NASA

Earth Resources
A Continuing
Bibliography
with Indexes

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NASA SP-7041 (57)

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 57

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

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

Scientific and Technical Information Division 1988
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 451 reports, articles, and other documents announced between January 1 and March 31, 1988 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 A88-10,000 in ascending accession number order;

STAR entries identified by accession number series N88-10,000 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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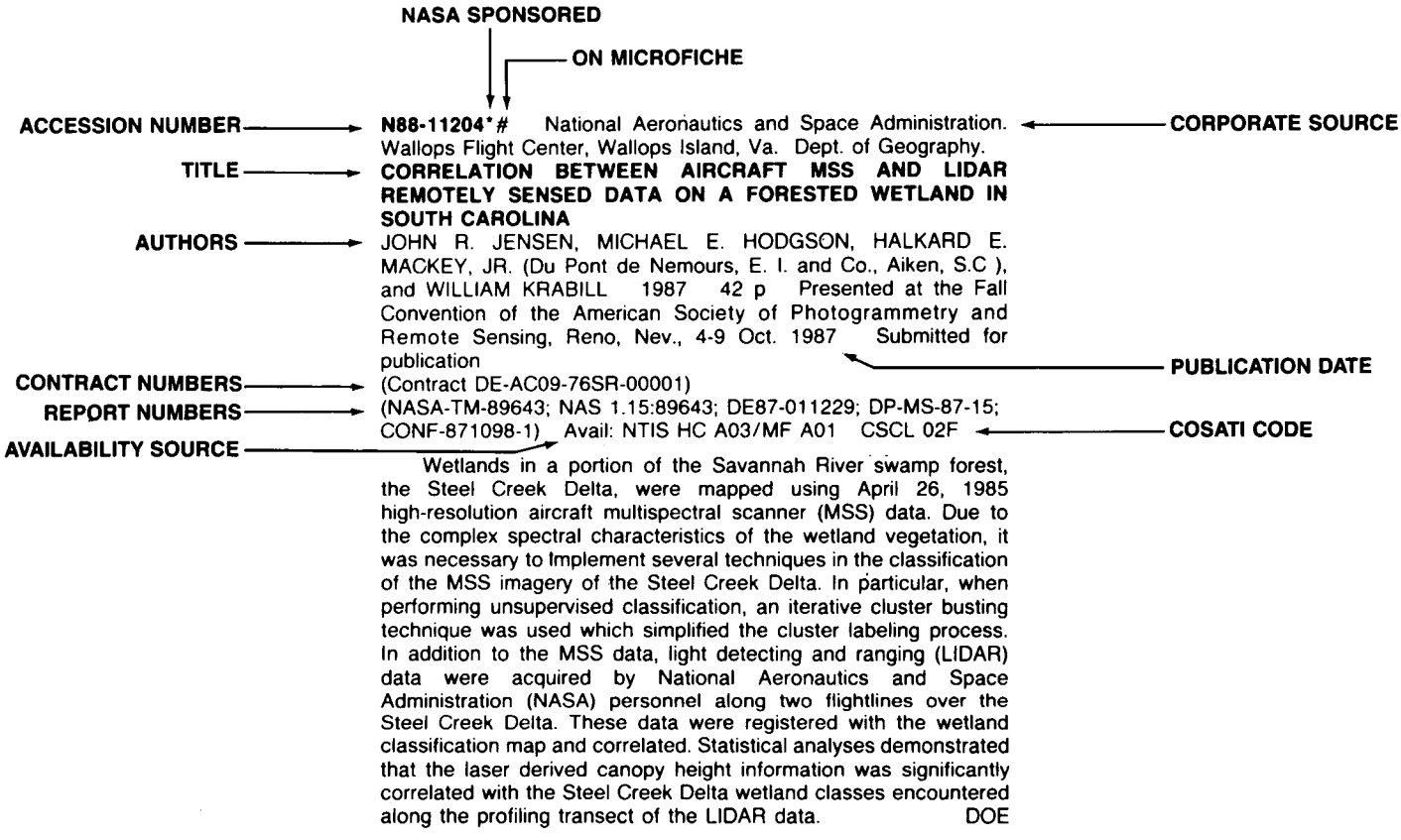
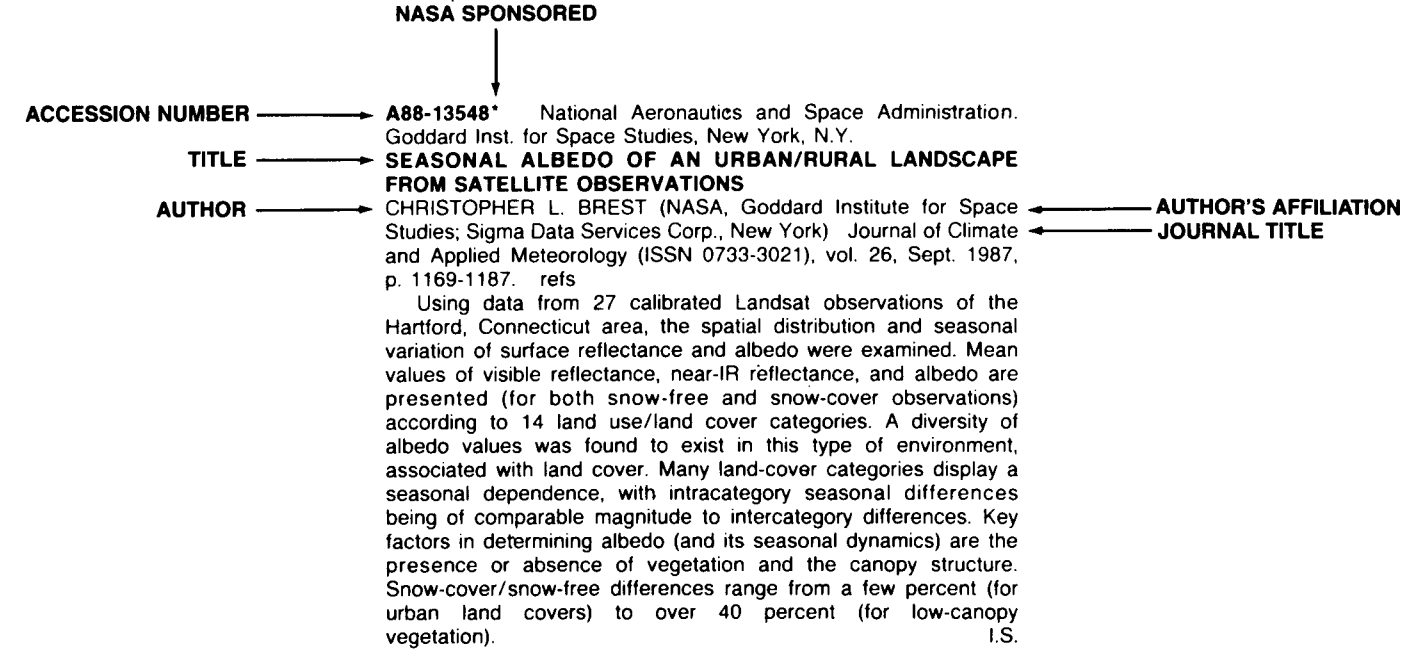
TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



EARTH RESOURCES

A Continuing Bibliography (Issue 57)

MAY 1988

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.

A88-10689
FIRE DETECTION USING DATA FROM THE NOAA-N SATELLITES
MICHAEL MATSON, GEORGE STEPHENS (NOAA, National Environmental Satellite, Data and Information Service, Washington, DC), and JENNIFER ROBINSON (National Center for Atmospheric Research, Boulder, CO) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 961-970. refs

Due to increased concern over the climatic and economic impact of fires associated with deforestation and seasonal burning, most of which occurs in remote parts of the world, it is necessary to find ways to effectively monitor such activity. The 3.8 micron channel on board the National Oceanic and Atmospheric Administration's polar-orbiting satellites is very sensitive to high temperature sources such as fires. Case studies in Mexico, Brazil, Mozambique and the Soviet Union have been selected to demonstrate the utility of this channel for fire detection. With the fire detection capability of the 3.8 micron channel and the daily global coverage, it is possible to monitor world-wide fire activity.
Author

A88-10690
SPECTRAL SEPARABILITY OF TROPICAL FOREST COVER CLASSES
ASHBINDU SINGH (Indian Forest Service, Imphal, India) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 971-979. refs

Spectral separability analysis of various tropical forest cover classes as recorded on Landsat MSS data were carried out for two test areas of northeastern India. The results indicated that two density classes of forests and two edaphic forest types formed spectrally separable classes but some of the important physiognomic units could not be reliably separated using Landsat MSS data in a spectrally complex tropical forest environment.
Author

A88-10691
SPATIAL AND TEMPORAL BEHAVIOUR OF A LARGE AGRICULTURAL AREA AS OBSERVED FROM AIRBORNE C-BAND SCATTEROMETER AND THERMAL INFRARED RADIOMETER
J. V. SOARES, R. BERNARD, and D. VIDAL-MADJAR (Centre de Recherches en Physique de l'Environnement, Issy-les-Moulineaux, France) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 981-996. Research supported by the Fundacao de Amparo aPesquisa do Estado de Sao Paulo, CNES, CNRS, and CNET. refs

Natural thermal emission in the 8-12 micron band as well as emission or diffusion of microwaves at low frequencies are known to be strongly correlated with the soil surface water content. Theoretical studies of the interaction between the soil/plant system and the atmosphere have shown that such measurements may be used to monitor the soil water budget. Experimental results from an airborne campaign are presented here. The surface temperature and radar cross-section spatial properties and their interrelations are examined for very different situations (wet and dry, bare and vegetated). It is shown that, as far as large-scale applications are concerned, the field scale can be considered as homogeneous for both measurements, and that it is possible to derive meaningful regional information from measurements at that scale. Therefore, at least for the test region, a high spatial resolution (of microwaves and thermal infrared measurements) is not required for the monitoring of surface soil moisture and thermal equilibrium for this 10-day period.
Author

A88-10693
SPECTRAL COMPONENTS ANALYSIS - RATIONALE, AND RESULTS FOR THREE CROPS
C. L. WIEGAND and A. J. RICHARDSON (USDA, Remote Sensing Research Unit, Weslaco, TX) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 1011-1032. refs

A spectral component analysis for three crops (wheat, cotton, maize) is used to quantify remote assessments of crop productivity and to unify field-observed interrelations among: leaf area index (LAI), the absorbed photosynthetically active radiation (APAR), and the saleable plant part. Remotely observable LAI and APAR inputs are validated for plant process crop growth and yield models. The rationale for the present analysis includes the concepts that vegetation indices (VI) adequately measure the amount of photosynthetically active tissue in plant canopies, and that high yields cannot be achieved unless growing conditions permit canopies to develop that intercept the available light during reproduction. Results show that APAR can be accurately estimated from VI, and that the relationship is linear.
R.R.

A88-10694
GROUND TRUTH - AN UNDERVIEW
M. D. STEVEN (Nottingham University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 1033-1038. refs

In an ideal world (for remote sensing) the nature of the surface would be completely specified by the spectral signature. In the real world, however, the complexity of natural surfaces, effects of the atmosphere and ambiguity of the spectral signatures act to limit remote sensing without ground truth to applications that demand little from the radiometric quantities in the data. Ground surveys are complementary to the synoptic overview provided by satellites, helping to link the image data to the surface context. This paper reviews the purposes and problems of such ground surveys and examines in particular the nature of the relationship between the object of inquiry and the spectral signature. The investigator must select object variables that are both appropriate to the application and well matched to the spectral signature. This problem is discussed in the context of vegetation canopies.
Author

A88-10696
OBLIQUE VIEW REFLECTANCE FOR ASSESSING NITROGEN STATUS OF INCOMPLETE CANOPIES
T. H. DEMETRIADES-SHAH and M. N. COURT (Aberdeen, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 1049-1055. Research supported by the Ministry of Agriculture, Fisheries and Food of England. refs

Crop reflectance measurements indicate that the addition of nitrogen to small plots of barley increased leaf chlorophyll concentrations and produced darker green canopies. It is shown that plant chlorophyll concentration is better predicted using oblique-looking reflectance measurements than vertically downward-looking measurements because the influence of soil reflectance is removed. Measurements were obtained independent of crop biomass using a band-pass radiometer. The method allows stress causing a change in leaf pigmentation to be detected at an early stage of growth, independent of ground cover. R.R.

A88-10697
GROUND TRUTH REQUIREMENTS FOR RADAR OBSERVATIONS OVER LAND AND SEA
J. LAMONT, S. QUEGAN, and I. A. WARD (GEC Research, Ltd., Marconi Research Centre, Chelmsford, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 1057-1067. Research supported by the Royal Aircraft Establishment.

Ground truth requirements for radar observations are discussed, with application to future radar missions including ERS-1, Radarsat, and JERS-1. The establishment of relations between the characteristics of flat homogeneous vegetated regions and the observed backscatter is first considered. Measurements necessary to validate two types of volume scattering models for vegetation layers, models where the scattering is represented by a random medium or by a collection of lossy scatterers, are discussed. Problems inherent in sea imaging with SAR are outlined, and a two-part program to resolve these problems is described. The optical program seeks to determine a data base on sea-surface characteristics and to develop techniques to support the airborne scatterometer, while the microwave program seeks to determine the dominant scattering mechanism under different wind and wave conditions. R.R.

A88-10700* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MONITORING GLOBAL VEGETATION USING NIMBUS-7 37 GHZ DATA - SOME EMPIRICAL RELATIONS
B. J. CHOUDHURY and C. J. TUCKER (NASA, Goddard Space Flight Center, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 1085-1090. refs

The difference of the vertically and horizontally polarized brightness temperatures observed by the 37 GHz channel of the SMMR on board the Nimbus-7 satellite are correlated temporally with three indicators of vegetation density, namely the temporal variation of the atmospheric CO2 concentration at Mauna Loa (Hawaii), rainfall over the Sahel and the normalized difference vegetation index derived from the AVHRR on board the NOAA-7 satellite. SMMR 37 GHz and AVHRR provide complementary data sets for monitoring global vegetation, the 37 GHz data being more suitable for arid and semiarid regions as these data are more sensitive to changes in sparse vegetation. The 37-GHz data might be useful for understanding desertification and indexing Co2 exchange between the biosphere and the atmosphere. Author

A88-10702
AN EXPLANATION OF ENHANCED RADAR BACKSCATTERING FROM FLOODED FORESTS
J. A. RICHARDS (New South Wales, University, Kensington, Australia), P. W. WOODGATE (Department of Conservation, Forests and Lands, Melbourne, Australia), and A. K. SKIDMORE (Australian National University, Canberra, Australia) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 1093-1100. refs

A simple structural backscatter model for a forest stand, suitable for use with L-band HH polarized radar imagery, is used to explain the increased level of backscattering observed from flooded forests. Measurements made of relative levels of backscatter from SIR-B image data of a flooded Australian forest are consistent with an interpretation based upon scattering mechanisms involving both the tree components and the understorey or forest floor. The change in Fresnel power reflection coefficient of the ground with flooding is advanced as the cause of the enhacement in backscattered power levels. Author

A88-10703
A PRELIMINARY ASSESSMENT OF LANDSAT TM IMAGERY FOR MAPPING VEGETATION AND SEDIMENT DISTRIBUTION IN THE WASH ESTUARY
DANIEL N. M. DONOGHUE and IAN SHENNAN (Durham, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 1101-1108. Research supported by the Nature Conservancy Council. refs

Analysis of Landsat Thematic Mapper (TM) image of May 14, 1984, has shown that such data can be used to survey vegetation and sediment distributions in the intertidal zone of the Wash estuary at a spatial detail comparable with current methods practiced by the Nature Conservancy Council. Multispectral classification of this TM image showed good separation of salt-marsh vegetation communities which had recently been surveyed by the Nature Conservancy Council and for which reliable training data could be taken. The sensitivity of classification performance, using both parametric and nonparametric algorithms, to apparently minor differences in phenology at training site locations demonstrates two requirements for improved salt-marsh classification. They are the need for strict definition of training data and that TM wave bands 2, 3, 4 and 5 provide suitable spectral vectors for classifying intertidal environments. Author

A88-10704
PROCESSING AIRBORNE MSS DATA FOR VEGETATION STUDIES
H. D. WILLIAMSON (Adelaide, University, Australia) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 1109-1117. refs
(Contract NERC-GR/3/5096)

This letter discusses the need for accurate processing of airborne multispectral data for vegetation studies. The processing includes radiometric and atmospheric corrections and allowances for environmental influences on the data. A methodology for such corrections using easily available collateral data is described and successfully applied to airborne multispectral data recorded in the Bawtry area of South Yorkshire, England. Author

A88-10920
DETERMINATION OF VEGETATION CANOPY PARAMETERS FROM REMOTE SENSING DATA [DISTANTSIONNOE OPREDELENIE PARAMETROV RASTITEL'NOGO POKROVA]
A. E. KUUSK (AN ESSR, Institut Astrofiziki i Fiziki Atmosfery, Tartu, Estonian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 89, 90. In Russian. refs

A method for the determination of vegetative canopy parameters from the values of the canopy's spectral reflectance coefficients (SRCs) is discussed. Using the Nilson-Kuusk (1984) model of canopy reflectance and the simulated values of vegetation canopy SRCs, the values for the leaf parameters (such as the area index, reflectivity and transmittance, the refractivity of the waxy layer, and the average size) and the soil reflectivity were derived. The

test based on simulated data yielded model parameters accurate to 5-12 percent. I.S.

