and R. NAGURA (NEC Corp., Space Development Div., Yokohama, Japan) Institute of Electronics and Communication Engineers of Japan, Transactions, Section E (English) (ISSN 0387-236X), vol. E68, July 1985, p. 421-424.

Multifunction imaging with high-efficiency data compression for remote sensing is achieved by organically combining a simply constructed stereoscopic imaging system and an applied predictive coding. Advancements in the LSI and optical sensor system technique have made possible the satellite employment of a charge coupled device (CCD) electronic scan imaging method. Three signal processing system methods are considered. R.R.

A86-43195*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE EARTH RADIATION BUDGET EXPERIMENT - SCIENCE AND IMPLEMENTATION
B. R. BARKSTROM and G. L. SMITH (NASA, Langley Research Center, Hampton, VA) Reviews of Geophysics (ISSN 8755-1209), vol. 24, May 1986, p. 379-390. refs

This paper gives an overview of the Earth Radiation Budget Experiment. The experiment consists of scanning and nonscanning radiometer packages on three spacecraft. One is a satellite with a 57 deg, inclination orbit which precesses around the earth once every 2 months. Packages are also flown on the sun-synchronous NOAA-F and NOAA-G operational meteorological satellites. The scanning radiometer includes three channels: shortwave, long-wave, and total. The nonscanner package encompasses a pair of wide-field-of-view radiometers and a pair of medium-field-of-view radiometers. Each pair consists of a total and a shortwave radiometer. The scientific importance and objectives of the mission are described, including the need for the three spacecraft and the utility of the complementary types of radiometers. Author

A86-43225* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MULTIPLE INSTRUMENT COVERAGE ANALYSIS
G. M. HORVAT (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Astrodynamics 1985; Proceedings of the Conference, Vail, CO, August 12-15, 1985. Part 1 . San Diego, CA, Univelt, Inc., 1986, p. 455-470. NASA-supported research.
(AAS PAPER 85-432)

In the Space Station era comprehensive investigations of the physical processes of the earth will rely on observations from several types of space-based instruments. Preliminary studies indicate that, due to projected limitations on spacecraft and launch-vehicle capability, these complementary instrument sets may have to be distributed among several spacecraft. The task of analyzing the coincident coverage areas between instruments operating from multiple spacecraft will be complex. Such factors as the instruments' observing capabilities, orbital parameters, and viewing constraints will have to be considered. To aid in this analysis a computer model is being developed. This model has the capability, among others, to compute the coincident coverage areas between two independently orbiting instruments. This paper describes the model, its capabilities, and several sample applications. Author

A86-43228* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
POLAR PLATFORM PAYLOAD REQUIREMENTS IN THE 1990'S
D. VANE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and M. DONOHOE (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: Astrodynamics 1985; Proceedings of the Conference, Vail, CO, August 12-15, 1985. Part 1 . San Diego, CA, Univelt, Inc., 1986, p. 519-528. NASA-sponsored research. refs
(AAS PAPER 85-396)

NASA's Earth Orbiting System (EOS) and NOAA's operational payloads represent two of the major users of the Space Station Polar Platform capabilities. The EOS program will be designed for Shuttle launch, servicing and on-orbit augmentation, while the NOAA's payload will be designed for the operational monitoring of the earth's atmosphere, oceans, and land masses. An overview is given of both the EOS and NOAA platform programs as well as the implied platform requirements. It is concluded that the generic platform design must be capable of operating at altitudes ranging from Shuttle altitudes to NOAA altitudes (approximately 850 km). In addition, it must be able to accommodate approximately 5000 kg of payload mass, provide 5000 W of continuous power and up to 13 kW of peak power for short durations, and store and transmit data at rates up to 300 Mbps. K.K.

A86-43229* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EARTH OBSERVING SYSTEM
R. E. HARTLE (NASA, Goddard Space Flight Center, Greenbelt, MD) and A. TUYAHOV (NASA, Washington, DC) IN: Astrodynamics 1985; Proceedings of the Conference, Vail, CO, August 12-15, 1985. Part 1 . San Diego, CA, Univelt, Inc., 1986, p. 529-550.
(AAS PAPER 85-397)

This paper summarizes concepts for an Earth Observing System (EOS) for the 1990s that will provide the observational capabilities and an information system needed to understand how the earth works as a system. The concept diverges somewhat from past practices in that it considers EOS as an information system, where mission operation, EOS data bases and information about other relevant data sets are tied together by an information network. Three EOS instrument packages were chosen on the basis of synergistic groupings of instruments to make simultaneous observations of selected phenomena over a variety of wavelengths. Author

A86-43699
EXPERIMENTS ON THE MILLIMETER-WAVE REMOTE SENSING OF EARTH RESOURCES USING THE SYNTHETIC-APERTURE PRINCIPLE [EKSPERIMENTY PO DISTANTSIONNOMU ISSLEDOVANIIU PRIRODNYKH RESURSOV V MILLIMETROVOM DIAPAZONE RADIOVOLN S ISPOL'ZOVANIEM PRINTSIPA SINTEZIROVANNOI APERTURY]
V. B. SHTEINSHLEIGER, G. S. MISEZHNIKOV, and A. G. SELSKII Radiotekhnika i Elektronika (ISSN 0033-8494), vol. 31, May 1986, p. 1046, 1047. In Russian. refs

A86-44407
ON THE CURRENT-VOLTAGE RELATIONSHIP OF THE MAGNETOSPHERIC GENERATOR AT INTERMEDIATE SPATIAL SCALES
J. F. VICKREY, R. C. LIVINGSTON, N. B. WALKER (SRI International, Menlo Park, CA), T. A. POTEMRA (Johns Hopkins University, Laurel, MD), R. A. HEELIS (Texas, University, Richardson) et al. Geophysical Research Letters (ISSN 0094-8276), vol. 13, June 1986, p. 495-498. refs
(Contract DNA001-85-C-0062; F49620-83-K-0025; F19628-83-K-0021)

Using data from the drift meter and magnetometer on board the HILAT satellite, fluctuations in high latitude electric and magnetic fields at scale sizes between 80 km and 3 km are examined. A comparison of data from summer and winter allows us to assess the impact of changing ionospheric conductivity on the magnetospheric generator. It is found that, at these scale sizes, the magnetosphere tends to behave as a constant current source that is independent of ionospheric conductivity. This characteristic was noted on both open and closed field lines. The electric field pattern, on the other hand, is much more highly structured in the winter than in the summer. This behavior implies scale size dependent potential drops on closed field lines.
Author

A86-46063
PHOTOGRAMMETRIC CONSTRUCTION SURVEYS USING A 35 MM CAMERA
J. N. HATZOPOULOS (California State University, Fresno) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 137-146. refs

The use of a 35 mm amateur camera for analytical photogrammetry in construction surveys is presented in detail. Special calibration procedures such as based on the finite element method permit precise detection and compensation of most systematic errors of inner orientation. Project design and processing based on a network structured file system is analysed. Experimentation testing indicates an accuracy of one part in the 10,000 of the photographic distance using a 50 mm lens. Author

A86-46068
ACCURACY OF THREE DIMENSIONAL MEASUREMENT USING STEREO SPACE PHOTOGRAPHS TAKEN BY ZEISS METRIC CAMERA OF SPACELAB 1
S. MURAI and R. MATSUOKA (Tokyo, University, Japan) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 177-184.

The accuracies of a pair of stereo space photographs of the Alps taken with the Carl Zeiss RMK A 30/23 Metric Camera from Spacelab 1 were determined with and without self-calibration using 36 ground control points measured both on the second generation photographs and on 1:50,000 topographic maps. Results obtained with and without 39 pass points selected and measured on the stereo photographs, show bundle adjustment to be a more suitable orientation method than single photograph orientation. The absolute accuracy was found to be poor, while the relative accuracy was suffficient, and the planimetric accuracy of + or - 29.8 m, and the height accuracy of + or 37.3 m, obtained with self-calibration, were in agreement with previous results for the first generation films. R.R.