A88-11452* Michigan Univ., Ann Arbor.
MICROWAVE DIELECTRIC SPECTRUM OF VEGETATION. I - EXPERIMENTAL OBSERVATIONS. II - DUAL-DISPERSION MODEL
MOHAMED A. EL-RAYES and FAWWAZ T. ULABY (Michigan, University, Ann Arbor) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-25, Sept. 1987, p. 541-557. refs
(Contract NAG5-480)

The microwave dielectric behavior of vegetation materials is examined as a function of water content, microwave frequency, and temperature. Dielectric spectra for various types of vegetation, such as leaves, stalks, and trunks at various moisture conditions, were measured using a coaxial probe technique. The basic features and operation of the coaxial probe system are described. Examples of dielectric measurements for the vegetation materials are presented, and the relation between temperature and the dielectric constant is studied. The development of a dual-dispersion model that accounts for the dielectric properties of water in both free and bound conditions is described. The applicability of the model is evaluated by comparing it with the dielectric data; good correlation is observed between the model and the data over a wide range of moisture conditions and over the 0.2-20 GHz range. I.F.

A88-11458*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE EMISSION FROM SMOOTH BARE FIELDS AND SOIL MOISTURE SAMPLING DEPTH
JAMES R. WANG (NASA, Goddard Space Flight Center, Greenbelt, MD) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-25, Sept. 1987, p. 616-622. refs

This paper studies the depth to which soil moisture can be directly estimated with microwave measurements over smooth bare fields. The analyses are based on both theoretical and experimental considerations at the frequencies of 1.4, 5.0, and 10.7 GHz. Radiative transfer calculations of microwave emissivities at these frequencies are performed with a number of moisture profiles measured for two soils. The calculated emissivities are compared with those derived from the Fresnel equation to deduce the microwave sampling depth in soils. The data acquired from the ground-level radiometric measurements during the summers of 1979-1981 are examined and compared with the theoretical analysis. Both theoretical and experimental analyses lead to the conclusion that the microwave samplinhg depth in soils is about one tenth of the wavelength of observation. It is shown that the moisture content at any depth near the surface of a smooth soil can be estimated, in principle, by a combination of a radiometric measurement and a curve generated by the Fresnel equation at an appropriate frequency, provided that the texture of the soil is known. Author

A88-11460
SAR DATA FILTERING FOR CLASSIFICATION
JEAN M. DURAND, JACQUELINE R. PERBOS (CNES, Toulouse, France), and BERNARD J. GIMONET (ONERA, Centre d'Etudes et de Recherche de Toulouse, France) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-25, Sept. 1987, p. 629-637. ESA-supported research. refs

This study compares several filtering techniques to improve the classification of a synthetic aperture radar (SAR) image. With this aim in view, thematic information and noise are separated by speckle analysis, and filters adapted to speckle models are proposed. The evaluation includes a brief theoretical analysis, a visual interpretation, a signal-to-noise ratio analysis, a comparison of required computer times, as well as classification results. The study also shows the effect of active microwaves on crop identification in the case where there is a one-date one-look SAR image, the utilization of X- and C-bands, and HH polarization. Author

A88-12334
MONITORING CHANGING DESERT BIOMASS THROUGH VIDEO DIGITIZATION OF LANDSAT MSS DATA - AN APPLICATION TO DUST STORM GENERATION
RAY LOUGEAY (New York, State University, Geneseo), ANTHONY J. BRAZEL, and TOMAS A. MILLER (Arizona State University, Tempe) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 53, Sept. 1987, p. 1251-1254. refs
(Contract NSF SES-84-07587)

Desert biomass for selected years of relatively high and low precipitation was observed with Landsat multispectral scanner data. MSS bands 2 and 4 were video digitized and preprocessed to remove temporally varying gain and bias factors. Although several vegetation indices and data transformation techniques were used in an attempt to enhance the signal contrast between desert vegetation and background soil, the relatively simple Difference Vegetation Index was found most appropriate. It was hypothesized that the increased desert biomass of wetter years may be significant, in reducing the frequency of dust storms, by forming a greater vegetative cover over dust source regions and thus increasing the threshold wind speeds required to entrain dust over extensive areas. A lower incidence of summer dust storms was generally found to be associated with high rates of winter/spring precipitation and higher biomass reflectance patterns. However, significant variability of reflectance was observed in wet years due to changing soil moisture and edaphic factors. The possible inability of MSS data to detect slight vegetative cover changes, and the limitations of the video digitizing technology employed, produced less than ideal correspondence between desert biomass reflectance and antecedent precipitation. Author

A88-12335
DROUGHT-STRESS DETECTION OF BUFFELGRASS WITH COLOR-INFRARED AERIAL PHOTOGRAPHY AND COMPUTER-AIDED IMAGE PROCESSING
J. H. EVERITT, D. E. ESCOBAR, M. A. ALANIZ (USDA, Agricultural Research Service, Weslaco, TX), and M. A. HUSSEY (Texas A & M University, College Station) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 53, Sept. 1987, p. 1255-1258. refs

A88-12729* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FOREST FIRE ADVANCED SYSTEM TECHNOLOGY (FFAST) CONCEPTUAL DESIGN STUDY
J. DAVID NICHOLS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and JOHN R. WARREN (USDA, Forest Service, Boise, ID) IN: Airborne reconnaissance X; Proceedings of the Meeting, San Diego, CA, Aug. 19, 20, 1986 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 2-8. refs

The National Aeronautics and Space Administration's Jet Propulsion Laboratory (JPL) and the U.S. Department of Agriculture (USDA) Forest Service completed a conceptual design study that defined an integrated forest fire detection and mapping system that will be based upon technology available in the 1990s. Potential system configuration options in emerging and advanced technologies related to the conceptual design were identified and recommended for inclusion as preferred system components. System component technologies identified for an end-to-end system include airborne mounted, thermal infrared (IR) linear array detectors, automatic onboard georeferencing and signal processing, geosynchronous satellite communications links, and advanced data integration and display. Potential system configuration options were developed and examined for possible inclusion in the preferred system configuration. The preferred system configuration will provide increased performance and be cost effective over the system currently in use. Forest fire management user requirements and the system component emerging technologies were the basis for the system configuration design. The conceptual design study defined the preferred system configuration that warrants continued refinement and development, examined economic aspects of the current and preferred system,

and provided preliminary cost estimates for follow-on system prototype development. Author

A88-13012* National Center for Atmospheric Research, Boulder, Colo.
RADIATION TRANSFER IN PLANT CANOPIES - TRANSMISSION OF DIRECT SOLAR RADIATION AND THE ROLE OF LEAF ORIENTATION
MICHEL M. VERSTRAETE (National Center for Atmospheric Research, Boulder, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Sept. 20, 1987, p. 10985-10995. refs
(Contract NASA ORDER S-56469)

Understanding the details of the interaction between the radiation field and plant structures is important climatically because of the influence of vegetation on the surface water and energy balance, but also biologically, since solar radiation provides the energy necessary for photosynthesis. The problem is complex because of the extreme variety of vegetation forms in space and time, as well as within and across plant species. This one-dimensional vertical multilayer model describes the transfer of direct solar radiation through a leaf canopy, accounting explicitly for the vertical inhomogeneities of a plant stand and leaf orientation, as well as heliotropic plant behavior. This model reproduces observational results on homogeneous canopies, but it is also well adapted to describe vertically inhomogeneous canopies. Some of the implications of leaf orientation and plant structure as far as light collection is concerned are briefly reviewed. Author

A88-14058
WETLAND VEGETATION CHANGE DETECTION USING HIGH RESOLUTION AIRCRAFT MSS DATA
E. J. CHRISTENSEN (EG&G Energy Measurements, Inc., Las Vegas, NV), J. R. JENSEN, E. W. RAMSEY (South Carolina, University, Columbia), and H. E. MACKEY, JR. (E.I. duPont de Nemours and Co., Inc., Savannah River Laboratory, Aiken, SC) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 148-162. refs
(Contract DE-AC09-76SR-00001)

High-resolution (5.6 x 5.6 m) aircraft MSS data were used to evaluate portions of the Savannah River floodplain swamp for vegetation change. Cypress-tupelo swamp forest was often replaced by more heat- and flood-tolerant marsh species. Rapid invasion by scrub/shrub communities took place in areas where cooling water releases were discontinued. It is concluded that high-resolution aircraft MSS data can be accurately registered if small areas are used and that wetland vegetation change can be accurately detected and monitored. K.K.

A88-14059
EVALUATION OF RIPARIAN VEGETATION TRENDS IN THE GRAND CANYON USING MULTITEMPORAL REMOTE SENSING TECHNIQUES
MICHAEL J. PUCHERELLI (USBR, Div. of Research and Laboratory Services, Denver, CO) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 172-181. USBR-supported research.

A88-14062* Science Applications Research, Lanham, Md.
A DETERMINATION OF SAMPLING INTENSITY TO CHARACTERIZE A LANDSAT MSS SCENE USING TWO BLOCK SIZES
N. HORNING, D. CASE (Science Applications Research, Lanham, MD), and R. NELSON (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 244-254. refs

Three Landsat MSS scenes were processed to empirically determine the sampling intensity needed to characterize various land cover types including water, conifer, and hardwood. The block sizes used as the sampling units were 497 by 500 pixels (picture elements) and 248 by 250 pixels. It is found that, for a given accuracy criterion, the sampling intensity is dependent on the abundance of the cover type of interest in the MSS scene. The results also indicate that, when using the smaller block size, a smaller percentage of the scene has to be classified to obtain a given level of accuracy. K.K.

A88-14063
REMOTE SENSING OF RUFFED GROUSE HABITAT IN THE KENTUCKY PORTION OF LAND BETWEEN THE LAKES, TVA, UTILIZING LANDSAT MSS AND TM DATA SETS
THOMAS C. KIND, JANE L. BENSON (Murray State University, KY), RICHARD L. LOWE, and MARCUS E. COPE (Tennessee Valley Authority, Golden Pond, KY) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 322-334. refs

A88-14065
INTERMEDIATE-SCALE VEGETATION MAPPING OF KANUTI NATIONAL WILDLIFE REFUGE, ALASKA USING LANDSAT MSS DIGITAL DATA
STEPHEN S. TALBOT (U.S. Fish and Wildlife Service, Anchorage, AK), MICHAEL D. FLEMING, and CARL J. MARKON (Technicolor Government Services, Inc., EROS Field Office, Anchorage, AK) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 392-406. refs

A88-14066
MAPPING FOREST COVER WITH SIR-B DATA
R. M. HOFFER, D. F. LOZANO-GARCIA, and D. D. GILLESPIE (Purdue University, West Lafayette, IN) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 407-415.

For the first time in the U.S. space program, digital synthetic aperture radar data were obtained from different incidence angles for the same area on the ground during Space Shuttle Mission 41-G in October 1984. Shuttle Imaging Radar-B data were obtained at incidence angles of 28, 45, and 58 deg of a predominantly forested study area in northern Florida. It is shown that different forest cover types and age classes, as well as other land use classes, can be identified and mapped because of distinctive differences in radar back-scatter at the different incidence angles. Author

A88-14478
A SIMPLE MODEL TO ESTIMATE THE DAILY VALUE OF THE REGIONAL MAXIMUM EVAPOTRANSPIRATION FROM SATELLITE TEMPERATURE AND ALBEDO IMAGES
V. CASELLES and J. DELEGIDO (Valencia, Universidad, Burjassot, Spain) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Aug. 1987, p. 1151-1162. refs

A88-14481* Maryland Univ., College Park.
CHARACTERIZATION AND CLASSIFICATION OF SOUTH AMERICAN LAND COVER TYPES USING SATELLITE DATA
J. R. G. TOWNSHEND, C. O. JUSTICE (Maryland, University, College Park), and V. KALB (NASA, Goddard Space Flight Center, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Aug. 1987, p. 1189-1207. refs
(Contract NERC-F60/G6/12; NAG5-399)

Various methods are compared for carrying out land cover classifications of South America using multitemporal Advanced Very High Resolution Radiometer data. Fifty-two images of the normalized difference vegetation index (NDVI) from a 1-year period are used to generate multitemporal data sets. Three main approaches to land cover classification are considered, namely the use of the principal components transformed images, the use of a characteristic curves procedure based on NDVI values plotted against time, and finally application of the maximum likelihood rule to multitemporal data sets. Comparison of results from training sites indicates that the last approach yields the most accurate results. Despite the reliance on training site figures for performance assessment, the results are nevertheless extremely encouraging, with accuracies for several cover types exceeding 90 per cent. Author

A88-14484
THE DERIVATION OF VEGETATION INDICES FROM AVHRR DATA
GEORGE GUTMAN (NOAA, National Environmental Satellite, Data, and Information Service, Washington, DC) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Aug. 1987, p. 1235-1243. refs

The reliability of a 1-week composited normalized difference vegetation index has been evaluated by using a cloud-screening algorithm applied to the visible and near-infrared data from the Advanced Very High Resolution Radiometer on NOAA-9. It is found that in some areas of the U.S. Great Plains this satellite sensor product may not be reliable due to the high frequency of cloud occurrence. Using the example of day-to-day variation in the observed clear-sky radiances for one target, the vegetation index is shown to have maxima at high off-nadir and low solar zenith angles; this behavior has been examined in detail. Some recommendations to improve the compositing technique are given. Author

A88-14882
VARIABILITY OF LANDSAT MSS SPECTRAL RESPONSES OF FORESTS IN RELATION TO STAND AND SITE CHARACTERISTICS
STEPHEN J. WALSH (North Carolina, University, Chapel Hill) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1289-1299. refs

The use of field measures of slope angle, slope aspect, cover type, crown size and crown density is evaluated in appraising the variabiilty of Landsat Multispectral Scanner (MSS) spectral responses for 182 sample sites within Crater Lake National Park, Oregon. Multiple linear regression models indicate that 73, 72, 71 and 57 percent of the variation in the mean response of MSS bands 4, 5, 6 and 7, respectively, was explained by the environmental variables entered into the models. In general, crown size and crown density are less important in altering spectral response than terrain orientation. This type of analysis is useful in guiding field work for remote sensing studies into areas that are environmentally diverse and which are, therefore, capable of significantly altering the spectral response of cover types. Author

A88-14883* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VEGETATION SPATIAL VARIABILITY AND ITS EFFECT ON VEGETATION INDICES
J. P. ORMSBY, B. J. CHOUDHURY, and M. OWE (NASA, Goddard Space Flight Center, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1301-1306. refs