A86-46086
ULTRA-LIGHT RECONNAISSANCE, ANOTHER TOOL
J. W. WALKER (Brigham Young University, Provo, UT) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 371-380.

Ultralight aircraft and controlled 2 1/4 and 35 mm cameras suspended in differential sponge mounts are found to reduce camera vibration, and make possible the production of sharp eight and 12 diameter large-scale low-altitude aerial photographs. Advantages of the technique include the reduction of blur from low flying speeds and the ability to fly beneath the temperature inversion layers. Results of recent test are reported. R.R.

A86-46110
A VIDEO CAMERA SYSTEM FOR MULTISPECTRAL SENSING
D. KING, J. VLCEK, and S. SHEMILT (Toronto, University, Canada) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 2 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 661-665. NSERC-sponsored research. refs

A brief description is given of a 4-band video data acquisition system designed to operate with one recorder in narrow spectral bands in the visible and near IR spectrum. It is designed to utilize four black and white solid-state cameras, a custom-built multiplexer, one 3/4 or 1/2 inch tape recorder, and a small black and white monitor. The acquired imagery can be played back as is in rapid-band sequencing for viewing or the individual bands can be displayed in 'freeze frame' mode for digitization and computer image processing. The first flight using ultricon tube (f = 8 mm) cameras at three diferent altitudes was conducted in October 1984 north of Toronto. The results given here describe digital analysis at 256 x 256 pixel resolution of two sets of 4-band video taken with 40 nm bandpass filters centered at 550 nm, 650 nm, 700 nm, and 800 nm wavelengths, one set taken at 305 m, and the other at 610 m altitude. Author

A86-46480* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
COMPARISON OF STRATOSPHERIC AIR PARCEL TRAJECTORIES CALCULATED FROM SSU AND LIMS SATELLITE DATA
J. AUSTIN (NASA, Langley Research Center, Hampton, VA) Journal of Geophysical Research (ISSN 0148-0227), vol. 91, June 20, 1986, p. 7837-7851. refs
(Contract NCC1-86)

Midstratospheric trajectories for February and March 1979 are calculated using geopotential analyses derived from limb infrared monitor of the stratosphere data. These trajectories are compared with the corresponding results using stratospheric sounding unit data. The trajectories are quasi-isentropic in that a radiation scheme is used to simply cross-isentrope flow. The results show that in disturbed conditions, quantitative agreement the trajectories, that is, within 25 great circle degrees (GCD) (one GCD about 110 km) may be valid for only 3 or 4 days, whereas during quiescent periods, quantitative agreement may last up to 10 days. By comparing trajectories calculated with different data some insight can be gained as to errors due to vertical resolution and horizontal resolution (due to infrequent sampling) in the analyzed geopotential height fields. For the disturbed trajectories described in this paper the horizontal resolution of the data was more important than vertical resolution; however, for the quiescent trajectories, which could be calculated accurately for a longer duration because of the absence of appreciable transients, the vertical resolution of the data was found to be more important than the horizontal resolution. It is speculated that these characteristics are also applicable to trajectories calculated during disturbed and quiescent periods in general. A review of some recently published trajectories shows that the qualitative conclusions of such works remains unaffected when the calculations are repeated using different data. Author

A86-46597
COMPARISON OF GEOS-3 AND SEASAT ALTIMETER RESOLUTION CAPABILITIES
K. M. MARKS and R. V. SAILOR (Analytic Sciences Corp., Reading, MA) Geophysical Research Letters (ISSN 0094-8276), vol. 13, July 1986, p. 697-700. refs

A comparison is made between GEOS-3 and Seasat altimeter data with regard to noise power spectral density (PSD), derived geoid PSD, and short wavelength resolution. At wavelengths greater than 450 km, the noise PSDs for GEOS-3 and Seasat are essentially the same, and are attributed to mesoscale oceanographic effects. At shorter wavelengths, the noise spectra diverge because of the higher GEOS-3 instrument noise. The average along-track geoid PSDs are nearly identical between wavelengths of 4500 and 72 km. The spectral coherence between repeat tracks shows that the short wavelength resolution of Seasat data is about 32 km, and for GEOS-3 it is about 60 km. Author

A86-46722* Arizona Univ., Tucson.
OPERATIONAL MTF FOR LANDSAT THEMATIC MAPPER
R. SCHOWENGERDT, C. ARCHWAMETY (Arizona, University, Tucson), and R. C. WRIGLEY (NASA, Ames Research Center, Moffett Field, CA) IN: Image quality: An overview; Proceedings of the Meeting, Arlington, VA, April 9, 10, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 110-118. refs
(Contract NCC2-234)

The Landsat Thematic Mapper (TM) represents significant improvements in spatial, spectral, and radiometric resolution over the older Multispectral Scanner System (MSS). For the last three years, NASA has conducted the Landsat Image Data Quality Analysis (LIDQA) program to quantify the performance of the TM on the Landsat-4 and 5 spacecraft. As part of this program, analysis of the TM imagery to extract the overall system modulation transfer function (MTF) has been performed. In this paper, the San Mateo Bridge in San Francisco is described as a target for calculation of the line spread function and MTF. The analysis of two TM scenes, one from 12/31/82 and one from 8/12/83, yielded effective-instantaneous-field-of-views (EIFOVs) of 40.8 meters and 48.6 meters, respectively. These values are compared with the 33.8 meter EIFOV predicted by component modelling of the TM sensor, and the differences discussed. Author

A86-46726
SENSOR DESIGN USING COMPUTER TOOLS II; PROCEEDINGS OF THE MEETING, ARLINGTON, VA, APRIL 11, 12, 1985
J. A. JAMIESON, ED. (Jamieson Science and Engineering, Inc., Washington, DC) Meeting sponsored by SPIE. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 550), 1985, 139 p. For individual items see A86-46727 to A86-46736.
(SPIE-550)

The present conference discusses topics in the computerized simulation of electronic sensor performance, subsystem design and testing, quality design and verification, and the relationship of optical engineering professionals to their computer design tools. Attention is given to advances in Landsat image processing and mapping, the modeling of linear scan electrooptic sensors, computer simulation-based design of multispectral scanners, laser imager computer simulation, and precise space telescope pointing by means of a quadrant detector. Also discussed are an adaptive telescope design using computer tools, a focal plane products data base, the use of personal computers in optical design, and the computer simulation of focal plane array performance using coupled ray trace and carrier diffusion models. O.C.

A86-46729
DESIGN OF MULTISPECTRAL SCANNERS USING COMPUTER SIMULATION
F. J. THOMSON (Michigan, Environmental Research Institute, Ann Arbor) IN: Sensor design using computer tools II; Proceedings of the Meeting, Arlington, VA, April 11, 12, 1985 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1985, p. 30-36. refs

Attention is given to the two roles that computer simulation can play in the design of multispectral scanners. Computer models of terrain, illumination geometry, atmospheric effects, and exploitation algorithms can furnish insights into the tradeoffs between important system variables. In addition, simulations can be used to evaluate system performance on the basis of selectively degraded empirical data sets. The combination of the two approaches can be used to furnish support and confirmation for the modeled results, and may also provide pictorial evidence supporting a particular sensor design. O.C.

A86-49441
ON THE MOTION OF SPRAY DROPS IN THE WAKE OF AN AGRICULTURAL AIRCRAFT
M. ATIAS and D. WEIHS (Technion - Israel Institute of Technology, Haifa) Atomisation and Spray Technology (ISSN 0266-3481), vol. 1, 1985, p. 21-36. refs

This paper summarizes results obtained using a mathematical model developed in order to investigate the behaviour of an agricultural airplane wake near the ground and the motion of sprays under the influence of this wake. The model describes the flow field generated following the motion of a pair of concentrated wing-tip vortices near the ground and the motion of evaporating drops in this flow field. As examples for use of this model, the distribution of different initial drop size sprays was investigated as well as the influence of the relative humidity and of changing initial velocity of the drops. Author

A86-49465
METEOSAT - ON STATION COME RAIN, COME SHINE
G. LEBEGUE Revue Aerospatiale (ISSN 0065-3780), July-Aug. 1986, p. 28-33. In English and French.

Meteosat is stationed in GEO and provides data for both public weather forecasts and for an international meteorological datebase. The 2.1 m diam, 3.2 m tall spacecraft carries sensors for the 0.5-0.9 micron (visible), 10.5-12.5 microns (thermal IR), and 5.7-7.1 microns (water vapor) bands which provide signals for real-time transmissions. The sensors are housed in a 40 cm aperture Richey-Chretien telescope and deliver images in the form of 2500 scan lines obtained every 30 min. The Meteosat program was initiated in 1973 by ESA as an eight-nation effort. Although the satellite is spin-stabilized, transmission and reception are handled completely with an electronically despun, entirely static antenna. The products of the satellite data comprise preprocessed images, wind vectors, sea surface temperature, cloud cover at different altitudes, cloud altitudes, humidity and local radiant flux and emissivity. M.S.K.

A86-49604#
THE TRANSPORTABLE REMOTE SENSING STATION TRAFES AND ITS EMPLOYMENT POSSIBILITIES [DIE TRANSPORTABLE FERNERKUNDUNGS-STATION TRAFES UND IHRE EINSATZMOEGLICHEITEN]
R. KATZENBEISSER (Dornier System GmbH, Friedrichshafen, West Germany) BMFT, Statusseminar ueber die Nutzung von Fernerkundungsdaten in der Bundesrepublic Deutschland, Garmisch-Partenkirchen, West Germany, Jan. 20-22, 1986, Paper. 10 p. In German.

It had been found that the coverage provided by stationary installations was not satisfactory in cases involving remote sensing studies conducted by the West German institute BGR, which is concerned with investigations related to the earth sciences and the location of raw materials. This situation led to the design of a transportable S-band station (Landsat MSS) by a German aerospace company in 1979. Considerations related to the

ata provided by the Environmental Research Satellites
ed the development of the concept of Trafes, which
modification of the first design of a transportable
ng station. The requirements which Trafes has to
iscussed. The possibility of a worldwide employment
arbitrary locations is important, taking into account
l regions and Antarctica. Employment possibilities are
esearch, development aid, and commercial projects.
G.R.

ATIONARY SATELLITE SOUNDING SYSTEM ILITIES FOR THE NATIONAL OCEANIC AND SPHERIC ADMINISTRATION OPERATIONS

HOWER, R. GIRD, and L. LAURITSON (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) IN: International Conference on Interactive Information and Processing Systems for Meteorology, Oceanography, and Hydrology, 2nd, Miami, FL, January 14-17, 1986, Preprints. Boston, MA, American Meteorological Society, 1986, p. 332-336. refs

The data processing and distribution system developed by NOAA to facilitate utilization of GOES VISSR Atmospheric Sounder (VAS) remote-sensing data by U.S. National Weather Service centers is characterized and illustrated with block diagrams. The VAS Data Utilization Centers (VDUCs) being installed are real-time interactive processing and display systems permitting rapid integration of VAS data with weather information from other sources. Each VDUC employs a configuration comprising a central processor with 16-Mb main memory, a 7.5-Gb disk-storage unit, eight interactive work stations, three programmer terminals, and additional peripherals. The hardware and file-management strategy of VDUC are described, and the types of VAS products needed for severe-storm, hurricane, and winter-storm forecasting are listed. The possible use of VAS data for wind determinations is discussed. T.K.

A86-50274* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
HIGH SPECTRAL RESOLUTION REMOTE SENSING OF THE EARTH

G. VANE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Sensors (ISSN 0746-9462), Dec. 1985, 7 p. NASA-supported research. refs

Early results of a major advance in remote sensing called imaging spectrometry (IS), the simultaneous acquisition of images in many narrow contiguous spectral bands throughout the visible and solar-reflected infrared portions of the spectrum, are discussed. The motivation for IS is reviewed, and the performance of IS is examined, describing prototype sensors. The analysis of IS data is addressed, including the problem of visual interaction with hyperspectral images and their statistical properties, and the effect of data dimensionality on multispectral scene classification. A test of the capability of imaging spectrometry to identify minerals is reported. C. D.

N86-28499*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SHUTTLE IMAGING RADAR VIEWS THE EARTH FROM CHALLENGER: THE SIR-B EXPERIMENT

J. P. FORD, J. B. CIMINO, B. HOLT, and M. R. RUZEK 15 Mar. 1986 146 p
(Contract NAS7-918)
(NASA-CR-177158; JPL-PUB-86-10; NAS 1.26:177158) Avail: NTIS HC A07/MF A01 CSCL 08B

In October 1984, SIR-B obtained digital image data of about 6.5 million km2 of the Earth's surface. The coverage is mostly of selected experimental test sites located between latitudes 60 deg north and 60 deg south. Programmed adjustments made to the look angle of the steerable radar antenna and to the flight attitude of the shuttle during the mission permitted collection of multiple-incidence-angle coverage or extended mapping coverage as required for the experiments. The SIR-B images included here are representative of the coverage obtained for scientific studies in geology, cartography, hydrology, vegetation cover, and oceanography. The relations between radar backscatter and incidence angle for discriminating various types of surfaces, and the use of multiple-incidence-angle SIR-B images for stereo measurement and viewing, are illustrated with examples. Interpretation of the images is facilitated by corresponding images or photographs obtained by different sensors or by sketch maps or diagrams. Author

N86-29175 Deutsche Geodaetische Kommission, Munich (West Germany).
CAMERA CALIBRATION IN PHOTOGRAMMETRIC PRACTICE [KAMMERKALIBRIERUNG IN DER PHOTOGRAMMETRISCHEN PRAXIS]

G. KUPFER, ed. and W. WESTER-EBBINGHAUS, ed. 1985 181 p In GERMAN Conf. held in Bonn, 21-22 Feb. 1985
(SER-B-275; ISBN-3-7696-8562-8; ISSN-0065-5317; ESA-86-96925) Avail: Issuing Activity

Research on calibration of air cameras for precision photogrammetry is reviewed. Laboratory and field calibrations are compared. Applications of photogrammetric systems are presented (in coal mining, car industry robots, monitoring of churches in subsidence areas).