Landsat MSS data were used to simulate low resolution satellite data, such as NOAA AVHRR, to quantify the fractional vegetation cover within a pixel and relate the fractional cover to the normalized difference vegetation index (NDVI) and the simple ratio (SR). The MSS data were converted to radiances from which the NDVI and SR values for the simulated pixels were determined. Each simulated pixel was divided into clusters using an unsupervised classification program. Spatial and spectral analysis provided a means of combining clusters representing similar surface characteristics into vegetated and non-vegetated areas. Analysis showed an average error of 12.7 per cent in determining these areas. NDVI values less than 0.3 represented fractional vegetated areas of 5 per cent or less, while a value of 0.7 or higher represented fractional vegetated areas greater than 80 per cent. Regression analysis showed a strong linear relation between fractional vegetation area and the NDVI and SR values; correlation values were 0.89 and 0.95 respectively. The range of NDVI values calculated from the MSS data agrees well with field studies. Author

A88-14884
SOIL AND SUN ANGLE INTERACTIONS ON PARTIAL CANOPY SPECTRA
ALFREDO R. HUETE (Arizona, University, Tucson) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1307-1317. Research supported by the University of Arizona. refs

The spectral behavior of an incomplete cotton canopy was analyzed in relation to solar zenith angle and soil background variations. Soil and vegetation spectral contributions towards canopy response were separated using a first-order interactive model and consequently used to compare the relative sensitivity of canopy spectra to soil background and solar angle differences. Canopy reflectance behavior with solar angle increased, decreased or remained invariant depending on the reflectance properties of the underlying soil. Sunlit and shaded soil contributions were found to alter vegetation index behavior significantly over different sun angles. Author

A88-14885
CHARACTERIZATION OF MEDITERRANEAN VEGETATION USING TM DATA - A CASE STUDY IN ANDALUSIA (SPAIN)
BERNARD LACAZE and RICHARD JOFFRE (CNRS, Centre L. Emberger, Montpellier, France) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1319-1333. In French. refs

The study is focused on the characterization of vegetation formations in a Mediterranean area (943 sq km) located in southern Spain: herbaceous canopies (rangelands), shrubby vegetation ('matorral'), and complex woody/herbaceous formations ('dehesa'). Vegetation formations (physiognomical units) have been characterized by their spectral responses in the six reflective TM channels and by vegetation indices. From the ratio index TM4/TM3 there has been derived a map displaying seven classes (water, bare soil, and five biomass levels reflecting the hierarchy of vegetation formations). Channels TM3, TM4, and TM5 have been considered for a supervised classification into nine land-cover categories (seven vegetation formations, bare soil, and water). The proportion of correct classification of vegetation formations is about 78 percent when considering test areas. Classification made from three principal components gives similar results. Author

A88-15155#
SATELLITE DATA IN DEVELOPMENT PROJECTS FROM THE PERSPECTIVE OF AN AGRICULTURAL CONSULTING FIRM [SATELLITENDATEN IN ENTWICKLUNGSPROJEKTEN AUS DER SICHT EINES IM AGRARBEREICH TAETIGEN CONSULTINGUNTERNEHMENS]
ERHARD MUELLER and THOMAS CHRISTIANSEN (Agrar- und Hydrotechnik GmbH, Essen, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 81-93. In German.

The use of satellite remote-sensing data in the feasibility-study phase of agricultural development projects is described and demonstrated. The advantages offered by thematic maps and series of maps from different seasons in the evaluation of large land areas are discussed, and images from an integrated land-development project carried out in Tanzania are provided. It is estimated that the use of satellite data in this project reduced the mapping effort from 30 to 2 man-months. The need for improvements in the distribution of satellite data and information on their availability is indicated. T.K.

A88-15158#
THE APPLICABILITY OF LANDSAT-TM AND SPOT MULTIBAND IMAGES TO PROBLEMS IN AGRICULTURE AND FORESTRY [UNTERSUCHUNG DES ANWENDUNGSPOTENTIALS VON LANDSAT-THEMATIC-MAPPER- UND SPOT-MULTIBAND-BILD-DATEN FUER LAND- UND FORSTWIRTSCHAFTLICHE AUF-GABENSTELLUNGEN]
W. KIRCHHOF (DFVLR, Oberpfaffenhofen, Federal Republic of Germany), W. MAUSER, and H.-J. STIBIG (Freiburg, Universitaet, Freiburg im Breisgau, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 129-144. In German.

Visual interpretations and supervised classifications of simulated TM and SPOT multispectral images of a test site near Freiburg (FRG) are presented, summarizing the findings of a DFVLR study (Kirchhof et al., 1985). The spectral bands of the scanners and the evaluation results are compiled in extensive tables and characterized in detail. Composite images with different band combinations and resolutions are provided. The point-by-point maximum-likelihood classifier employed is found to give better results with 30-m pixels than with 20-m pixels, probably because the local context is ignored; the need for improved algorithms capable of exploiting the information content of higher-resolution images is indicated. T.K.

A88-15159#
CLASSIFICATION OF FOREST DAMAGE USING MULTISPEC-TRAL-SCANNER DATA [WALDSCHADENSKLASSIFIZIERUNG ANHAND MULTISPEKTRALER SCANNER-DATEN]
G. KRITIKOS, M. SCHROEDER, and V. AMANN (DFVLR, Institut fuer Optoelektronik, Oberpfaffenhofen, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 145-159. In German. refs

Airborne MSS images of healthy and damaged single spruce trees and forest stands, obtained at altitudes 300, 1000, and 4000 m are analyzed to determine spectral signatures for classification purposes. Sample images taken over the northern Black Forest (FRG) in 1983-1984 and tables and graphs of numerical data are provided, and the feasibility of semiautomatic (interactive) interpretation using selected training sites and appropriate classification algorithms is explored. It is pointed out that the 10-m resolution of the 4000-m images is similar to that of future remote-sensing satellites. Computer-assisted classification is found to be about as accurate as manual interpretation of aerial photographs, and even better results are expected when 1.6-micron data and algorithms which include structural parameters become available. T.K.

A88-15161#
POTENTIAL AND LIMITATIONS OF SPACE REMOTE SENSING FOR FOREST INVENTORY AND MAPPING [MOEGLICHKEITEN UND GRENZEN DER FERNERKUNDUNG AUS DEM WELTRAUM FUER WALDINVENTUR UND -KARTIERUNG]
G. HILDEBRANDT (Freiburg, Universitaet, Freiburg im Breisgau, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 165-185. In German. refs

The use of satellite remote-sensing data in forestry is discussed, surveying the capabilities of current satellite sensors and their applications in the FRG and Europe. The types of information required for adequate monitoring of forest conditions are indicated; conventional and remote-sensing approaches to obtaining this information are described; and their use by different FRG organizations is documented in extensive tables. It is suggested that satellite data can best be used to produce (1) regional forest maps at scale 1:100,000 or 1:200,000, (2) 1:50,000 operational maps of FRG forest regions (updated on a 10-yr basis), and (3) large-scale national or international forest inventories (as proposed by Hildebrandt, 1981 and 1983). T.K.

A88-15162#
POSSIBILITIES FOR A PRAXIS-ORIENTED APPLICATION OF AERIAL COLOR IR IMAGES TO EVALUATE THE HEALTH OF TREES [MOEGLICHKEITEN EINER PRAXISORIENTIERTEN AUSWERTUNG VON FARBINFRAROT-LUFTBILDERN ZUR BEURTEILUNG DER BAUMVITALITAET]
W. BAETZ, R. HAYDN, and T. WINTGES (Gesellschaft fuer Angewandte Fernerkundung mbH, Munich, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 187-194. In German.

The interpretation of false-color images derived from aerial IR photography to evaluate the status of forests is described and demonstrated. The spectral signatures of green vegetation types are briefly characterized; the application of the IHS color transform to enhance IR images is outlined; and graphs, spectra, diagrams, and a sample image are provided. The limitations of present techniques are indicated, and a number of short-term and long-term improvement efforts are discussed. T.K.

A88-15174#
RADAR DATA FOR AGRICULTURE - A PRAXIS-ORIENTED CASE STUDY OF SAR-580 OVERFLIGHTS OF THE SOUTHWESTERN FRG (1984) [RADARDATEN FUER DIE LANDWIRTSCHAFT - EINE PRAXISORIENTIERTE FALLSTUDIE DER SAR-580-BEFLIEGUNG IN SUEDWESTDEUTSCHLAND (1984)]
CORNELIA SCHMIDT (Trier, Universitaet, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 527-534. In German. refs

The use of radar images to obtain detailed land-use information in regions with small fields is demonstrated. L-band and X-band images of a 650-sq km test site near Breisach (FRG) were obtained (in HH, VV, HV, and VH polarization) by an airborne CV 580 SAR in July 1984, to provide reference data for SIR-B experiments. Quick-look images with resolution of about 5 m were then evaluated to check the radar performance and the location of the overflight paths prior to digital processing and analysis of the data. The

features identifiable in the L-band and X-band images are indicated in tables and discussed, and land-use maps of the test region are provided. T.K.

A88-15461
APPLICABILITIES OF IMAGING RADAR FOR CLASSIFICATION OF FOREST VEGETATION
RALF KESSLER (Freiburg, Universitaet, Freiburg im Breisgau, Federal Republic of Germany) Photogrammetria (ISSN 0031-8663), vol. 41, Sept. 1987, p. 221-232. refs

With the urgent need for experimental knowledge with imaging radar, in the last few years a great number of data sets from airborne and spaceborne systems have been collected from many European test sites. This paper reviews woodland and agricultural aspects of land use, based on the authors experience with Seasat-SAR, SAR-580 and SIR-B imagery. It presents potential applications as well as the limitations of the microwave remote sensing sensor for operational tasks of land-use inventory. Author

A88-15911#
REMOTE SENSING THE LAND OF EAST AND SOUTHERN AFRICA - 1977-1987
HASSAN M. HASSAN and ALLAN FALCONER (Regional Centre for Services in Surveying, Mapping and Remote Sensing, Nairobi, Kenya) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 8 p. refs
(IAF PAPER 87-161)

The demand for natural resources data, and for the requisite specialized service in surveying and mapping resulted in the establishment of the Regional Center for Services in Surveying, Mapping and Remote Sensing in Nairobi, Kenya in 1975. This program is now very much concerned with the application of remote sensing to crop forecasting, forest resources mapping, map revision, and other aspects of natural resources data collection and management. This paper examines training, user products, and projects in which they are successfully employed. In many applications, the satellite data are used as a substitute for a map. This passive function can be exploited to organize existing field survey teams and use them more effectively. Mapping techniques are found to be effective for scales in the range 1:100,000 to 1 million. Large area mosaics provide valuable context for many regional features. For field assessments of crops, forest, or other natural resources, the use of satellite images provided particularly valuable, both for field use and for compiling final results. Author

A88-15913#
ESTIMATING RAINFALL AND BIOMASS FOR THE PASTURELAND ZONE OF THE WEST AFRICAN SAHEL
J. B. STEWART (Institute of Hydrology, Wallingford, England), E. C. BARRETT (Bristol, University, England), J. R. MILFORD (Reading, University, England), J. C. TAYLOR (Silsoe College, Bedford, England), and B. K. WYATT (Institute of Terrestrial Ecology, Bangor, Wales) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 6 p. Research supported by the U.K. Overseas Development Administration and CEC.
(IAF PAPER 87-166)

To provide an early indication of below average rainfall and pastureland biomass production, which could lead to famine conditions, methods of estimating rainfall and biomass of the Sahelian region of West Africa using satellite observations were developed. 10 and 30 day rainfall were successfully estimated from the duration of rain bearing clouds, derived from Meteosat infrared radiation measurements. Biomass was estimated from the Perpendicular Vegetation Index derived from Landsat MSS data and ground based biomass measurements for an area in the center of the Republic of Niger. The accuracy of these estimates were found to be generally reasonable when checked against an independent set of biomass measurements. These methods are to be incorporated into an operational system for this region of Africa. Author

A88-15914#
LARGE SCALE FOREST TYPE MAPPING USING SATELLITE DATA
R. N. JADHAV, V. K. SRIVASTAVA, A. K. KANDYA, G. V. SARAT BABU, M. M. KIMOTHI (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) et al. IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 5 p. refs
(IAF PAPER 87-167)

This paper describes the methodology developed for selection of suitable season imagery, the right digital enhancement product, classification accuracy, and cost factors involved in the preparation of a forest type map of a typical Survey of India 1:50,000 scale topographical map covering an area of 62,500 ha using Landsat MSS data. It was found that February/March season data are more suitable for forest type identification than October/November season imagery. Digital enhancement techniques, especially histogram equalization, depicted forest-type differentiation more prominently. The accuracy of the prepared map was 90 percent at 95-percent confidence limits. It took 45 man-days for completing the project and entailed an expenditure of 28,654 Rs. Average cost for one ha is only 50 paise ($ 0.04). Author

A88-17030
IDENTIFICATION AND DYNAMICS OF AGRICULTURAL ENVIRONMENTS IN NORTHEAST THAILAND FROM LANDSAT IMAGES (1972, 1976, 1982)
M. BRUNEAU (CNRS, Centre d'Etudes de Geographie Tropicale, Bordeaux, France), J. KILIAN (Institut de Recherches Agronomiques Tropicales, Montpellier, France), H. LE MEN (Institut Geographique National, Paris, France), and C. MONGKOLSAWAT (Khon Kaen University, Thailand) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 25-29.

A88-17031
USE OF REMOTE SENSING FOR VEGETATION AND LANDUSE MAPPING IN MOUNTAINOUS AREAS - THE CASE OF CENTRAL NEPAL
D. BLAMONT (CNRS, Meudon, France) and C. MERING (Institut Francais de Recherche Scientifique pour le Developpement en Cooperation, Bondy, France) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 41-46. refs

A major difficulty encountered during the mapping of vegetation cover in the Himalayas of central Nepal with the Landsat MSS is the range of different lighting conditions on the slopes at the moment of data collection. It is presently reported that the elaboration of three sectors where the lighting conditions can be considered homogeneous leads to the solution of the problem of the width and reciprocal overlapping of the radiometric spectra for vegetation cover and cultivated areas. Each homogeneously lighted sector may be further treated with a series of techniques adaptable to specific problems. O.C.