ESA

N86-29176 Bonn Univ. (West Germany).
CAMERA CALIBRATION IN PHOTOGRAMMETRIC PRACTICE, INTRODUCTION [KAMMER-KALIBRIERUNG IN DER PHOTOGRAMMETRISCHEN PRAXIS - EINE EINFUEHRUNG]

G. KUPFER *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 7-10 1985 In GERMAN
Avail: Issuing Activity

Laboratory, stellar and ground calibrations are developed to assess accuracy and reliability of photographic systems and their components. Calibration of photographic systems is based on analytic assessment systems and software and calibration of aerial images in close-range photogrammetry. Algorithms to obtain simultaneous calibration of photographic systems and aerial images are developed. System reproduction, film printing plate flatness, filter glass plane parallelism, and definition of image plane or image coordinate system are calibrated in laboratory with a visual procedure using goniometers, theodolites and lens/mirror systems. Stellar calibration with or without filters is influenced by emulsion sensitivity. Ground calibration is based on image measurement and geodetic observations. Economical application of the different procedures is assessed. ESA

N86-29177 Zeiss (Carl), Oberkochen (West Germany).
ON ACCURACY OF LABORATORY CALIBRATIONS AND ON AERIAL CAMERA STABILITY WITH THE EXAMPLE OF SPACELAB RMK A 30/23 [UEBER DIE GENAUIGKEIT VON LABORKALIBRIERUNGEN UND DIE STABILITAET VON LUFTBILDKAMMERN AM BEISPIEL DER SPACELAB-RMK A 30/23]

H. K. MEIER *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 11-14 1985 In GERMAN
Avail: Issuing Activity

The RMK A 30/23 camera was selected for the Metric Camera experiment on the first Spacelab mission devised to determine laboratory calibration accuracy and RMK stability, based on 1000 high resolution color and black and white measurement images and to determine the applicability of photogrammetric snap shots in 1:100,000 or 1:50,000-scale mapping. Comparison of the calibrations performed in various laboratories with different calibration procedures and instruments shows good homogeneity. Calibrations of RMK A 30/23 before and after Spacelab mission show good geometric quality. The RMK A 30/23 is further improved with forward motion compensation to attain 2x to 10x basic resolution with equal geometric quality. ESA

N86-29180 Ecole Polytechnique Federale de Lausanne (Switzerland).
COMPARATIVE ANALYSIS OF CAMERAS [VERGLEICHENDE ANALYSE VON AUFNAMEKAMMERN]
O. KOELBL *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 48-64 1985 In GERMAN
Avail: Issuing Activity

Image quality and metric precision for Zeiss Jena LMK with automatic forward motion compensation, Wild Heerbrugg RC 10A, and Zeiss Oberbrocken RMK are analyzed. Image quality is analyzed using modulation transmission function under flight conditions and metric precision with aerotriangulation of a photogrammetric block (6 lines: 7 images). The test field and the photographic mission are described. Field measurements show better image quality than laboratory measurements. Comparison of the results on Panatomic-X Film and Plus-X Film show little enhancement of measurement accuracy with increased resolution capacity. ESA

N86-29195 Technische Univ., Hanover (West Germany).
CALIBRATION OF A DIGITAL CAMERA SYSTEM [KALIBRIERUNG EINES DIGITALEN AUFNAHMESYSTEMS]
T. LUHMANN *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 165-173 1985 In GERMAN
Avail: Issuing Activity

Calibration of a CCD surface sensor and of a photogrammetric reproduction system is presented. A digital system including a camera with an 80 mm lens, a 120 mm lens for reproduction in the sensor surface, and a CCD camera without lens is calibrated. Analog-to-digital conversion, coordinate measurement, and data transfer are performed. Images are subjected to simultaneous calibration to determine the 3-D target point coordinates of the test field and the internal and external orientation parameters after bundle adjustment. Without previous image processing, accuracy is 10 to 20 micron. The CCD surface sensors can be applied in photogrammetric systems and as sensors for large-scale analog-to-digital conversion of measuring images. Digital image production and processing can be applied in photogrammetric point determination. ESA

N86-29196 Technische Hochschule, Darmstadt (West Germany).
PHOTOGRAMMETRIC PROPERTIES OF FILM CAMERA LINHOF AERO TECHNICA 45 AFTER SIMPLE TRANSFORMATIONS [PHOTOGRAMMETRISCHE EIGNESCHAFTEN DER FILMKAMERA LINHOF AERO TECHNIKA 45 NACH EINFACHEN UMBAUTEN]
G. BERG, A. BERGMANN, and B. WROBEL *In* Deutsche Geodaetische Kommission Camera Calibration in Photogrammetric Practice p 174-181 1985 In GERMAN
Avail: Issuing Activity

Photogrammetric properties and utility for aerial surveys of a 9 x 12 camera were assessed. Flatness of the image surface and camera internal orientation are studied. The camera was modified to meet photogrammetric requirements. Images are processed using bundle adjustment for field calibration of the camera. The maximum deviation is 2 mm for the spatial coordinates. According to the price-to-performance ratio, the camera is a feasible alternative to other cameras. Further investigations to obtain more accuracy through better image flatness are recommended. ESA

N86-29282*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCEEDINGS OF THE SECOND PILOT CLIMATE DATA SYSTEM WORKSHOP
1986 268 p Workshop held in Greenbelt, Md., 29-30 Jan. 1986
(NASA-CP-2430; NAS 1.55:2430) Avail: NTIS HC A12/MF A01 CSCL 04B

The proceedings of the workshop held on January 29 and 30, 1986 are discussed. Data management, satellite radiance data, clouds, ultraviolet flux variations in the upper atmos during El Nino events, and the use of optical disk the topics covered.

N86-29487# General Accounting Office, Washing Resources Community and Economic Development Div
WEATHER SATELLITES: USER VIEWS C CONSEQUENCES OF ELIMINATING A CIVILIAN ORBITER
Mar. 1986 62 p
(PB86-180254; GAO/RCED-86-111; B-222140) Avail: NT A04/MF A01 CSCL 04B

It was found that the polar orbiters are used by NO weather forecasting, search and rescue operations, and purposes; by NASA for climate research; by DOD as a supplem and backup to its own weather satellites; and by countries worldwide for weather forecasting and environmental data collection. Some users in NOAA and DOD reported that the elimination of one of NOAA's polar-orbiting weather satellites would harm their programs, but most users said that they would continue their programs with one satellite. All user's, however, said that the second satellite was important as a backup to the first and that the loss of all service would have serious consequences. GRA

N86-30124*# Princeton Univ. Observatory, N. J.
EVALUATION OF SELECTED DETECTOR ARRAYS FOR SPACE APPLICATIONS Final Report, 1 Jun. 1982 - 30 Jun. 1985
J. L. LOWRANCE Jun. 1985 31 p
(Contract NAG5-241)
(NASA-CR-176979; NAS 1.26:176979) Avail: NTIS HC A03/MF A01 CSCL 14B

The development of a high density Schottky barrier Infrared Charged Coupled Device (IRCCD) type image sensor for earth observation was initiated. A dual band 512 pixel linear array was developed, which was capable of being butted end to end to make an arbitrarily long linear array. Measurement made on palladium silicide IRCCDs that were two-dimensional 63 x 32 pixel arrays were summarized. The test data on a 512 pixel linear array is also summarized. B.G.

N86-30249# Netherlands Agency for Aerospace Programs, Delft.
REPORT ON THE PHASE A STUDY OF A JOINT INDONESIAN-NETHERLANDS TROPICAL EARTH RESOURCES SATELLITE (TERS) PROGRAM
M. IRSYAM, ed. and A. P. HOEKE, ed. Feb. 1985 45 p
(JTERS-84-10; ETN-86-97498) Avail: NTIS HC A03/MF A01

The baseline of the Tropical Earth Resources Satellite (TERS) System was established. Using the possibilities of the high true equatorial orbit, 4 observation opportunities per day, a coverage area of at least 10 deg N to 10 deg S latitude, and the selective viewing capability combined with a cloud sensor, the TERS concept is an appropriate system to complement and to compete with the conventional systems with optical instruments and planned radar systems. User requirements for TERS as a monitoring device for Indonesia are specified. Results of a cost/benefit assessment indicate expected benefits which for Indonesia alone may justify the investment. The political/legal aspects were assessed and a public information plan was drafted. ESA

N86-31085# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE X-SAR SCIENCE TEAM
H. OETTL *In its* The X-SAR Science Plan p 7-10 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

The SIR-C X-band SAR mission for remote sensing of weather, oceans, ice, vegetation, pollution, and geological features is introduced. Mission objectives include comparison of different polarizations and investigations of frequencies for SAR applications. ESA

N86-31087# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
RADAR TECHNOLOGY
F. HEEL and D. SOLIMINI *In its* The X-SAR Science Plan p 27-41 Nov. 1985
Avail: NTIS HC A08/MF A01; DFVLR, Cologne DM 32

Atmospheric and ionospheric effects on SAR signal performance in the frequency range of the X-SAR/SIR-C mission are reviewed. Mission accompanying ground truth activities and calibration facilities are discussed. Processor capability to achieve improved SAR image quality is assessed. ESA

N86-31094*# National Aeronautics and Space Administration, Washington, D.C.
EARTH OBSERVING SYSTEM. DATA AND INFORMATION SYSTEM. VOLUME 2A: REPORT OF THE EOS DATA PANEL
1986 63 p
(NASA-TM-87777; NAS 1.15:87777) Avail: NTIS HC A04/MF A01 CSCL 05B

The purpose of this report is to provide NASA with a rationale and recommendations for planning, implementing, and operating an Earth Observing System data and information system that can evolve to meet the Earth Observing System's needs in the 1990s. The Earth Observing System (Eos), defined by the Eos Science and Mission Requirements Working Group, consists of a suite of instruments in low Earth orbit acquiring measurements of the Earth's atmosphere, surface, and interior; an information system to support scientific research; and a vigorous program of scientific research, stressing study of global-scale processes that shape and influence the Earth as a system. The Eos data and information system is conceived as a complete research information system that would transcend the traditional mission data system, and include additional capabilties such as maintaining long-term, time-series data bases and providing access by Eos researchers to relevant non-Eos data. The Working Group recommends that the Eos data and information system be initiated now, with existing data, and that the system evolve into one that can meet the intensive research and data needs that will exist when Eos spacecraft are returning data in the 1990s. Author

N86-31097# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
PHASE A TECHNICAL STUDY SUMMARY REPORT FOR A TROPICAL EARTH RESOURCES SATELLITE (TERS)
1984 116 p Prepared in cooperation with National Aerospace Lab., Amsterdam, Netherlands, Signaal, Utrecht State Univ., Netherlands, and Technische Physische Dienst TNO-TH, Delft, Netherlands
(JTERS-84-07; ETN-86-97496) Avail: NTIS HC A06/MF A01

The high (1681 km) equatorial orbit of the Tropical Earth Resources Satellite with its particle radiation hazards (as compared to an alternative low near equatorial orbit with operational complications) was studied. Selective viewing by cloud sensor and cross track instrument pointing was analyzed. The consequences of the high spectral resolution (20 m color, 10 m panchromatic) for the designs of instrument, satellite systems, data handling, and ground data processing were assessed. Ground observations at different solar illumination angles and view angles were simulated. A satellite configuration concept was defined. The concept seems feasible, although it is technologically challenging. Radiation aspects require a careful development and may influence the design of instrument and spacecraft systems. ESA

N86-31098# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
PROPOSAL TO NIVR FOR A SYSTEM DEFINITION STUDY OF A TROPICAL EARTH RESOURCES SATELLITE (TERS)
1984 158 p Prepared in cooperation with National Aerospace Lab., Amsterdam, Netherlands, Signaal, Utrecht State Univ., Netherlands, and Technische Physische Dienst TNO-TH, Delft, Netherlands
(NTERS-84-11; ETN-86-97497) Avail: NTIS HC A08/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 into the feasibility aspects of such a project. The technical definition includes system and subsystem design specifications, and definition of the products to be supplied to the users. The execution of the project is defined up to and including the in-orbit checkout. ESA

N86-31126*# Geological Survey, Denver, Colo.
A REGIONAL 17-18 MA THERMAL EVENT IN SOUTHWESTERN ARIZONA
W. E. BROOKS *In* Lunar and Planetary Inst. Papers Presented to the Conference on Heat and Detachment in Crustal Extension on Continents and Planets p 18-21 1985
Avail: NTIS HC A08/MF A01 CSCL 08G

A regional thermal event in southwestern Arizona 17 to 18 Ma ago is suggested by discordances between fission track (FT) and K-Ar dates in Tertiary volcanic and sedimentary rocks, by the abundance of primary hydrothermal orthoclase in quenched volcanic rocks, and by the concentration of Mn, Ba, Cu, Ag, and Au deposits near detachment faults. A high condont alteration index (CAI) of 3 to 7 is found in Paleozoic rocks of southwestern Arizona. The high CAI may have been caused by this mid-Tertiary thermal event. Resetting of temperature-sensitive TF dates (2) 17 to 18 Ma with respect to K-Ar dates of 24 and 20 Ma has occurred in upper plate volcanic rocks at the Harcuvar and Picacho Peak detachments. Discordances between FT and K-Ar dates are most pronounced at detachment faults. However, on a regional scale Ft dates from volcanic and sedimentary rocks approach 17 to 18 Ma event in areas away from known detachment faults. Effects of detachment faulting on the K-Ar system suggest that dates of correlative rocks will be younger as the detachment fault is approached. Author

N86-31633*# National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH NOAA-G WEATHER SATELLITE
J. KUKOWSKI, B. LITTIN, and J. ELLIOTT 19 Aug. 1986 11 p
(NASA-TM-89245; NASA-NEWS-RELEASE-86-115; P86-10175; NAS 1.15:89245) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, BWI Airport, Md. 21240 CSCL 22B

A meteorological weather satellite, NOAA-G, is scheduled to be launched from Vandenberg Air Force Base, Calif., aboard a U.S. Air Force Atlas-E launch vehicle, no earlier than 11:47 a.m., EDT, August 30. The satellite, a third-generation operational weather satellite, will be placed into a near-polar orbit at an altitude of 518 miles. The spacecraft, NOAA-10 in orbit, will circle the globe 14 times each day observing a different position of the Earth's surface on each revolution as the Earth turns beneath the spacecraft's orbit. It will become the morning satellite, joining NOAA-9, in NOAA's two polar orbit satellite system. The satellite's orbital period will be approximately 101 minutes. The orbit is planned to be Sun synchronous so that the spacecraft will cross the equator at approximately 7:30 a.m. (southbound) and 7.30 p.m. (northbound), local solar time. Like other NOAA satellites, NOAA-G will collect meteorological data and transmit the information directly to users around the world to enhance local weather analysis and forecasting. In addition to assisting in local weather forecasting, the satellite data are used for hurricane

tracking and warning, and for agricultural, commercial fishing, forestry, maritime and other industrial uses. Author

N86-31944*# Rochester Inst. of Tech., N. Y. School of Photographic Arts and Sciences.
LANDSAT 4 BAND 6 DATA EVALUATION Quarterly Report
15 Sep. 1984 6 p
(Contract NAS5-27323)
(NASA-CR-177173; NAS 1.26:177173; QR-8) Avail: NTIS HC A02/MF A01 CSCL 05B

The objectives of this investigation are to evaluate and monitor the radiometric integrity of the LANDSAT-D Thematic Mapper (TM) thermal infrared channel (Band 6) data to develop improved radiometric preprocessing calibration techniques for removal of atmospheric effects. Efforts this period have concentrated on underflight data collection. Two successful flights were made on September 18 and October 6. The radiosonde data for these flights have been obtained. Author

N86-31945*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LANDSAT-4 AND LANDSAT-5 MULTISPECTRAL SCANNER COHERENT NOISE CHARACTERIZATION AND REMOVAL
J. C. TILTON and W. L. ALFORD, principal investigators (Defense Mapping Agency, Washington, D.C.) May 1986 46 p Original contains color illustrations
(NASA-TP-2595; REPT-86B0040; NAS 1.60:2595) Avail: NTIS HC A03/MF A01 CSCL 14B