A88-17114* Michigan Univ., Ann Arbor.
MICROWAVE PROPAGATION CONSTANT FOR A VEGETATION CANOPY WITH VERTICAL STALKS
FAWWAZ T. ULABY, AHAD TAVAKOLI, and THOMAS B. A. SENIOR (Michigan, University, Ann Arbor) (ESA and IEEE, International Geoscience and Remote Sensing Symposium, Zurich, Switzerland, Sept. 8-11, 1986) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-25, Nov. 1987, p. 714-725. refs
(Contract NAG5-480)

An equivalent-medium model is developed to relate the propagation constant gamma, associated with propagation of the

mean field through a vegetation canopy, to the geometrical and dielectric parameters of the canopy constituents. The model is intended for media containing vertical cylinders, representing the stalks, and randomly oriented disks, representing the leaves. The formulation accounts for both absorption and scattering by the cylinders, but uses a quasi-static approximation with respect to the leaves. The model was found to be in good agreement with experimental results at 1.62 and 4.75 GHz, but underestimates the extinction loss at 10.2 GHz. The experimental component of the study included measurements of the attenuation loss for horizontally polarized and vertically polarized waves transmitted through a fully grown corn canopy, and of the phase difference between the two transmitted waves. The measurements were made at incidence angles of 20, 40, 60, and 90 deg relative to normal incidence. The major conclusion of this study is that the proposed model is suitable for corn-like canopies, provided the leaves are smaller than lambda in size. Author

A88-17115*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LASER-INDUCED FLUORESCENCE (LIF) FROM PLANT FOLIAGE
EMMETT W. CHAPPELLE and DARREL L. WILLIAMS (NASA, Goddard Space Flight Center, Greenbelt, MD) (ESA and IEEE, International Geoscience and Remote Sensing Symposium, Zurich, Switzerland, Sept. 8-11, 1986) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-25, Nov. 1987, p. 726-736. NASA-supported research. Previously announced in STAR as N87-18204. refs

The fluorescence spectra and fluorescence induction kinetics of green plants excited at 337 nm by a laser were studied. They correlate with plant type, as well as with changes in the physiology of the plant as the result of stress. The plant types studied include herbaceous dicots, monocots, hardwoods, conifers, and algae. These plant types could be identified on the basis of differences in either the number of fluorescent bands or the relative intensity of the bands. Differences in fluorescent spectra which could be related to vigor status are observed in conifers located in an area of high atmospheric deposition. Changes in the fluorescence spectra and induction kinetics are also seen in plants grown under conditions of nutrient deficiency and drought stress. Author

A88-17850
RECONSTRUCTION OF THE OPTICAL PARAMETERS OF A CROP CANOPY ACCORDING TO THE SPECTRAL BRIGHTNESS COEFFICIENT USING THE MONTE CARLO METHOD [O VOSSTANOVLENII OPTICHESKIH PARAMETROV POSEVA PO KOEFFITSIENTU SPEKTRAL'NOI IARKOSTI METODOM MONTE-KARLO]
A. MARSHAK (AN ESSR, Institut Astrofiziki i Fiziki Atmosfery, Tartu, Estonian SSR) Eesti NSV Teaduste Akadeemia, Toimetised, Fueuesika-Matemaatika (ISSN 0367-1429), vol. 36, no. 3, 1987, p. 289-293. In Russian. refs

The general approach for solving the inverse problem involving the estimation of crop-canopy parameters by the Monte Carlo method is described. The canopy is simulated by horizontal mat leaves. Numerical results for estimating the transmittance and reflectance characteristics of leaves and the soil brightness coefficient are presented. In addition, the inversion of the canopy-reflectance model for estimating the leaf area index is considered. B.J.

A88-18292
PREPARING FOR SATELLITE MICROWAVE SYSTEMS FOR RENEWABLE RESOURCE MANAGEMENT
R. J. BROWN (Canada Centre for Remote Sensing, Ottawa) Geocarto International (ISSN 1010-6049), vol. 2, Sept. 1987, p. 31-37. refs

Exceptional timeliness of vegetation-monitoring data is obtainable by means of microwave imaging. Attention is presently given to the renewable resource management-related use of SAR imagery from ESA, NASDA, and Canadian Radarsat operations by means of methodologies currently being developed in Canada under the egis of the Radar Data Development Program (RDDP). The program further encompasses data acquisition by both airborne SAR imagery and ground-based scatterometers. The results obtained thus far by the RDDP in the fields of crop type determination, land use change determination, and agricultural field size assessment are discussed. O.C.

A88-18294
DIGITAL REMOTE SENSING FOR FORESTRY - REQUIREMENTS AND CAPABILITIES, TODAY AND TOMORROW
F. J. AHERN (Canada Centre for Remote Sensing, Ottawa) and D. G. LECKIE (Canadian Forestry Service, Chalk River, Canada) Geocarto International (ISSN 1010-6049), vol. 2, Sept. 1987, p. 43-52. refs

A88-18870
DIRECTIONAL REFLECTANCE FACTOR DISTRIBUTIONS FOR TWO FOREST CANOPIES
JOHAN KLEMAN (Stockholm, Universitet, Sweden) Remote Sensing of Environment (ISSN 0034-4257), vol. 23, Oct. 1987, p. 83-96. Research supported by the Swedish Board for Space Activities. refs

Directional reflectance factor distributions were measured over one pine (Pinus silvestris) and one spruce stand (Picea abies), with sun elevations in the range 30-50 deg. Measurements were made from a helicopter at 200 m altitude, using a handheld radiometer with wavelength bands centered at 0.68, 0.85, and 1.6 microns. Assuming bilateral symmetry, only one half of the hemisphere was measured, with 45 deg azimuthal and 15 deg zenithal increments, up to 60 deg off-nadir. Both stands showed a highly anisotropic reflectance, especially in the red band, and less pronounced differences in the 0.85 micron band. The effect in the 1.6 micron band was intermediate between the two other bands. In the red band the reflectance of the spruce stand varied with a factor of 7 within the measured cone, but markedly less for the pine stand. The data were also analyzed along a transect corresponding to the SPOT off-nadir geometry, as typical for summer registrations in Scandinavia. It was found that at 27 deg off-nadir in a WNW direction the reflectance increased by a factor of up to 1.6, as compared to nadir measurement. Systematic reflectance variation within the SPOT field of view was up to 10 percent for the spruce canopy, in the maximum westerly off-nadir direction. Since spruce forest is among the most anisotropically reflecting vegetation types due to its geometrical structure and dense canopy, the stated values probably represent maximum values for the angular dependence that will be met in applications. Author

A88-18871
A MODEL FOR SOIL SURFACE ROUGHNESS INFLUENCE ON THE SPECTRAL RESPONSE OF BARE SOILS IN THE VISIBLE AND NEAR-INFRARED RANGE
JERZY CIERNIEWSKI (Poznan, Akademia Rolnicza, Poland) Remote Sensing of Environment (ISSN 0034-4257), vol. 23, Oct. 1987, p. 97-115. Research supported by the Institute of Land-Surveying and Cartography. refs

A88-19187* Michigan Univ., Ann Arbor.
MEASURING AND MODELING THE BACKSCATTERING CROSS SECTION OF A LEAF
T. B. A. SENIOR, K. SARABANDI, and F. T. ULABY (Michigan, University, Ann Arbor) Radio Science (ISSN 0048-6604), vol. 22, Nov. 1987, p. 1109-1116. refs
(Contract NAG5-480)

Leaves are a significant feature of any vegetation canopy, and for remote sensing purposes it is important to develop an effective model for predicting the scattering from a leaf. From measurements of the X band backscattering cross section of a coleus leaf in varying stages of dryness, it is shown that a uniform resistive sheet constitutes such a model for a planar leaf. The scattering is determined by the (complex) resistivity which is, in turn, entirely specified by the gravimetric moisture content of the leaf. Using an available asymptotic expression for the scattering

from a rectangular resistive plate which includes, as a special case, a metallic plate whose resistivity is zero, the computed backscattering cross sections for both principal polarizations are found to be in excellent agreement with data measured for rectangular sections of leaves with different moisture contents. If the resistivity is sufficiently large, the asymptotic expressions do not differ significantly from the physical optics ones, and for naturally shaped leaves as well as rectangular sections, the physical optics approximation in conjunction with the resistive sheet model faithfully reproduces the dominant feataures of the scattering patterns under all moisture conditions. Author

A88-19571
ESTIMATION OF SOIL TEMPERATURE PROFILES FROM REMOTE MICROWAVE AND IR MEASUREMENTS [OTSENKA PROFILIA TEMPERATURY POCHVY PO DANNYM DISTANTSIONNYKH SVCH- I IK-IZMERENII]
E. A. REUTOV and A. M. SHUTKO (AN SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 78-85. In Russian. refs

A method for estimating soil temperature profiles on the basis of the heat-conduction equation is presented. The procedure uses microwave and IR remote-sensing data and makes possible soil-temperature estimation with an rms error of 3 K and a maximum error of less than 5.0-5.6 K. B.J.

A88-19572
MONTE CARLO ESTIMATION OF CROP-CANOPY ARCHITECTURE PARAMETERS ON THE CANOPY REFLECTANCE [OTSENKA METODOM MONTE-KARLO VLIIANIIA PARAMETROV ARKHITEKTURY POSEVA NA EGO KOEFFITSIENT SPEKTRAL'NOI IARKOSTI]
IU. K. ROSS and A. L. MARSHAK (AN ESSR, Institut Astrofiziki i Fiziki Atmosfery, Tartu, Estonian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 86-93. In Russian.

The directional reflectance of a canopy modeled by horizontal mat leaves and opaque stalks is examined. The influence of canopy architecture height, size of leaves and stalks, leaf-to-leaf spacing, genetic spiral angle, etc. on the reflection indicatrix is considered. B.J.

A88-19813
THE RELATIONSHIP BETWEEN BRIGHTNESS TEMPERATURE AND SOIL MOISTURE - SELECTION OF FREQUENCY RANGE FOR MICROWAVE REMOTE SENSING
K. S. RAO, GIRISH CHANDRA, and P. V. NARASIMHA RAO (Indian Institute of Technology, Bombay, India) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1531-1545. Research sponsored by the Department of Science and Technology. refs

The analysis of brightness temperature data acquired from field and aircraft experiments demonstrates a linear relationship between soil moisture and brightness temperature. However, the analysis of brightness temperature data acquired by the Skylab radiometer demonstrates a nonlinear relationship between soil moisture and brightness temperature. In view of the above and also because of recent theoretical developments for the calculation of the dielectric constant and brightness temperature under varying soil moisture profile conditions, an attempt is made to study the theoretical relationship between brightness temperature and soil moisture as a function of frequency. Through the above analysis, the appropriate microwave frequency range for soil moisture studies is recommended. Author

A88-19814
ESTIMATION OF THE EVAPOTRANSPIRATION USING SURFACE AND SATELLITE DATA
Y. V. SERAFINI (IBM France, S.A.; Ecole Normale Superieure, Paris, France) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1547-1562. refs

A method to derive evapotranspiration from a combination of satellite and conventional data is investigated. For this purpose NOAA AVHRR infrared images on clear days of various seasons are used to derive surface temperatures over France. These temperatures are then compared to the shelter-height temperatures collected at the WMO standard meteorological stations at the time of satellite overpass. The difference between the two temperatures varies both with season and latitude. To analyze those results, a model of the soil-vegetation interface, forced by a reconstruction of the surface fluxes derived from the WMO data, is used. The model simulates reasonably well the diurnal and seasonal variations in the difference between satellite surface temperature and surface-air temperature. The corresponding latitudinal variations which occur in summer may be interpreted in terms of evapotranspiration. The limitations of this method are determined by a model sensitivity study; in particular they are due to the role played by tall vegetation. Author

A88-19816
PRELIMINARY EVALUATION OF THE RELATIONSHIPS BETWEEN SPOT-1 HRV DATA AND FOREST STAND PARAMETERS
F. M. DANSON (Sheffield, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1571-1575. refs

Image data recorded from SPOT-1 were correlated with five forest stand parameters: mean percentage canopy cover, tree density, mean tree diameter at breast height (DBH), mean tree height and subcompartment age. With the exception of percentage canopy cover, the correlation coefficients for the near-infrared waveband (S3) were all significant at the 99 percent confidence level. The correlation coefficients for the red (S2) and green (S1) wavebands were lower and this may be due to the low dynamic range of the data for forest canopies in these wavebands. Author

N88-10410# Physics and Electronics Lab. TNO, The Hague (Netherlands).
MOISTURE DETERMINATIONS IN AND UNDER VEGETATION CANOPIES. PART 2: RESULTS AFTER PARAMETERIZATION OF THE CLOUD MODEL
G. P. DELOOR Dec. 1986 38 p
(FEL-1986-63; TD-87-0051; ETN-87-90861) Avail: NTIS HC A03/MF A01

The CLOUD one layer vegetation model was parameterized. Calculations to determine the influence of soil moisture content and biomass on the radar backscatter as a function of frequency can be made. It is clear that soil moisture and biomass determinations need different frequencies and incidence angles. A 75 deg grazing angle is optimum for soil moisture measurements (minimum interference by the canopy), while 45 and 20 deg are better for obtaining information on the actual canopy itself (minimum interference by the underlying soil). The lower angle is used in SLAR observations, while 45 deg seems more realistic for observation from space. ESA

N88-10411*# Kansas State Univ., Manhattan. Evapotranspiration Lab.
ESTIMATING REGIONAL EVAPOTRANSPIRATION FROM REMOTELY SENSED DATA BY SURFACE ENERGY BALANCE MODELS Annual Report, 15 May 1986 - 14 Feb. 1987
GHASSEM ASRAR, EDWARD KANEMASU, R. B. MYNENI, R. L. LAPITAN, T. R. HARRIS, J. M. KILLEEN, D. I. COOPER, and C. HWANG 14 Feb. 1987 64 p
(Contract NAG5-389)
(NASA-CR-181400; NAS 1.26:181400) Avail: NTIS HC A04/MF A01 CSCL 08H

Spatial and temporal variations of surface radiative temperatures of the burned and unburned areas of the Konza tallgrass prairie were studied. The role of management practices, topographic conditions and the uncertainties associated with in situ or airborne surface temperature measurements were assessed. Evaluation of diurnal and seasonal spectral characteristics of the burned and unburned areas of the prairie was also made. This was accomplished based on the analysis of measured spectral reflectance of the grass canopies under field conditions, and

modelling their spectral behavior using a one dimensional radiative transfer model. Author

N88-10434# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Umweltmeteorologie.
INVESTIGATION OF LARGE SCALE IMPACT OF AIR POLLUTION COMPONENTS ON FOREST ECOSYSTEMS IN BAVARIA, WEST GERMANY
DIETER PAFFRATH and WOLFGANG PETERS Apr. 1987 175 p In GERMAN; ENGLISH summary Sponsored by Bayerischen Staatsministerium fuer Landesentwicklung und Umweltfragen, West Germany
(DFVLR-FB-87-17; ISSN-0171-1342; ETN-87-90779) Avail: NTIS HC A08/MF A01; DFVLR, Cologne, West Germany DM 47.50

On the basis of large scale concentration distributions of SO2, NOx, ozone, and acidity forming particles over forest damage areas, measured by aircraft and van, typical average impact distributions were obtained. The impact of polluted fog on forests was investigated. No direct effects of gaseous SO2 and NOx can be detected. However, serious forest damage seems to prevail in areas where the average ozone concentration is highest. A clear influence of polluted fog on forest disease is not found. ESA

N88-11204*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va. Dept. of Geography.
CORRELATION BETWEEN AIRCRAFT MSS AND LIDAR REMOTELY SENSED DATA ON A FORESTED WETLAND IN SOUTH CAROLINA
JOHN R. JENSEN, MICHAEL E. HODGSON, HALKARD E. MACKEY, JR. (Du Pont de Nemours, E. I. and Co., Aiken, S.C), and WILLIAM KRABILL 1987 42 p Presented at the Fall Convention of the American Society of Photogrammetry and Remote Sensing, Reno, Nev., 4-9 Oct. 1987 Submitted for publication
(Contract DE-AC09-76SR-00001)
(NASA-TM-89643; NAS 1.15:89643; DE87-011229; DP-MS-87-15; CONF-871098-1) Avail: NTIS HC A03/MF A01 CSCL 02F

Wetlands in a portion of the Savannah River swamp forest, the Steel Creek Delta, were mapped using April 26, 1985 high-resolution aircraft multispectral scanner (MSS) data. Due to the complex spectral characteristics of the wetland vegetation, it was necessary to implement several techniques in the classification of the MSS imagery of the Steel Creek Delta. In particular, when performing unsupervised classification, an iterative cluster busting technique was used which simplified the cluster labeling process. In addition to the MSS data, light detecting and ranging (LIDAR) data were acquired by National Aeronautics and Space Administration (NASA) personnel along two flightlines over the Steel Creek Delta. These data were registered with the wetland classification map and correlated. Statistical analyses demonstrated that the laser derived canopy height information was significantly correlated with the Steel Creek Delta wetland classes encountered along the profiling transect of the LIDAR data. DOE

N88-11205*# Purdue Univ., West Lafayette, Ind. Lab. for Applications of Remote Sensing.
ESTIMATING SCATTERED AND ABSORBED RADIATION IN PLANT CANOPIES BY REMOTE SENSING Final Report
G. S. T. DAUGHTRY and K. J. RANSON 16 Nov. 1987 22 p
(Contract NAG5-771)
(NASA-CR-181390; NAS 1.26:181390; LARS-071587) Avail: NTIS HC A03/MF A01 CSCL 02F