A technique for characterizing the coherent noise found in LANDSAT-4 and LANDSAT-5 multispectral scanner (MSS) data is described along with a companion technique for filtering out the coherent noise. The techniques are demonstrated on LANDSAT-4 and LANDSAT-5 MSS data sets, and explanations of the noise pattern are suggested. A cookbook procedure of characterizing and filtering the coherent noise using special NASA/Goddard IDIMS functions is included. Also presented are analysis results from the retrofitted LANDSAT-5 MSS sensor which shows that the coherent noise has been substantially reduced. Author

N86-31970# Begeleidingscommissie Remote Sensing, Delft (Netherlands).
ACTIVITIES REPORT IN REMOTE SENSING SUPERVISION Annual Report, 1983 [JAARVERSLAG 1983]
1984 52 p In DUTCH
(ETN-86-97383) Avail: NTIS HC A04/MF A01

Remote sensing application to sea surface investigations (ship microwave radar systems for wave observation, spectrophotometry of surface water, and oil detection using multispectral scanners, laser fluoro sensors, and high frequency radar techniques); agriculture and nature protection (field spectrometer measurements to determine biomass, thermal images and false color photographs to determine the hydrological soil condition, detection of crop damage and illness caused by pollution and/or heat, and cadastral mapping); and town and country planning are discussed. Processing of remote sensing data is considered. ESA

N86-32006*# Little (Arthur D.), Inc., Cambridge, Mass.
SPACE SYSTEMS REQUIREMENTS DEFINITION
In its System Study of the Utilization of Space for Carbon Dioxide Research p 112 Oct. 1985
Avail: NTIS HC A23/MF A01 CSCL 04B

The compilation of Scientific Data Requirements (SDRs) were based on discussions with a representative cross section of the scientific community and a selected survey of the extensive literature dealing with the measurement of CO2-induced climatic changes. This approach resulted in a baseline set of SDRs to determine what could be accomplished with space-based sensors. Twenty-three SDRs emerged as the basis for the investigation of space systems. B.G.

N86-32014# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF THE ATMOSPHERIC AEROSOL DISTRIBUTION BY MULTI-CHANNEL REMOTE SENSING TECHNIQUES M.S. Thesis
S. R. BULFINCH Mar. 1986 88 p
(AD-A167885) Avail: NTIS HC A05/MF A01 CSCL 04A

A simple image processing technique applied to channel 1 and channel 2 of the NOAA AVHRR sensor may be used to discern variations in aerosol particle size distribution. Ratios of the channel 1 albedo to the channel 2 albedo are calculated and displayed as an image. High ratio values are shown to indicate increased levels of submicron aerosols, while low ratio values indicate increased levels of supermicron aerosols. Horizontal variations in aerosol distributions may be observed directly by noting variations in ratio values, and vertical distributions may be inferred through the application of appropriate regional models of aerosol transport. A model of offshore advection of urban particles within the marine boundary layer is presented. Interpreting ratio values in light of this model, the offshore transport of urban aerosol particles is observed in AVHRR imagery of Sourthern California during the period 17-25 October 1984. Author (GRA)

N86-32276# Georgia Inst. of Tech., Atlanta.
REAL TIME MATH MODEL FOR INFRARED Final Technical Report, Jun. 1983 - Sep. 1985
D. R. HERTLING and R. C. REARICK Jan. 1986 59 p
(Contract F30602-81-C-0185)
(AD-A168133; GIT/E4857A-85; RADC-TR-85-247) Avail: NTIS HC A04/MF A01 CSCL 17E

The main objective of this work was to access the feasibility of developing a real time math model which could be used to process infrared imagery with current real-time stereo compilation equipment. A survey of existing infrared sensors, imaging sensors, photogrammetric techniques and procedures for stereo viewing and plotting are pesented. A flexible system model was developed which can be adapted to various types of infrared imaging systems. Investigations revealed that the photogrammetric techniques accurate enough for mapping and targeting applications require accurate flight dynamics data which must be simultaneously recorded with the imagery. It is theoretically possible to process certain images which contain known or analytically solvable ground information; however, such procedures would depend upon the image itself and would not be amenable to evolving into a generalized math model. GRA

N86-32819# Danish Meteorological Inst., Copenhagen.
OPERATIONAL EXPERIENCES WITH THE ARGOS SYSTEM IN GREENLAND
F. JENSEN *In* CNES The 10th ARGOS Users Conference 14 p 1985
Avail: NTIS HC A14/MF A01

The ARGOS system was deployed as a primary communication system for automatic weather stations distributed along the coast of Greenland. Operational experience with ARGOS is good and, for the northernmost stations, this system is considered to provide the best and the most simple means of data communication. Since Greenland is located in the polar region the ARGOS system gives nearly consecutive coverage as regards synoptic measurements if the system comprises two satellites with orbits reasonably well separated. ESA

N86-32822# Norwegian Defence Research Establishment, Kjeller.
DESCRIPTION OF THE NORWEGIAN DOPPLER POSITIONING PROGRAM
P. H. ANDERSEN, K. AKSNES, and E. HAUGEN (Royal Norwegian Council for Scientific and Industrial Research, Oslo) *In* CNES The 10th ARGOS Users Conference 10 p 1985
Avail: NTIS HC A14/MF A01

A satellite Doppler positioning program was developed. The sequential version of the program updates the satellite parameters and then performs the transmitter positioning. A version which utilizes Doppler data over several passes for the updating of orbital

elements and estimation of unknown positions in a simultaneous manner was written. Results indicate that this procedure gives more accurate estimates of the positions than the sequential method. ESA

N86-32843# Technische Hogeschool, Delft (Netherlands). Microwave Lab.
THE DELFT UNIVERSITY OF TECHNOLOGY SCATTEROMETER (DUTSCAT): A SIX-FREQUENCY AIRBORNE SCATTEROMETER
E. P. W. ATTEMA and P. SNOEIJ *In* ESA Microwave Remote Sensing Applied to Vegetation p 127-129 Jan. 1985 Sponsored by Delft University and Netherlands Remote Sensing Board
Avail: NTIS HC A08/MF A01

The Delft University of Technology Scatterometer is a multiband coherent pulse scatterometer installed in a Beechcraft Queen Air research aircraft. The radar system uses a 0.9 m diameter dual polarized parabolic dish antenna mounted on a support structure and protected by a radome. In the support structure the RF parts of the radar are mounted. This whole system can be tilted between 0 and 80 deg incidence angle, looking to the left. The incidence angle and polarization are selected by the operator inside the aircraft. Frequencies are between 1.2 and 17.25 GHz. It is used for vegetation studies. ESA

N86-32864*# California Univ., Santa Barbara.
SUPPORT FOR GLOBAL SCIENCE: REMOTE SENSING'S CHALLENGE
J. E. ESTES and J. L. STAR *In its* Remote Sensing Information Sciences Research Group, Santa Barbara Information Sciences Research Group, year 3 13 p 5 Jan. 1986
Avail: NTIS HC A05/MF A01 CSCL 05B

Remote sensing uses a wide variety of techniques and methods. Resulting data are analyzed by man and machine, using both analog and digital technology. The newest and most important initiatives in the U. S. civilian space program currently revolve around the space station complex, which includes the core station as well as co-orbiting and polar satellite platforms. This proposed suite of platforms and support systems offers a unique potential for facilitating long term, multidisciplinary scientific investigations on a truly global scale. Unlike previous generations of satellites, designed for relatively limited constituencies, the space station offers the potential to provide an integrated source of information which recognizes the scientific interest in investigating the dynamic coupling between the oceans, land surface, and atmosphere. Earth scientist already face problems that are truly global in extent. Problems such as the global carbon balance, regional deforestation, and desertification require new approaches, which combine multidisciplinary, multinational research teams, employing advanced technologies to produce a type, quantity, and quality of data not previously available. The challenge before the international scientific community is to continue to develop both the infrastructure and expertise to, on the one hand, develop the science and technology of remote sensing, while on the other hand, develop an integrated understanding of global life support systems, and work toward a quantiative science of the biosphere. Author