Several research avenues are summarized. The relationships of canopy characteristics to multispectral reflectance factors of vegetation are reviewed. Several alternative approaches for incorporating spectrally derived information into plant models are discussed, using corn as the main example. A method is described and evaluated whereby a leaf area index is estimated from measurements of radiation transmitted through plant canopies, using soybeans as an example. Albedo of a big bluestem grass canopy is estimated from 60 directional reflectance factor measurements. Effects of estimating albedo with substantially smaller subsets of data are evaluated. Author

N88-12160# Food and Agriculture Organization of the United Nations, Rome (Italy). Remote Sensing Center.
VEGETATION CLASSIFICATION, LAND SYSTEMS AND MAPPING USING SPOT MULTISPECTRAL DATA: PRELIMINARY RESULTS
J. A. HOWARD and D. LANTIERI *In* CNES, SPOT 1: First In-Flight Results p 137-149 1987
Avail: CEPADUES-Editions, Toulouse, France

Multispectral SPOT data covering 1800 sq km of Central Kenya were evaluated for vegetation classification, land systems, and mapping using a hierarchical approach to vegetation classification. The study of natural vegetation shows that major improvements can be obtained when the analysis is made within land systems easily delineated on SPOT imagery. Woody vegetation can be mapped in 3 broad height classes (forest greater than 20 m, woodland 5 to 20 m, shrubland less than 5 m) and 3 cover classes (closed, dense to open, sparse). Grasslands can be mapped in classes according to cover (dense, open) and habitat. Supervised digital classification provides better results than unsupervised classification. Study of agriculture shows that inside each land system, farming types can be mapped on SPOT imagery by field sizes (five classes), field density (three classes) and irrigated/nonirrigated land. Crop type mapping is improved when performed inside strata defined by farm size and density. Visual interpretation and mapping of forest plantations within a land system provide information on forest cover, stand height/density classes, and species. ESA

N88-12166# Centre National d'Etudes Spatiales, Toulouse (France). Lab. d'Etudes et de Recherches en Teledetection Spatiale.
VEGETATION STUDIES IN THE NATIONAL PARK OF COMOE (IVORY COAST) USING SPOT 1 SATELLITE DATA
F. BLASCO, F. LAVENU, and G. SAINT *In its* SPOT 1: First In-Flight Results p 189-195 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

The capability of SPOT-1 to discriminate from space the woody fraction from the grass cover in areas where trees and shrubs are scattered was tested. The study of the panchromatic and multispectral modes offered the possibility to classify secondary vegetation types and to map them at scales of 1/50,000. ESA

N88-12168# Asian Inst. of Tech., Bangkok (Thailand).
A COMPARATIVE THEMATIC MAPPING ANALYSIS OF SPOT DATA: THE VIENTIANE PLAIN (LAOS)
D. BOREL, KAEW NUALCHAWEEK, and PHADEJ SAVASDIBUTR (Mekong Committee Secretariat, Bangkok, Thailand) *In* CNES, SPOT 1: First In-Flight Results p 203-208 1987
Avail: CEPADUES-Editions, Toulouse, France

Thematic mapping of the 3500 sqkm Vientiane plain (Laos) a potential agricultural area, in terms of floods, soils, and topography is described. Photointerpretation of images at scale 1:30,000 allowed the production of maps at scale 1:100,000 in terms of geomorphology, morphopedology, land use/land cover, flood risk assessment, and agrosystems. The results are the reference data to test the possibility of using SPOT images to conduct the inventory of the natural environment and agricultural potentialities for this area. Results are encouraging. ESA

N88-12169# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SPOT DATA FOR CROP DISCRIMINATION IN SOUTHERN BRAZIL
G. T. BATISTA, S. C. CHEN, J. F. DALLEMAND, and A. T. TARDIN *In* CNES, SPOT 1: First In-Flight Results p 209-222 1987
Avail: CEPADUES-Editions, Toulouse, France

Spatial resolution and spectral characteristics of SPOT HRV data for crop discrimination in Southern Brazil, taking into

consideration the off-nadir viewing capability of SPOT were assessed using a test site having a variety of cover types during the winter growing season. Results using interactive image processing facilities show a systematic vertical noise especially noticeable in band 2 of SPOT occurring at a 7 pixel interval when both P and XS modes of 1 HRV were obtained simultaneously. The near infrared band presents the greatest information content in all satellite products analyzed compared with the visible bands. However, using a single band for crop discrimination, the chlorophyll absorption bands (band 2 for SPOT/HRV and band 3 for LANDSAT/TM) perform better than the near infrared band. It is necessary to implement contextual analysis to benefit from the augmented spatial resolution of SPOT. ESA

N88-12170# Ministere de l'Agriculture (France).
SPOT: A TOOL FOR AGRICULTURAL STATISTICS [SPOT: UN OUTIL POUR LES STATISTIQUES AGRICOLES]
J. MEYER-ROUX, PH. FOURNIER, and R. PASTORELLI *In* CNES, SPOT 1: First In-Flight Results p 225-233 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

Use of SPOT satellite data to get or improve agricultural statistics by constructing an areaframe sampling, automated classification to get crop acreages, and extracting the yield component for crop prediction, was studied. The delays in the distribution are sufficient for the first two objectives, not for the third one. The quality control of the data suggests that SPOT images are well suited for areaframes since most physical boundaries on the ground can be recognized on images and vice-versa. Equalization of the data of twin images must be made before doing an automated classification covering both of them. ESA

N88-12171# Institut National de la Recherche Agronomique, Thiverval-Grignon (France).
APPLICATION OF MULTITEMPORAL SPOT DATA FOR CROP MONITORING: EFFECTS OF FROST AND DROUGHT [APPLICATIONS DES DONNEES MULTIDATES SPOT A LA SURVEILLANCE DES CULTURES: EFFETS DU GEL ET DE LA SECHERESSE]
P. BOISSARD, J. G. POINTEL, J. P. MOREAU, and G. RIVET *In* CNES, SPOT 1: First In-Flight Results p 235-244 1987 In FRENCH
(Contract PEPS-80; CNES-ATP-1985)
Avail: CEPADUES-Editions, Toulouse, France

Crop monitoring by SPOT in unusual weather conditions is described. Climatic conditions of 1986 in Ile-de-France region are different from normal conditions based on 40 yr averaging, because of strong frost during February followed by hydric deficit. These meteorological data are responsible for cereal field decrease (10 to 20 q/ha). Three SPOT scenes were analyzed: one at the end of cold conditions, two during the hotest period. The results show how SPOT allows frost injuries description in relation to final yield. Crop response to hydric stress is monitored using a vegetation index variation within a 5 day period. ESA

N88-12172# Ministere de l'Energie et des Ressources (Quebec). Centre de Coordination de la Teledetection.
USE OF SPOT PANCHROMATIC IMAGERY TO UPDATE FOREST MAPS OF NORTHERN QUEBEC, CANADA [UTILISATION DE L'IMAGE SPOT PANCHROMATIQUE DANS LA MISE A JOUR DES CARTES FORESTIERES DU QUEBEC BOREAL, CANADA]
MAURICE CARIGNAN, CHANTAL SEUTHE, and JEAN-PIERRE LETOURNEAU *In* CNES, SPOT 1: First In-Flight Results p 247-252 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

The use of a SPOT panchromatic image to update forest cut-overs on 1:20 000 maps was studied. In the boreal forest, the SPOT picture could replace conventional aerial photographs to clearly delineate clear and strip cuts and the remaining forested patches. The area differences computed from both sources of information are less than 5 percent. However, it is anticipated that high costs and long delays in acquiring SPOT images will limit, in the short term, their widespread use. ESA

N88-12173# Technical Research Centre of Finland, Espoo.
STAND BASED FOREST INVENTORY FROM SPOT IMAGE. FIRST EXPERIMENTS
TUOMAS HAEME and ERKKI TOMPPO *In* CNES, SPOT 1: First In-Flight Results p 253-258 1987
Avail: CEPADUES-Editions, Toulouse, France

A stand-based forest inventory method where the preliminary inventory result for the forest management plan is obtained with numerical interpretation of SPOT satellite images (and/or LANDSAT TM images) is considered. Stand delineation and stand variates estimation, as well as change detection are studied. The basic ground truth data are field-measured systemic sample plots of a national forest survey. The visible channels are nearly similar, but SPOT includes more spatial information than LANDSAT TM images. The interpretation of SPOT images requires spatial interpretation methods. Stand delineation with SPOT image segmentation shows differences when compared to corresponding segmentation from LANDSAT TM. Visual products made from SPOT images can partially replace aerial photographs. ESA

N88-12174# Sveriges Lantbruksuniv., Umea. Remote Sensing Lab.
APPLICABILITY OF SPOT FOR FOREST INVENTORY, MAPPING AND CHANGE MONITORING
S. JAAKKOLA, L. JOHANSSON, and O. HAGNER *In* CNES, SPOT 1: First In-Flight Results p 259-264 1987
(Contract PEPS-PROJ-155)
Avail: CEPADUES-Editions, Toulouse, France

Use of digital SPOT satellite imagery for forest inventory was studied on a test site in northern Sweden. The original image data was matched (PA+XS), corrected geometrically, and resampled to 10 m. Filtering algorithms were developed and/or applied for detection of logging roads and timber stand boundaries. Timber stand mapping was made using three methods derived from the maximum likelihood rule. Change monitoring was tried by interpreting a single date SPOT image and a year-old CIR aerial photo. All logging roads could be mapped; 88 percent of new clear cuts are found; and 95 percent and 87 percent of timber stands, with 6 and 9 classes, respectively, are correctly classified. The segment timber stand mapping approach developed gives the best results considering visual impression, the overall performance tested, and the boundary analysis made. ESA

N88-12182# Kernforschungszentrum, Karlsruhe (West Germany).
DEVELOPMENT OF A METHOD FOR FOREST DAMAGE INVENTORY USING MULTISPECTRAL SCANNER DATA
G. HILDEBRANDT, A. KADRO, S. KUNTZ, and C. KIM (Freiburg Univ., West Germany) Mar. 1987 105 p In GERMAN; ENGLISH summary Original contains color illustrations
(Contract PEF-83/001/EG)
(KFK-PEF-25; ISSN-0931-2749; ETN-87-91033) Avail: NTIS HC A06/MF A01

Spectral reflection properties of forest vegetation, especially the difference between healthy and damaged trees and stands, was investigated, based on the evaluation of multispectral scanner data in the visual, near IR, and middle IR. Data were collected from different flight altitudes. A computer aided classification for forest stand damage inventory is discussed. ESA

N88-12183# International Bank for Reconstruction and Development, Washington, D.C.
DESERTIFICATION IN THE SAHELIAN AND SUDANIAN ZONES OF WEST AFRICA
J. E. GORSE and D. R. STEEDS 1987 77 p
(PB87-217063; WORLD BANK/TP-61; ISBN-0-8213-0897-1; LC-87-16131) Avail: NTIS MF A01; HC available from World Bank, 1818 H Street, N.W., Washington, D.C. 20433 CSCL 08B

Desertification is defined as the sustained decline of the biological productivity of arid and semi-arid land. It is the results

of pressures both human (increased population) and climatic (variable rainfall and long-term changes in climate). Three traditional production systems exist in the Sahelian and Sudanian Zones (SSZ): agrosylvicultural, and sylvopastoral. Development activities were tried in the past in the agriculture, livestock, and forestry sectors. Strategies for better resource management depend on the balance between the rural population and the carrying capacity of the land. Such strategies include increasing research on production systems, training staff and farmers, reducing the population through child spacing and resettlement, increasing the stock of fuelwood, reforming land laws, and providing incentives for increased agricultural and forestry production. GRA

N88-13761*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE USE OF AIRBORNE IMAGING SPECTROMETER DATA TO DETERMINE EXPERIMENTALLY INDUCED VARIATION IN CONIFEROUS CANOPY CHEMISTRY
NANCY A. SWANBERG (TGS Technology, Inc., Moffett Field, Calif.) and PAMELA A. MATSON *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 70-74 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 08B

It was experimentally determined whether induced differences in forest canopy chemical composition can be detected using data from the Airborne Imaging Spectrometer (AIS). Treatments were applied to an even-aged forest of Douglas fir trees. Work to date has stressed wet chemical analysis of foilage samples and correction of AIS data. Plot treatments were successful in providing a range of foliar N2 concentrations. Much time was spent investigating and correcting problems with the raw AIS data. Initial problems with groups of drop out lines in the AIS data were traced to the tape recorder and the tape drive. Custom adjustment of the tape drive led to recovery of most missing lines. Remaining individual drop out lines were replaced using average of adjacent lines. Application of a notch filter to the Fourier transform of the image in each band satisfactorily removed vertical striping. The aspect ratio was corrected by resampling the image in the line direction using nearest neighbor interpolation. Author

N88-13762*# Research Center Graz (Austria).
OVERVIEW OF AUSTRIAN AIRBORNE IMAGING SPECTROMETER (AIS) PROGRAMME AND FIRST RESULTS
C. BANNINGER *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 75-82 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 08B

Airborne Imaging Spectrometer (AIS) data collected from eight test areas in Austria were evaluated for their usefulness in forest damage assessment, geobotany, alpine vegetation mapping, and land use classification. Difficulties encountered in installing the SPAM spectral analysis software for use on the image display system and the necessity to adapt existing programs for this task impeded and delayed the analysis of the AIS data. Spectral reflectance curves obtained from a geobotanical test site show a marked increase in reflectance across most of the measured spectrum for metal stressed spruce trees compared with nonstressed spruce trees. Author

N88-13763*# Delaware Univ., Newark. Coll. of Marine Studies.
AIS-2 SPECTRA OF CALIFORNIA WETLAND VEGETATION
MICHAEL F. GROSS, SUSAN L. USTIN (California Univ., Davis.), and VYTAUTAS KLEMAS *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 83-90 15 Aug. 1987 Prepared in cooperation with California Univ., Berkeley
(Contract NAGW-950)
Avail: NTIS HC A09/MF A01 CSCL 08B

Spectral data gathered by Airborne Imaging Spectrometers-2 from wetlands were analyzed. Spectra representing stands of green Salicornia virginica, green Sesuvium verrucosum, senescing Distichlis spicata, a mixture of senescing Scirpus acutus and Scirpus californicus, senescing Scirpus paludosus, senescent S. paludosus, mowed senescent S. paludosus, and soil were isolated. No difference among narrowband spectral reflectance of the cover types was apparent between 0.8 to 1.6 micron. There were, however, broadband differences in brightness. These differences were sufficient to permit a fairly accurate decomposition of the image into its major cover type components using a procedure that assumes an additive linear mixture of surface spectra. Author

N88-13764*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TOWARD DETECTING CALIFORNIA SHRUBLAND CANOPY CHEMISTRY WITH AIS DATA
CURTIS V. PRICE and WALTER E. WESTMAN *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 91-97 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 08B

Airborne Imaging Spectrometer (AIS)-2 data of coastal sage scrub vegetation were examined for fine spectral features that might be used to predict concentrations of certain canopy chemical constituents. A Fourier notch filter was applied to the AIS data and the TREE and ROCK mode spectra were ratioed to a flat field. Portions of the resulting spectra resemble spectra for plant cellulose and starch in that both show reduced reflectance at 2100 and 2270 nm. The latter are regions of absorption of energy by organic bonds found in starch and cellulose. Whether the relationship is sufficient to predict the concentration of these chemicals from AIS spectra will require testing of the predictive ability of these wavebands with large field sample sizes. Author

N88-13765*# Montana Univ., Missoula.
MEASURING NEAR INFRARED SPECTRAL REFLECTANCE CHANGES FROM WATER STRESSED CONIFER STANDS WITH AIS-2
GEORGE RIGGS and STEVEN W. RUNNING *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 100-106 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 08B

Airborne Imaging Spectrometer-2 (AIS-2) data was acquired over two paired conifer stands for the purpose of detecting differences in spectral reflectance between stressed and natural canopies. Water stress was induced in a stand of Norway spruce and white pine by severing the sapwood near the ground. Water stress during the AIS flights was evaluated through shoot water potential and relative water content measurements. Preliminary analysis with raw AIS-2 data using SPAM indicates that there were small, inconsistent differences in absolute spectral reflectance in the near infrared 0.97 to 1.3 micron between the stressed and natural canopies. Author

N88-14456# Joint Publications Research Service, Arlington, Va.
AN-30M CLOUD-SEEDING AIRPLANE IN INTERNATIONAL EXHIBITION Abstract Only
A. PYRKOV *In its* USSR Report: Earth Sciences p 2 22 May 1987 Transl. into ENGLISH from Vozdushnyy Transport (Moscow, USSR), 6 Dec. 1986 p 4
Avail: NTIS HC A06/MF A01

The capabilities of the AN-30M aircraft intended for weather modification flights are noted. It is claimed that this new aircraft is very effective. The airplane was also tested in agricultural applications, and it has been used to purify the air over industrial enterprises. R.J.F.