N86-32903*# National Aeronautics and Space Administration, Washington, D.C.
SPECTROSCOPIC DATABASE
N. HUSSON, A. BARBE, L. R. BROWN, B. CARLI, A. GOLDMAN, H. M. PICKETT, A. E. ROCHE, L. S. ROTHMAN, and M. A. H. SMITH *In its* Atmospheric Ozone 1985. Assessment of our Understanding of the Processes Controlling its Present Distribution and Change, Volume 3 41 p 1985
Avail: NASA, Goddard Space Flight Center, Code 610, Greenbelt, Md. 20770 HC free; NTIS HC A23/MF A01 CSCL 04A

Several aspects of quantitative atmospheric spectroscopy are considered, using a classification of the molecules according to the gas amounts in the stratosphere and upper troposphere, and reviews of quantitative atmospheric high-resolution spectroscopic measurements and field measurements systems are given. Laboratory spectroscopy and spectral analysis and prediction are presented with a summary of current laboratory spectroscopy capabilities. Spectroscopic data requirements for accurate derivation of atmospheric composition are discussed, where examples are given for space-based remote sensing experiments of the atmosphere: the ATMOS (Atmospheric Trace Molecule) and UARS (Upper Atmosphere Research Satellite) experiment. A review of the basic parameters involved in the data compilations; a summary of information on line parameter compilations already in existence; and a summary of current laboratory spectroscopy studies are used to assess the data base. B.G.

09

GENERAL

Includes economic analysis.

A86-41154* Alabama Univ., Huntsville.
COMMERICAL USE OF SPACE - STATUS AND PROSPECTS
C. A. LUNDQUIST (Alabama, University, Huntsville) and W. C. SNODDY (NASA, Marshall Space Flight Center, Huntsville, AL) IN: Winter National Design Engineering Show and Conference, Anaheim, CA, December 11-13, 1985, Conference Talks . Stamford, CT, Cahners Exposition Group, 1985, p. 225-239. refs

The development of commercial enterprises in space is discussed. The convenience and cost-effectiveness of satellites for communications are examined; satellite communications is an established industry and continues to grow. Meteorological satellites and remote sensing satellite systems (Landsat and SPOT) are being utilized to collect earth resources data. The development of materials processing facilities in space is studied. Current and proposed systems for transporting payloads to space and space lab facilities are investigated. The advantages a space station will provide to communications, earth resources, and materials processing are analyzed. The role of governments in the commercialization of space is described. I.F.

A86-41981
SPACE TECHNOLOGY AND RESOURCE MANAGEMENT
P. S. THACHER Journal of International Affairs (ISSN 0022-197X), vol. 39, Summer 1985, p. 151-166. refs

The applications of space technology to the management of natural resources are examined. Meteorological and oceanographic satellite data, MSS and thematic mapper images, and Space Shuttle recorded images are useful for monitoring resources; these satellite data are utilized for determining weather conditions (droughts) and vegetation indices, especially in Africa. Long-range research on the global processes of the earth, in order to understand biogeochemical cycles and the links between geophysical and biospheric processes is described. The relationship between desertification, famine, and droughts are analyzed. The development of the Global Environmental Monitoring System which collects and analyzes meteorological data related to global resources and environmental issues is discussed. The objectives of NASA's earth science research programs and the Global Resources Information Database are considered. The need for international cooperation for resource management and the role of the UN in monitoring natural resources are studied. I.F.

A86-43717
REMOTE SENSING FROM SPACE
B. R. K. PFEIFFER (ESA, Earth Observation Programmes Dept., Noordwijk, Netherlands) IN: SPACECOM '85; Space and Radiocommunications Symposium, 5th, Paris and Le Bourget, France, June 5-7, 1985, Speakers' Papers . Geneva, Switzerland, International Telecommunication Union, 1985, p. 195-201.

This paper provides an overview of the world-wide activities of remote sensing from space. It covers the main categories of instruments, giving examples from previous missions, and describes the type of products obtained. A summary of past and present

remote sensing missions is given, and an outline of future missions and trends is included. Typical uses of remote sensing data in science and applications are mentioned. Author

A86-44401
A US DILEMMA - SATELLITE REMOTE SENSING PRIVATIZATION
P.-M. ADRIEN (Project Management Associates, Inc., Vienna, VA) Space Policy (ISSN 0265-9646), vol. 2, May 1986, p. 93, 94.

The legislative mandate issued by Congress through the Land Remote Sensing Act brought about the privatization of the Landsat program in 1985. It is pointed out that as a result of this development the U.S. has embarked on a unique experiment. The U.S. would like to obtain a part of the profits expected to be derived from the market for satellite remote sensing products. However, a realization of such plans would require that the U.S. maintains its leadership in modern remote sensing technology. It is felt that the implementation of such plans is difficult in the light of the Gramm-Rudman amendment. A way has to be found to overcome these difficulties, because a failure to do so would result in the loss of the leadership in remote sensing technology to other countries. G.R.

A86-45518
THE SPOT PROGRAM - HISTORY, GOALS, SYSTEM DESCRIPTION AND GENERAL ORGANIZATION [LE PROGRAMME SPOT - HISTORIQUE, OBJECTIFS, DESCRIPTION DU SYSTEME ET ORGANISATION GENERALE]
G. BRACHET (SPOT Image, S.A., Toulouse, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 100, 1985, p. 13-25. In French.

The observational objectives and design and performance parameters of the SPOT remote sensing satellite are summarized. SPOT will monitor air, land, water and vegetation characteristics and changes with uniform quality whole-earth multitemporal coverage. The SPOT program was initiated by French, Belgium and Swedish agencies in the mid-1970s after initial successes with the Landsat program had identified the numerous applications which could benefit from access to high-quality satellite-based remote sensing imagery. SPOT has two imaging sytems, a monochromatic sensor with 10 m ground resolution and a color scanner furnishing 20 m resolution on a swath 27 deg wide. The 830 km altitude, circular, heliosynchronous SPOT orbit was selected to permit repeat coverage of any location on earth every 26 days. SPOT has on-board data storage capabilities for delaying data transmission until a ground station is in view. The organization of the agencies responsible for manufacturing, operating and maintaining SPOT and disseminating and marketing the data is outlined. M.S.K.

A86-46065
COMMERCIALIZING THE LAND VIEWING SATELLITES - WHO PAYS?
J. C. PRICE (USDA, Agricultural Research Service, Beltsville, MD) IN: ASP, Annual Meeting, 51st, Washington, DC, March 10-15, 1985, Technical Papers. Volume 1 . Falls Church, VA, American Society of Photogrammetry, 1985, p. 152-159. refs

The commercialization of remotely sensed data is discussed with emphasis on the benefits derived from the satellite operator selling proprietary computer systems and encrypted data at a lower cost than that of standard format data. The encoding of satellite data would facilitate user analysis while reducing unauthorized data reproduction. Methods implied from information theory, as well as the classification of images from Landsat data and the use of hashing tables, are considered. R.R.

A86-46959*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EARTH OBSERVATIONS IN THE TWENTY-FIRST CENTURY
M. A. GELLER (NASA, Goddard Space Flight Center, Greenbelt) *AIAA, Space Station in the Twenty-first Century, Meeting*, Reno, NV, Sept. 3-5, 1986. 12 p.
(AIAA PAPER 86-2345)

Some of the achievements of earth observations from past space missions are described. Also discussed are the achievements to be anticipated from currently approved and planned earth observation missions. In looking forward to what the objectives of earth observations from space are expected to be in the future, together with what technology is expected to enable, what the earth observing program will look like during the first part of the twenty-first century is discussed. It is concluded that a key part of this program will be long-term observations holistically viewing the earth system. Author

A86-49479* California Univ., Santa Barbara.
SUPPORT FOR GLOBAL SCIENCE - REMOTE SENSING'S CHALLENGE
J. E. ESTES and J. L. STAR (California, University, Santa Barbara) Geocarto International, no. 1, 1986, p. 3-14. refs
(Contract NASW-455)

Advances in remote sensing techniques are discussed. The benefits possible to remote sensing with the new Earth Observing System, which is composed of the Space Station and coorbiting and polar satellite platforms, are examined. Current changes in the remote sensing field, which involve a change from an industrial society to an informational society, force technology to high technology with high touch, short term to long term, centralized to decentralized, hierarchies to networks, and either/or to multiple option systems are studied. The explanatory and objective types of analyses for investigating biophysical, geochemical, and socioeconomic processes are described; the procedures include: morphometric, cause and effect, temporal and functional and ecological system analyses, inventory, mapping, monitoring, and modeling. I.F.

N86-31976# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
ACTIVITIES REPORT IN AEROSPACE SURVEY AND SPACE SCIENCES Annual Report, 1984
1984 38 p
(ETN-86-98042) Avail: NTIS HC A04/MF A01

Education and research programs in photogrammetry, aerial photography and remote sensing, cartography, land resource surveys and rural development, Earth resources surveys, urban survey, and human settlement analysis are described. ESA

N86-32510 National Aerospace Lab., Amsterdam (Netherlands). Spaceflight Div.
PROPOSAL FOR NLR ACTIVITIES IN THE TROPICAL EARTH RESOURCES SATELLITE (TERS) SYSTEM DEFINITION
H. F. A. ROEFS 1984 69 p
(Contract NIVR-1013)
(NLR-MEMO-RS-84-019-L; ETN-86-97780) Avail: Issuing Activity

Technical, work planning, and financial aspects of Dutch participation in the Tropical Earth Resources Satellite project are summarized. Mission requirements, data handling and processing, and satellite operations are emphasized. ESA

N86-32845# European Space Agency, Paris (France).
REMOTE SENSING APPLICATIONS IN CIVIL ENGINEERING
N. LONGDON, comp. Mar. 1985 107 p Postgraduate Summer School held in Dundee, Scotland, 19 Aug. - 8 Sep. 1984; sponsored by Science andEngineering Research Council, ESA, Council of Europe and European Association of Remote Sensing Labs.
(ESA-SP-216; ISSN-0379-6566; ETN-86-95251) Avail: NTIS HC A06/MF A01

The physical basis of remote sensing; data reception; ESA Earth observation programs; the UK National Remote sensing Center; digital image processing; space cartography; land use

applications of remote sensing; remote sensing for highway engineers; geological surveys for nuclear plant location; estuary observations; snow and ice monitoring; and coastal zone monitoring were discussed.

ESA

N86-32849# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).

ESA AND ITS EARTH OBSERVATION PROGRAMS

J. N. DEVILLIERS *In its* Remote Sensing Applications in Civil Engineering p 19-28 Mar. 1985

Avail: NTIS HC A06/MF A01

The ESA Earth Observation Programs in meteorology (Meteosat) precise time transfer (LASSO), remote sensing of the oceans (ERS-1), and cartographic mapping from Spacelab are described. Reception, processing and distribution of satellite remote sensing data are outlined. The requirements for advanced satellite missions in land observation and solid Earth physics, and studies undertaken to define and determine the feasibility of such missions are summarized. ESA

N86-32850# Royal Aircraft Establishment, Farnborough (England). National Remote Sensing Centre.

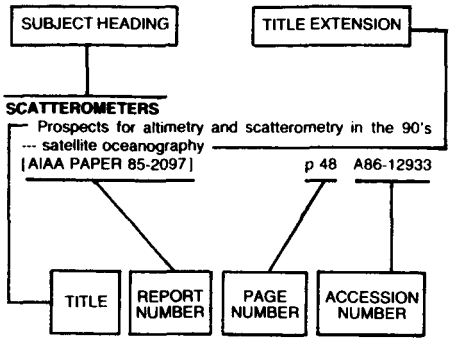
THE UK NATIONAL REMOTE SENSING CENTRE

P. VASS and M. ELKINGTON *In* ESA Remote Sensing Applications in Civil Engineering p 29-33 Mar. 1985

Avail: NTIS HC A06/MF A01

The UK National Remote Sensing Centre, including its organization and terms of reference; data reception facilities; data services and products; image processing facilities and major operations; and main fields of application are described. Domains covered include: coastal processes; oceanography and marine applications; land applications; information handling techniques; education and training; hydrology and water resources; and geological applications. Satellites and sensors, including ERS-1, and geographic information systems are discussed. ESA

Typical Subject Index Listing



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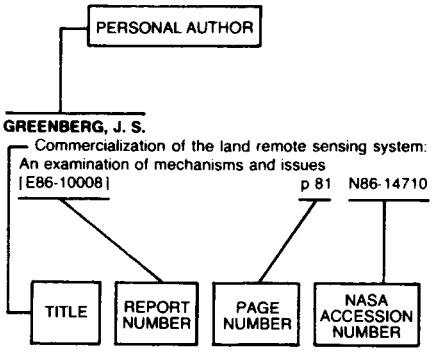

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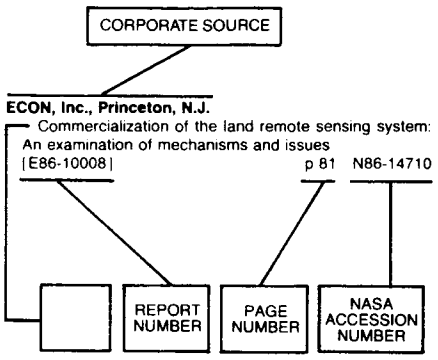

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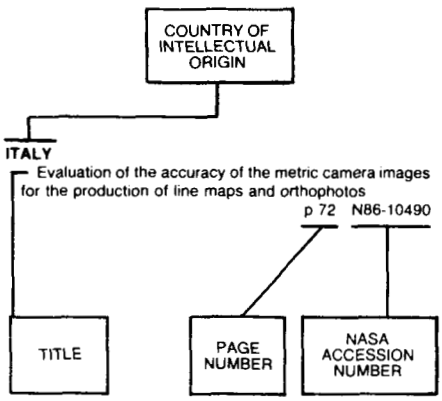

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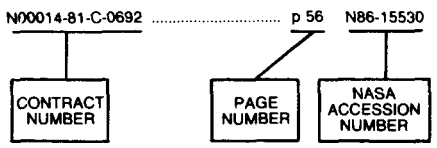

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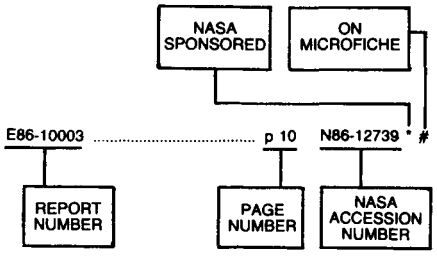

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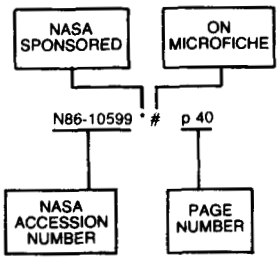

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