N88-14483 Wageningen Agricultural Univ. (Netherlands).
APPLICATION OF REMOTE SENSING TO AGRICULTURAL FIELD TRIALS Ph.D. Thesis
J. G. P. W. CLEVERS Apr. 1986 227 p
(ISBN-90-6754-089-7; ISSN-0169-345X; B8677421; PUB-86-4(1986); ETN-88-91349) Avail: Issuing Activity

Use of remote sensing to support and/or replace conventional agricultural field measurements in field trials by enabling quantitative information about an entire field trial to be obtained instantaneously, repeatedly, and nondestructively was assessed. Black and white multispectral aerial photography (visible and near infrared) is shown

to be the most appropriate technique. The validity of canopy spectral reflectance factors, derived by a method of calibration and data correction, is demonstrated. A simplified reflectance model for vegetation is derived for estimating leaf area index (LAI) during the whole growing season by means of a corrected infrared reflectance factor. The latter factor is derived from the infrared reflectance by correcting for the reflectance of the background (soil and yellow leaves). Statistical analysis of field trials reveals that the presence of treatment effects can be shown with larger power and that coefficients of variation are smaller for the LAI estimated by the simplified reflectance model than for the LAI measured in the field. 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.

A88-13548* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
SEASONAL ALBEDO OF AN URBAN/RURAL LANDSCAPE FROM SATELLITE OBSERVATIONS
CHRISTOPHER L. BREST (NASA, Goddard Institute for Space Studies; Sigma Data Services Corp., New York) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 26, Sept. 1987, p. 1169-1187. refs

Using data from 27 calibrated Landsat observations of the Hartford, Connecticut area, the spatial distribution and seasonal variation of surface reflectance and albedo were examined. Mean values of visible reflectance, near-IR reflectance, and albedo are presented (for both snow-free and snow-cover observations) according to 14 land use/land cover categories. A diversity of albedo values was found to exist in this type of environment, associated with land cover. Many land-cover categories display a seasonal dependence, with intracategory seasonal differences being of comparable magnitude to intercategory differences. Key factors in determining albedo (and its seasonal dynamics) are the presence or absence of vegetation and the canopy structure. Snow-cover/snow-free differences range from a few percent (for urban land covers) to over 40 percent (for low-canopy vegetation). I.S.

A88-13624
SOUTH CENTRAL COAST COOPERATIVE AEROMETRIC MONITORING PROGRAM (SCCCAMP)
WALTER F. DABBERDT (National Center for Atmospheric Research, Boulder, CO) and WILLIAM VIEZEE (SRI International, Menlo Park, CA) American Meteorological Society, Bulletin (ISSN 0003-0007), vol. 68, Sept. 1987, p. 1098-1110. Research sponsored by the Western Oil and Gas Association, California Air Resources Board, and EPA. refs

The SCCCAMP field measurement program, conducted on Sept. 3 to Oct. 7, 1985, is the most comprehensive mesoscale photochemical study of its type ever undertaken. The study area encompasses 2 x 10,000 sq km of coastal and interior south-central California including the Santa Barbara Channel. A review of earlier experimental and analytical studies in the area is followed by the organizational framework and planning for this cooperative program. The experimental design and measurement systems are described. Existing ground-based meteorological and air pollution networks were supplemented by additional surface aerometric stations, dual Doppler radars, rawinsondes, and a network of Doppler acoustic profilers. Airborne measurement platforms included one dual-channel lidar, three aerometric sampling aircraft, and a meteorological research aircraft. Gas tracer tests included 4-h releases of three perfluorocarbon gas tracers. Tracer measurements were made over two-day periods at 50 surface locations and aloft by aircraft with a near-realtime two-trap chromatographic system. Author

A88-13700
TECHNIQUES AND INSTRUMENTS FOR INVESTIGATING TRACE GASES IN THE ATMOSPHERE [METODY I PRIBORY DLIA ISSLEDOVANIIA MALYKH GAZOVYKH PRIMESEI V ATMOSFERE]
V. U. KHATTATOV, ED. Moscow, Gidrometeoizdat (Tsentral'naia Aerologicheskaia Observatoriia, Trudy, No. 161), 1986, 88 p. In Russian. No individual items are abstracted in this volume.

Methods for determining trace gas components in the atmosphere which are essential to the study of the ozone layer and atmospheric contamination are presented. Particular attention is given to problems in the development of highly sensitive optical gas analyzers for observing radioactive trace gases in the free atmosphere with high performance and possible averaging of their concentration fields at different space and time scales. Data on the natural variability of carbon monoxide and nitrogen peroxide in the background atmosphere are presented. K.K.

A88-14056* National Aeronautics and Space Administration. Earth Resources Lab., Bay St. Louis, Miss.
DEVELOPMENT OF GEOGRAPHIC INFORMATION DATA BASE FOR PITKIN COUNTY, COLORADO USING LANDSAT IMAGERY AND OTHER ANCILLARY DATA
THOMAS D. CHENG (NASA, Earth Resources Laboratory, Bay Saint Louis, MS) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 62-71. refs

A88-14880
REMOTE SENSING METHODOLOGIES AND GEOGRAPHY
PAUL J. CURRAN (Sheffield, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1255-1275. refs

Remote sensing is a technique used in scientific and technological approaches to geographical research. In the scientific approaches (of which the empirical are the most popular) the motivation is curiosity, the goal is knowledge and the methodology is often induction to derive theory and then deduction to verify theory. In the technological approaches the motivation is human need, the goal is the application of knowledge and the methodology is design. This review discusses both approaches, concentrating on the problems of taking a scientific approach and the unwillingness of geographers to accept an often more suitable technological approach. It is argued throughout that both types of approach can be valid, both can be useful and both are suitable methodologies for remote sensing in geography. Author

A88-15153#
CARTOGRAPHIC AND PLANNING APPLICATIONS OF THE INSTITUT FUER ANGEWANDTE GEODAESIE LAND-INFORMATION SYSTEM (IFAG-LIS) [ANWENDUNGEN DES LANDINFORMATIONSSYSTEMS DES INSTITUTS FUER ANGEWANDTE GEODAESIE - IFAG-LIS - IN KARTOGRAPHIE UND PLANUNG]
WOLFGANG GOEPFERT IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 31-47. In German. refs

The organization of IfAG-LIS is explained, and its use in some typical applications is demonstrated. IfAG-LIS comprises cartographic, alphanumeric, vector, and raster data bases and is designed to facilitate the integration of ground-based, aerial, and satellite remote-sensing data. Applications to map updating, forest inventory and analysis, and site and traffic-network analysis are described and illustrated with flow charts and sample images. T.K.

A88-15154#
POSSIBLE USES OF CLASSIFIED SATELLITE IMAGE DATA IN STATE AND REGIONAL PLANNING - THE EXAMPLE OF LAND-USE MAPPING IN BADEN-WUERTTEMBERG [ANWENDUNGSMOEGLICHKEITEN KLASSIFIZIERTER SATELLITENBILDDATEN IN DER REGIONAL- UND LANDESPLANUNG AM BEISPIEL DER LANDNUTZUNGSKARTIERUNG BADEN-WUERTTEMBERG]
HANS-PETER BAEHR and JUERGEN BAUMGART (Karlsruhe, Universitaet, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 49-60. In German. refs

A88-15160#
POSSIBLE USES OF TM DATA TO OBTAIN ENVIRONMENTAL INFORMATION FOR PLANNING PURPOSES [EINSATZMOEGLICHKEITEN VON THEMATIC-MAPPER-DATEN ZUR GEWINNUNG PLANUNGSBEDEUTSAMER UMWELTINFORMATIONEN]
J. BRAEDT (Bayerisches Staatsministerium fuer Landesentwicklung und Umweltfragen, Munich, Federal Republic of Germany), R. HAYDN, and P. VOLK (Gesellschaft fuer Angewandte Fernerkundung mbH, Munich, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 161-164. In German.

The applicability of satellite remote-sensing data to land-use and regional-planning problems is discussed, summarizing the results of a pilot study undertaken in Bavaria in 1985 using Landsat TM images. It is pointed out that the TM information is of much greater value in these applications than that obtainable with Landsat MSS. Specific applications to urban planning, land-use studies, microclimate characterization (cold-air sectors), and vegetation status evaluations (as indicators of environmental pollution) are considered. T.K.

A88-15163#
THE USE OF REMOTE SENSING IN THE FRG DEVELOPMENTAL AID PROGRAM [DIE NUTZUNG DER FERNERKUNDUNG IM BEREICH DER DEUTSCHEN ENTWICKLUNGSHILFE]
REINHARD GEORG (Deutsche Gesellschaft fuer Technische Zusammenarbeit GmbH, Eschborn, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 219-239. In German.

The role of remote sensing in foreign-aid development projects sponsored by the FRG Ministry for Economic Cooperation is surveyed. Topics addressed include the construction and operation of APT/WEFAX receiving stations for Meteosat and NOAA weather data in northern and eastern Africa, planning for Landsat and SPOT receiving stations at Ouagadougou (Burkina Faso), and the transportable remote-sensing station TRAFES. T.K.

A88-15164#
POSSIBLE APPLICATIONS OF REMOTE SENSING IN LESS FAVORED AREAS OF EUROPE [EINSATZMOEGLICHKEITEN DER FERNERKUNDUNG IN STRUKTURSCHWACHEN GEBIETEN (LESS FAVOURED AREAS) IN EUROPA]
FRANZ JASKOLLA (Muenchen, Universitaet, Munich, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 241-250. In German. refs

The applicability of remote sensing to the ecological mapping of Europe is assessed, with a focus on less favored areas, summarizing the results of studies undertaken for the European Economic Community. Maps, block diagrams, and a table listing the environmental indicators and their observability via remote sensing are provided. Particular attention is given to the potential of digitally processed Landsat-TM, SPOT, and radar images for mapping. The importance of obtaining multitemporal images of the same region is stressed. T.K.

A88-15875#
AN OVERVIEW OF APPLICATIONS OF SATELLITE REMOTE SENSING WITHIN THE UNITED NATIONS ENVIRONMENT PROGRAMME
D. WAYNE MOONEYHAN (UN, Global Resource Information Database, Carouge,. Switzerland) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 7 p.
(IAF PAPER 87-109)

The United Nations Environment Program (UNEP), which was created in the same year that the first Earth Resources Technology Satellite was launched, now depends upon data from remote sensing systems to provide information critical to environmental assessments. UNEP's utilization of satellite data has grown from a few applications developed by partner organizations and consultants in the early days of Landsat to hundreds of applications today. These applications are developed both by its own in-house capabilities of the Global Resource Information Database program centers, projects by national governments which provide information on the local level, and by international organizations and large-scale research organization that provide information on the global scale with numerous consultants in remote sensing working at all levels. Remote sensing, in the last few years, has become critical to the mandated objectives of UNEP. Author

A88-15909#
APPLICATION OF SATELLITE REMOTE SENSING TO LAND RESOURCES SURVEY
LIANGCAI CHU (Research Institute of Surveying and Mapping, Beijing, People's Republic of China) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 3 p.
(IAF PAPER 87-159)

Applications of satellite remote sensing to land resources survey in China are reviewed. The projects completed so far include the measurement of the total area of China, a map of the current landuse status for the whole country at a scale of 1:250,000, total area measurements for each of the thirty provinces and municipalities, 1:250,000-scale maps of the current landuse status for each of the thirty provinces and municipalities, and a satellite image map of the current landuse status of China at a scale of 1:2,000,000. Some future projects are also discussed. V.L.

A88-15917#
DETECTION OF ANTHROPOGENIC CHANGES WITH THE USE OF FREQUENCY ANALYSIS OF SATELLITE DATA
I. NOVIKOV (AN SSSR, Moscow, USSR), B. SOBISHEK, and Y. NEKOVARJ (Ministry of Forest and Water Economy, Czech Hydrometeorological Institute, Czechoslovakia) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 6 p.
(IAF PAPER 87-172)

The use of geoecological space monitoring based on satellite data to detect the impact of anthropogenic pollution on the atmosphere, vegetation, soil cover, and water bodies is discussed. The methods of interactive processing of satellite data are described. Changes in brightness of land cover and the amplitude-frequency characteristics of reflected radiation are studied in order to determine areas of pollution. An example revealing the use of geoecological space monitoring is presented. I.F.

A88-17027
THE IMPORTANCE OF THE NOAA-AVHRR DATA IN RESOURCES INVENTORIES AND ENVIRONMENTAL MONITORING IN ARGENTINA AND NEIGHBORING COUNTRIES
D. A. GAGLIARDINI and H. KARSZENBAUM (Centro Argentino de Estudios de Radiocommunicaciones y Compatibilidad Electromagnetica, Buenos Aires, Argentina) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 7-10. refs

A88-17028
REMOTE SENSING OF ENVIRONMENTAL FACTORS AFFECTING HEALTH
PETAR JOVANOVIC (Association of Scientific Unions of Yugoslavia, Belgrade) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 11-18. refs

An evaluation is made of the results of efforts to identify environmental parameters, whether natural or anthropogenic, affecting human, animal, and vegetable populations on the basis of satellite remote sensing imagery. Attention is given to the detection of factors associated with endemic, communicable, and chronic diseases through the parallel study of environmental epidemiological and biological parameters. Heath problems addressed encompass malaria, shistosomiasis, skin cancers, skeletal deformities, and tripanozomiasis. O.C.

A88-17492
INTERPRETATION AND ANALYSIS OF THE URBAN LANDSCAPE EVOLUTION OF THE MONTREAL (CANADA) REGION USING LANDSAT DATA [INTERPRETATION ET ANALYSE DE L'EVOLUTION DU PAYSAGE URBAIN DE L'AGGLOMERATION DE MONTREAL (CANADA) A L'AIDE DES DONNEES LANDSAT]
L. CHARBONNEAU, D. MORIN, and A. ROYER (Sherbrooke, Universite, Canada) Photo Interpretation (ISSN 0031-8523), vol. 25, Sept.-Oct. 1986, p. 1-5, 7, 9, 11. In French, English, and Spanish.

A88-17493
STUDIES OF URBAN LANDSCAPES USING A LANDSAT TM IMAGE - EXAMPLE OF BRUSSELS (BELGIUM) [ETUDES DES PAYSAGES URBAIN A L'AIDE D'UNE IMAGE-SATELLITE LANDSAT TM - EXAMPLE DE BRUXELLES /BELGIQUE/]
M.-L. DE KEERSMAECKER (Louvain, Universite Catholique, Louvain-la-Neuve, Belgium) Photo Interpretation (ISSN 0031-8523), vol. 25, Sept.-Oct. 1986, p. 13-17, 19. In French, English, and Spanish.

A88-17494
MICROTEXTURAL STUDY OF URBAN DISTRICTS - AN AID TO THE DETERMINATION OF THEIR SPATIAL ORGANIZATIONS (THE EXAMPLE OF BRUSSELS, BELGIUM) [ETUDE MICROTEXTURALE DES QUARTIERS URBAINS - UNE AIDE A LA DETERMINATION DE LEURS ORGANISATIONS SPATIALES (L'EXEMPLE DE BRUXELLES, BELGIQUE)]
M.-L. DE KEERSMAECKER (Louvain, Universite Catholique, Louvain-la- Neuve, Belgium) Photo Interpretation (ISSN 0031-8523), vol. 25, Sept.-Oct. 1986, p. 21-25, 27. In French, English, and Spanish.

A88-17495
TYPES OF URBAN DISTRICTS IN NANJING (CHINA) FROM LANDSAT IMAGES [TYPES DE QUARTIERS URBAINS A NANJING (CHINE) D'APRES LANDSAT]
R. ZHAO (Chinese Academy of Sciences; Nanjing, Institute of Geography, People's Republic of China; CNRS, Laboratoire de Cartographie Thematique; Strasbourg I, Universite, France) Photo Interpretation (ISSN 0031-8523), vol. 25, Sept.-Oct. 1986, p. 29-33, 35. In French, English, and Spanish.

An interurban classification of Nanjing, China is performed based on Landsat images of the region collected between 1977 and 1981 and in-depth knowledge of the city. A principal component analysis was performed to obtain neochannels of independent factorial scores. These neochannels are sensitive to diachronic thematic variations and nuances in the brightness of soils and materials, and they can distinguish between built-up surfaces and those covered with vegetation. Factorial data were divided into clearly identified classes, and ternary color compositions were then produced from the classified factorial images. Eleven morphologies, characterized by differences in the quality of materials, densities of construction, and linear organizations, were obtained by this process. R.R.

A88-18297
GIS AND REMOTE SENSING DATA INTEGRATION
PETER D. ARCHIBALD (PAMAP Graphics, Ltd., Victoria, Canada) Geocarto International (ISSN 1010-6049), vol. 2, Sept. 1987, p. 67-73. refs

Geographic Information Systems are concerned with the digital capture of spatial data and spatially related attributes and their linkage relative to one another. Most importantly, geographic information processing deals with the query, analyses, reporting and output of these data. Remote sensing has always provided a primary source of geographic data to these systems, although not in the digital sense. Environmentally based surveys such as those developed for forest inventory, have relied heavily on aerial photography since its inception as a large area operational tool four decades ago; however, digital remote sensing has now been brought to a point in its development where real applications have been demonstrated. The functional requirements to develop an operational interface for forestry related applications are discussed, including both graphics display and data processing problems.
Author

A88-19354
ENVIRONMENT MONITORING [MONITORING OKRUZHAIUSHCHEI PRIRODNOI SREDY]
IU. A. IZRAEL', ED. Moscow, Gidrometeoizdat, 1986, 120 p. In Russian. No individual items are abstracted in this volume.

Papers are presented on such topics as the interactive processing of space remote-sensing data on environmental quality; the formation of sulfur-compound pollutants in the atmosphere over northern Kazakhstan; a balance model for lead and cadmium circulation in the Lake Baikal region; and the use of atomic absorption spectrophotometry to determine the content of heavy metals in solid specimens. Attention is also given to pollution studies in the Mediterranean, characteristics of summer phytoplankton in the Sea of Azov, a probabilistic model of the exogenic dynamics of forest landscapes, and the effect of oil pollution on gas exchange between the ocean and the atmosphere. B.J.

A88-19363
REMOTE-SENSING STUDIES OF THE NATURAL RESOURCES OF SIBERIA [DISTANTSIONNYE ISSLEDOVANIIA PRIRODNYKH RESURSOV SIBIRI]
V. N. SHARAPOV, ED. Novosibirsk, Izdatel'stvo Nauka, 1986, 200 p. In Russian. No individual items are abstracted in this volume.

This collection of papers covers such topics as aerial and space photographic techiques for the geosystemic monitoring of Siberian regions, forest mapping in western Siberia, landscape zoning during geocryological studies, the distribution of ground

water in the BAM region, and the mapping of water-erosion processes. Methodological aspects of the computer-aided processing of remote-sensing images are considered along with remote-sensing investigations of biological resources. B.J.

N88-10412# Utah State Univ., Logan.
REMOTE SENSING-ARID LANDS WORKSHOP, PAGE, ARIZONA, JUNE 10-12, 1986 Workshop Summary Report
R. H. HAWKINS, F. J. WOBBER, and E. P. SPRINGER May 1987 32 p Workshop held in Page, Ariz., 10-12 Jun. 1986 Prepared in cooperation with DOE, Washington, D.C. and Los Alamos National Lab., N. Mex.
(DE87-012368; DOE/ER-0321; CONF-860618-SUMM) Avail: NTIS HC A03/MF A01

This report describes research sponsored by the US Department of Energy (DOE) Office of Energy Research to evaluate advanced remote sensing technologies for environmental research. The program dénoted as REFLEX (REmote FLuvial EXperiments) stresses new applications of remote sensing systems and advanced digital analysis to the solution of environmental problems from energy development. REFLEX experiments are being conducted at sites within the continental United States and Alaska. The experiments described here are being done on arid and semiarid sites in the western United States. Currently, two REFLEX experiments are being conducted in arid/semiarid ecosystems. At the Pacific Northwest Laboratory (PNL) in Richland, Washington, the REFLEX experiment will test hypotheses on the prediction of evapotranspiration (ET) over arid landscapes. The heterogeneity of arid and semiarid landscapes makes estimation of ET over an area quite difficult, and remote sensing, both aerial and ground based, offers tremendous potential in solving this sampling problem. The second REFLEX experiment in arid/semiarid ecosystems is being conducted on surface hydrology and soil erosion in arid watersheds. Two study sites, the Plutonium Valley Watershed at the Nevada Test Site and Walnut Gulch Experimental Watershed at Tombstone, Arizona, have been selected for the experiment. Remote sensing will be used to initialize and parameterize hydrologic models that can predict watershed responses to change on two spatial and temporal scales. DOE

N88-10421# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Hauptabteilung Angewandte Datentechnik.
REMOTE SENSING WITH LANDSAT 5 THEMATIC MAPPER (TM) AND ITS APPLICATION TO VARIOUS PLANNING LEVELS: A CASE STUDY FROM THE WUERZBURG AREA, WEST GERMANY
RUEDIGER GLASER Nov. 1985 133 p In GERMAN; ENGLISH summary Original contains color illustrations
(DFVLR-FB-86-62; ISSN-0171-1342; ETN-87-90595) Avail: NTIS HC A07/MF A01; DFVLR, Cologne, West Germany DM 57.50

Part of a LANDSAT Thematic Mapper (TM) scene is taken to demonstrate the applicability of remote sensing techniques to various planning levels. Standard digital image processing techniques are presented, and the information obtained is compared to that derived from visual interpretation. A quantitative land classification of the scene shows that TM data can be effectively used on the local planning level. ESA

N88-10428# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Meteorologische Fernerkundung.
REMOTE SENSING OF ENVIRONMENTAL POLLUTION
KARL-THEODOR KRIEBEL Mar. 1987 111 p Course held in Buenos Aires, Argentina, 18 Oct. - 2 Nov. 1982
(DFVLR-MITT-87-04; ISSN-0176-7739; ETN-87-90590) Avail: NTIS HC A06/MF A01; DFVLR, Cologne, West Germany, DM 35

Scattering, absorption, emission, and radiative transfer in the atmosphere; the principles of remote sensing; atmospheric correction of satellite data; and monitoring of atmospheric aerosols and trace gases were discussed. ESA

N88-12157# Institut Geographique National, Paris (France).
FEASIBILITY STUDY OF A RANGE OF PRODUCTS DRAWN FROM SPOT SATELLITE IMAGERY AND SPECIFIC TO ROAD-LAYING STUDIES
M. DORIDOT and M. PAUSADER *In* CNES, SPOT 1: First In-Flight Results p 113-119 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

Use of SPOT satellite imagery for road making in developing countries is considered. In subdesert regions SPOT images are useful for detecting road construction materials, for analyzing water basins, for dimensioning bridges, and for charting obstacles. The SPOT three dimensional products, levels, slopes, and block diagrams are particularly useful. ESA

N88-12158# Centre National d'Etudes Spatiales, Toulouse (France). Lab. d'Etudes et de Recherches en Teledetection Spatiale.
ADAPTATION OF NUMERICAL SPOT DATA TO AN URBAN ENVIRONMENT
JACQUES TOURNET, JEAN CUSSOL, CATHERINE PEDRON, GILBERT SAINT, and CATHERINE LEPRIEUR *In its* SPOT 1: First In-Flight Results p 121-126 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

Processing of SPOT images to provide urban engineers with a spectrally (decorrelation, resampling) and texturally (filtering) improved product is described. Objectives are the numerical analysis of such data incorporated into an urban data bank with an automatic extraction of specific data basically linked to the themes studied. ESA

N88-12161# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
SPOT FOR EARTHQUAKE HAZARD ZONING IN SOUTHERN ITALY, A PROVISIONAL REPORT
H. TH. VERSTAPPEN and R. J. ELSINGA *In* CNES, SPOT 1: First In-Flight Results p 151-156 1987
Avail: CEPADUES-Editions, Toulouse, France

Earthquake hazard zoning is introduced using an area hit by an earthquake of magnitude 6.8 on the Richter scale as an example. The area is geologically complex and strongly influenced by neotectonics. Geomorphologically, it is characterized by considerable relief and widespread mass movements. The defined zoning in this area was compared with the percentage damage distribution of the earthquake and the zoning was extrapolated to a comparable area elsewhere. In addition to the (panchromatic) SPOT stereo images of both areas, LANDSAT images and aerial photographs (1:35,000 and 1:10,000) were used with the field survey. The SPOT data, because of their spatial resolution and stereoscopic capacity, are most useful; LANDSAT data provide insufficient detail and the aerial photographs lack a general overview. ESA

N88-12184# Geological Survey, Denver, Colo.
A WORKSHOP ON DESERT PROCESSES, SEPTEMBER 24-28, 1984: REPORT ON THE CONFERENCE
JOHN F. MCCAULEY and JACK N. RINKER 1987 25 p Workshop held in Flagstaff, Ariz.
(AD-A184599; USGS-CIRC-989) Avail: NTIS HC A03/MF A01 CSCL 08F

At present, the United States Geological Survey is monitoring geometeorological conditions in different types of deserts in Arizona, using data relayed by satellite from solar-powered Geomet stations. These stations consist of automated data-collection platforms coupled with an array of sensors that measure boundary-layer atmospheric and geologic conditions at frequent intervals, around the clock. Such data are essential to studies of surface geologic processes in deserts, particularly wind erosion, and of the landforms that develop in response to these processes. The Geomet data are also of interest to the U.S. Army, which must operate in various types of deserts and therefore needs information related to natural hindrances to cross-country movement, selection of aircraft landing sites, cover and

concealment, camouflage, dust generation, and location of usable water. The U.S. Army Engineer Topographic Laboratories, Center for Remote Sensing (ETL-CRS), has evaluated a variety of remote sensors and image-analysis techniques in subhumid regions, and a part of its research program is directed toward applying these techniques to the Army's need for information on desert terrain. The complementary research needs of the USGS and ETL-CRS resulted in a workshop held in Flagstaff, Ariz., on September 24 to 28, 1984. GRA

N88-13785*# Chicago Univ., Ill. Dept. of Geophysical Science.
TOMS AS A MONITOR OF THE ULTRAVIOLET RADIATION ENVIRONMENT: APPLICATIONS TO PHOTOBIOLOGY Abstract Only
JOHN E. FREDERICK *In* NASA. Goddard Space Flight Center, Scientific and Operational Requirements for TOMS Data p 27-30 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 13B

The flux of biologically relevant ultraviolet radiation that reaches the surface of the Earth varies with the ozone amount, surface reflectivity, and cloudcover. The Total Ozone Mapping Spectrometer (TOMS) provides information relevant to all three items. A recent application of satellite-based ozone measurements has been to develop climatologies of the biologically significant UV-B radiation reaching the Earth's surface. A growing body of research suggests that UV-B radiation tends to suppress the immune system of laboratory mice. At tropical latitudes, it is likely that parasitical diseases develop most readily in people who have experienced immune system suppression from UV-B exposure. The computed distribution of surface radiation combined with information on disease incidence may clarify the role of UV-B as a suppressor of the human immune system. TOMS used in conjunction with radiative transfer calculations can provide information of relevance in photobiology. Author

N88-13811*# National Air and Space Museum, Washington, D.C. Center for Earth and Planetary Studies.
ENVIRONMENTAL PROCESSES AND SPECTRAL REFLECTANCE CHARACTERISTICS ASSOCIATED WITH SOIL EROSION IN DESERT FRINGE REGIONS
P. A. JACOBBERGER 20 Oct. 1987 28 p
(Contract NAS5-28774)
(NASA-CR-182332; NAS 1.26:182332) Avail: NTIS HC A03/MF A01 CSCL 08B

Results of analysis of spectral variation of sand dunes in El Ghorabi, Bahariya, Egypt; Tombouctou/Azaouad, Mali; and Tsodilo Hills, western Botswana are presented. Seasonal variations in dune extent and location of dune crests and their relationship to such factors as wind and weather variations are emphasized. J.P.B.

N88-14499# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, Idaho.
INTEGRATED GLOBAL BACKGROUND MONITORING NETWORK
G. B. WIERSMA, J. F. FRANKLIN, A. KOHLER, H. CROZE, and C. BOELCKE (United Nations Environment Program, Nairobi, Kenya) Dec. 1986 31 p Presented at the 5th US-USSR Symposium on Comprehensive Analysis of the Environment, Washington, D.C., 10 Dec. 1986
(Contract DE-AC07-76ID-01570)
(DE88-001503; EGG-M-39086; CONF-861269-2) Avail: NTIS HC A03/MF A01

One of the more significant problems when trying to determine what impact pollutants are having on global cycles is not knowing what natural levels should be for both abiotic (gases, trace elements) and biotic (ecosystem functions) processes. It is believed that a well designed, coordinated network of baseline stations in remote areas around the world can provide a data base that will allow best current estimates to be made of biotic and abiotic baseline conditions. These baseline conditions will then help us make better comparisons with more impacted areas, and thus help us more fully understand the impact man is having on his world. This paper examines the history of background pollution monitoring at the international level, describes current activities in the field of integrated background monitoring, and proposes criteria for the development of a global network of baseline stations to coordinate background monitoring for the presence, accumulation and behavior of pollutants in remote ecosystems. In this paper, this network is called the Integrated Global Background Monitoring Network. DOE

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A88-10923
AN ANALYTICAL METHOD FOR THE APPROXIMATE GEODETIC CORRELATION OF METEOROLOGICAL-SATELLITE SCANNER IMAGES ACCORDING TO REFERENCE POINTS [ANALITICHESKII SPOSOB PRIBLIZHENNOI GEODEZICHESKOI PRIVIAZKI SKANERNYKH IZOBRAZHENII METEOROLOGICHESKIKH ISZ PO OPORNYM TOCHKAM]
M. V. IVANCHIK and V. A. KROVOTYNTSEV (AN USSR, Morskoi *Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR*) *Issledovanie* Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 109-115. In Russian. refs

A georeferencing method is proposed which relies on the coordinates of characteristic reference points on space images, the orbital inclinations, and the satellite revolution period. The method does not require the satellite trajectory data input, and the algorithms of the procedure are simple and compact, making it possible to program a problem with a small expenditure of the computer time for image processing. The correlating accuracy of the method is + or - 20-30 km. I.S.

A88-11456*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE GEOSCIENCE LASER ALTIMETRY/RANGING SYSTEM
STEVEN C. COHEN, JOHN J. DEGNAN, III, JACK L. BUFTON, JAMES B. GARVIN, and JAMES B. ABSHIRE (NASA, Goddard Space Flight Center, Greenbelt, MD) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-25, Sept. 1987, p. 581-592. Previously announced in STAR as N87-14687. refs

The Geoscience Laser Altimetry/Ranging System (GLARS), a combined laser ranging and altimetry system capable of subcentimeter position determinations of retroflector targets and subdecimeter profiling of topography, is described. The system uses advanced but currently available state-of-the-art components. Laboratory, field, and numerical experiments have indicated the suitability of GLARS as an instrument for Eos and other space platforms. V.L.

A88-12884* Northwestern Univ., Evanston, Ill.
A REVISED ESTIMATE OF PACIFIC-NORTH AMERICA MOTION AND IMPLICATIONS FOR WESTERN NORTH AMERICA PLATE BOUNDARY ZONE TECTONICS
CHARLES DEMETS, RICHARD G. GORDON, SETH STEIN, and DONALD F. ARGUS (Northwestern University, Evanston, IL) Geophysical Research Letters (ISSN 0094-8276), vol. 14, Sept. 1987, p. 911-914. refs
(Contract NSF EAR-84-17323; NSF EAR-86-18038; NAG5-885)

Marine magnetic profiles from the Gulf of Californa are studied in order to revise the estimate of Pacific-North America motion. It is found that since 3 Ma spreading has averaged 48 mm/yr, consistent with a new global plate motion model derived without any data. The present data suggest that strike-slip motion on faults west of the San Andreas is less than previously thought, reducing the San Andreas discrepancy with geodetic, seismological, and other geologic observations. R.R.

A88-14451
FREE AIR GRAVITY ANOMALIES OVER THE OCEANS FROM SEASAT AND GEOS 3 ALTIMETER DATA
G. BALMINO, B. MOYNOT, M. SARRAILH, and N. VALES (Bureau Gravimetrique International, Toulouse, France) EOS (ISSN 0096-3941), vol. 68, Jan. 13, 1987, p. 17-19. CNES-CNRS-supported research. refs

Global mean sea surface data derived from Seasat and GEOS 3 altimetry (Marsh, 1985) have been used to calculate 15 x 15-min free air gravity anomalies over all of the ocean between 72 deg N and 60 deg S. The present paper describes the use of the inverse Stokes-operator computation method in conjunction with a spherical harmonic gravity field model of high degree and order (GRIM-L1; Reigber et al., 1985) and gives a brief overview of the results. A total of 500,000 point values were computed and used to construct large- and small-scale contour maps; the gravity values obtained have a range of about 500 mgal. T.K.

A88-15173#
THE USE OF SATELLITE ALTIMETRY FOR GEODETIC AND GEOPHYSICAL PURPOSES [ZUR NUTZUNG DER SATELLITENALTIMETRIE FUER GEODAETISCH-GEOPHYSIKALISCHE ZWECKE]
CH. REIGBER and W. BOSCH (Deutsches Geodaetisches Forschungsinstitut, Munich, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 517-525. In German. refs

The fundamental principles and techniques of gravitation-potential measurement and geoid determination using satellite altimetry data are reviewed. Topics addressed include the basic relationship of altimetry to geodesy, the processing of radar altimetry data, the generation of geophysical data bases, and the applications of typical data products (digital models of the sea surface, oceanic geoids, global gravitation models, records of time-dependent phenomena, and analyses of ice signals). Particular attention is given to the use of GEOS-3 and Seasat data in the FRG and to plans for the ERS-1 mission. T.K.

N88-10407# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
ACCURACY OF GPS SURVEYING TECHNIQUE AND ITS POSSIBLE APPLICATION TO THE WEGENER PROJECT
J. B. ZIELINSKI Sep. 1985 53 p Sponsored by Technische Hogeschool, Delft, The Netherlands
(REPT-85.3; ETN-87-90831) Avail: NTIS HC A04/MF A01

Satellite geodesy in the Mediterranean region (Wegener project), using the GPS technique, was studied as to mobile laser site surveying, intraplate deformation study, and completion of the main Wegener-MEDLAS network. The precision of the baseline determination was assessed, and its sensitivity to different bias and error sources tested by numerical simulations. The factor which influences the results most seriously is orbit inaccuracy, but this influence is not so grave as previously supposed. With the future 18 satellite constellation and present orbital accuracy the precision 10 to the minus 7th power for 100 km baselines should be possible. ESA

N88-12159# Institut Geographique National, Paris (France).
CARTOGRAPHY AND TOPOGRAPHY WITH SPOT [CARTOGRAPHIE ET TOPOGRAPHIE AVEC SPOT]
PATRICE FOIN *In* CNES, SPOT 1: First In-Flight Results p 129-133 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

Production methods for topographic cartography using SPOT images are discussed. The definition of the data itself, and its thematic applications, such as using SPOT digital terrain models in geology and agronomy are considered. Altimetry (and its thematic applications), updating medium-scale maps, space-maps, and thematic cartography, especially related to land use, are reveiwed. ESA

N88-12187# Massachusetts Inst. of Tech., Cambridge.
RESEARCH IN GEODESY BASED UPON RADIO INTERFEROMETRIC OBSERVATIONS OF GPS (GLOBAL POSITIONING SYSTEM) SATELLITES Final Report, 5 Feb. 1982 - 31 Dec. 1985
CHARLES C. COUNSELMAN, III 31 Dec. 1986 18 p
(Contract F19628-82-K-0002)
(AD-A184040; AFGL-TR-87-0091) Avail: NTIS HC A03/MF A01 CSCL 08E

MIT explored and extended the capabilities of the new technique of geodesy by radio interferometry using signals from the NAVSTAR Global Positioning System (GPS) satellites. Accuracy in the determination of long relative-position, or baseline, vectors between fixed points on the earth was improved by the use of doubly differenced, dual frequency (LI and L2 band). Carrier phase observations, and by determining the orbits of the satellites from observations at widely spaced sites whose relative positions were well known a priori from quasar observations. Accuracy of about 1 part in 10 million of the length of a long baseline, and 1 millimeter for a short baseline, was achieved. GRA

N88-12861 Ohio State Univ., Columbus.
RADIAL ORBIT ERROR REDUCTION AND SEA SURFACE TOPOGRAPHY DETERMINATION USING SATELLITE ALTIMETRY Ph.D. Thesis
THEODOSSIOS ENGELIS 1987 190 p
Avail: Univ. Microfilms Order No. DA8717631

A method is presented in satellite altimetry that attempts to simultaneously determine the geoid and sea surface topography with minimum wavelengths of about 500 kn and to reduce the radial orbit errors caused by geopotential errors. The modeling of the radial orbit error is made using the linearized Lagrangian perturbation theory. Secular and second order effects are also included. A Fourier series formulation allows for easier computation of different statistics. Numerical estimates for the radial orbit error and geoid undulation error are computed using the differences of two geopotential models as potential coefficient errors, for a Seasat orbit. To provide statistical estimates of the radial distances and the geoid, a covariance propagation is made based on the full geopotential covariances. Accuracy estimates for the Seasat orbits are given which agree quite well with the already published results. Observation equations are developed using sea surface heights and crossover discrepancies as observeable. The potential of the method is demonstrated in a solution where simulated geopotential errors and the Levitus sea surface topography are used to generate the observables for a three day Seasat arc. The simulation results show that the method can be used to effectively reduce the radial orbit error and recover the sea surface topography.
Dissert. Abstr.

04

GEOLOGY AND MINERAL RESOURCES

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

A88-10023
THE USE OF SPACE PHOTOGRAPHS FOR THE REGIONAL METALLOGENIC ANALYSIS OF FOLDED REGIONS [PRIMENENIE KOSMICHESKIKH SNIMKOV PRI REGIONAL'NOM METALLOGENICHESKOM ANALIZE SKLADCHATYKH OBLASTEI]
N. A. IAKOVLEV, V. Z. SAKHATOV, N. V. SKUBLOVA, and K. A. MARKOV Leningrad, Izdatel'stvo Nedra, 1986, 161 p. In Russian. refs

The work examines the use of space remote-sensing images for the regional metallogenic analysis of folded regions, including the western Baikal region, central and southern Kazakhstan, and the Lesser Caucasus. Fracture faults, the block structure of

territories, and concentric structures are investigated; and the role of the tectonic factor in the localization of endogenic mineral deposits is examined. A method for the computerized interpretation of remote-sensing and geological data is described. B.J.

A88-10067
OPTICAL PARAMETERS OF THE ATMOSPHERE AND HIGH-RESOLUTION LONG-EXPOSURE IMAGING
G. WEIGELT, G. BAIER, S. HELM, M. MUELLER, and C. WURM (Erlangen-Nuernberg, Universitaet, Erlangen, Federal Republic of Germany) IN: Workshop on ESO's Very Large Telescope, 2nd, Venice, Italy, Sept. 29-Oct. 2, 1986, Proceedings . Garching, Federal Republic of Germany, European Southern Observatory, 1986, p. 215-220. DFG-supported research. refs

The investigation of optical parameters of the atmosphere is important for site selection for future large telescopes. From speckle interferograms many different parameters can be derived. The following optical parameters have been studied for many different nights: (1) long-exposure point-spread function, (2) image motion of speckle interferograms (short-exposure images), (3) temporal variation of the size (FWHM) of speckle interferograms, (4) differential image motion between the two Airy disks of two 5-cm apertures at a distance of 30 cm (and calibration measurements for the ESO seeing monitor), (5) speckle life time, and (6) isoplanicity of speckle interferograms (space variance of speckle interferograms). Author

A88-10916
TRANSREGIONAL LINEAMENTS OF THE SOUTHEASTERN REGION OF THE RUSSIAN PLATFORM [TRANSREGIONAL'NYE LINEAMENTY IUGO-VOSTOKA RUSSKOI PLATFORMY]
N. N. IAKHIMOVICH and S. P. MAKAROVA (Vsesoiuznyi Nauchno-Issledovatel'skii Geologorazvedochnyi Neftianoi Institut, Orenburg, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 64-67. In Russian. refs

Remote images of the southeastern Russion platform were used to identify structures on the Ik-Irtek and Ashkadar structural zones and the adjacent regions of the southern Ural and the northern Caspian basin. It is suggested that these linear structures were initiated deep in the earth mantle; they are vertical secants of the mantle as well as of the Russian platform surface. These lineaments control the position of oil-gas traps and may be viewed as regional and transregional zones of oil and gas accumulation. I.S.

A88-10917
METHOD FOR THE STUDY OF GEOLOGICAL DYNAMICS USING AERIAL AND SPACE DATA (IN REFERENCE TO THE SOUTHERN USSR) [K METODIKE IZUCHENIIA DINAMIKI GEOLOGICHESKIKH PROTSESSOV PO AEROKOSMICHESKIM DANNYM /NA PRIMERE IUGA SSSR/]
IA. G. KATS, A. V. TEVELEV, A. I. POLETAEV, and E. F. RUMIANTSEVA (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 68-75. In Russian. refs

Medium-scale space images of the Murgab and Tedzhen delta regions and of the Turkestan-Iranian region were used to study the dynamics of recent geological processes. Regions of continental sedimentation, deformation of bedded structures, and interaction of deep-seated major blocks of the earth crust were identified. It is shown that the zone of the major Kopetdag fracture should not be considered as a structure dividing the Iranian and the Turan plates, but as a foremost suture on the active contact of the two plates. I.S.

A88-10918
COMPARATIVE TECTONICS OF THE KURA AND SURKHANDAR'IA BASINS ACCORDING TO SPACE IMAGES [SRAVNITEL'NAIA TEKTONIKA KURINSKOI I SURKHANDAR'INSKOI VPADIN PO DANNYM KOSMICHESKIKH SNIMKOV]
A. V. TEVELEV and E. I. BLIUMKIN (Moskovskii Gosudarstvennyi Universitet, Moscov, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 76-80. In Russian. refs

A88-10919
USE OF SPACE IMAGERY FOR THE ASSESSMENT OF THE ENGINEERING-GEOLOGICAL CONDITIONS FOR THE LOWER-IRTYSH LACUSTRINE-MARSHY FLATLANDS [PRIMENENIE KOSMICHESKIKH SNIMKOV DLIA OTSENKI INZHENERNO-GEOLOGICHESKIKH USLOVII OZERNO-BOLOTNYKH RAVNIN NIZHNEGO PRIIRTYSH'IA]
A. I. SVITNEV (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Gidrogeologii i Inzhenernoi Geologii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 81-88. In Russian. refs

A88-11667* Brown Univ., Providence, R. I.
ABUNDANCE AND DISTRIBUTION OF ULTRAMAFIC MICROBRECCIA IN MOSES ROCK DIKE - QUANTITATIVE APPLICATION OF MAPPING SPECTROSCOPY
JOHN F. MUSTARD and CARLE M. PIETERS (Brown University, Providence, RI) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Sept. 10, 1987, p. 10376-10390. refs
(Contract NASW-4048; NAGW-748)

Data from the Airborne Imaging Spectrometer were used to map the distribution and abundance of the serpentized ultramafic microbreccia (SUM) component in the Moses Rock dike, which is a Tertiary diatreme located on the Colorado Plateau in Utah. The geologic setting and composition of Moses Rock dike are discussed together with its texture and the relationship to the bedrock of surface materials. These observations along with laboratory spectroscopic data are used to interpret surface mineralogy of the dike and the surrounding regions from the imaging spectometer data. The spatial distribution and the abundance of the primary surface components were calculated using a nonlinear model for the mixing of spectra from multicomponent surfaces. The derived SUM distribution and abundance data support McGetchin's (1968) model for the emplacement of Moses Rock dike as a fluidized system. I.S.

A88-11668* Washington Univ., Seattle.
DETECTABILITY OF MINERALS ON DESERT ALLUVIAL FANS USING REFLECTANCE SPECTRA
HUGH SHIPMAN and JOHN B. ADAMS (Washington, University, Seattle) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Sept. 10, 1987, p. 10391-10402. refs
(Contract NASW-4016; NAGW-85)

The visible and near-infrared reflectance spectra of soil samples collected from desert alluvial and colluvial surfaces in the Cuprite mining district, Nevada, were analyzed. These surfaces are downslope from hydrothermally altered volcanic rocks that contain spectrally characteristic minerals such as alunite and kaolinite. Coarse fractions of the soils on the alluvial fans are mineralogically variable and express the upslope lithologies; fine fractions are remarkably similar mineralogically and spectrally in all samples because of dilution of local mineral components by regionally derived windblown dust. Theoretical models for spectral mixing and for particle-size effects were used to model the observed spectral variations. Diagnostic mineral absorption bands in the spectra of fan materials were enhanced by computationally removing the spectrum of the homogeneous fine-soil component. Results show that spectral mixing models are useful for analyzing data with high spectral resolution obtained by field and aircraft spectrometers. Author

A88-12333
A COMPARISON OF LANDSAT MSS AND TM IMAGERY FOR INTERPRETATION OF GEOLOGIC STRUCTURE
TIMOTHY E. TOWNSEND (Exxon Production Research Co., Houston, TX) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 53, Sept. 1987, p. 1245-1249. refs

Landsat-4 Multispectral Scanner (MSS) and Thematic Mapper (TM) images of the Death Valley region in California are compared to demonstrate the improved interpretability of geologic structures afforded by Landsat TM data. The greater spatial resolution of the Landsat TM data allows faults and folds to be interpreted more reliably; secondary features such as en echelon folds that cannot be resolved by MSS can be mapped with TM. Identifying en echelon folds associated with strike-slip faults and determining their orientation can help characterize the sense-of-strike separation. This additional information may be critical to understanding the tectonics of an area. Author

A88-12763
CATACLYSMIC HYDROTHERMAL VENTING ON THE JUAN DE FUCA RIDGE
EDWARD T. BAKER, GARY J. MASSOTH, and RICHARD A. FEELY (NOAA, Pacific Marine Environmental Laboratory, Seattle, WA) Nature (ISSN 0028-0836), vol. 329, Sept. 10, 1987, p. 149-151. NOAA-supported research. refs

The discovery of a 700-m-thick, 20-km-diameter eddylike 'megaplume' created by a brief but massive release of high-temperature hydrothermal fluids near 44 deg 49 min N, 130 deg 14 min W on the Juan de Fuca Ridge is reported. This discovery supports the hypothesis that discontinuous emission of hydrothermal fluids occurs. The megaplume had a mean temperature anomaly of 0.12 deg C and overlay compositionally distinct plumes emanating from an apparently steady-state vent field at the same location. The megaplume was formed in a few days, yet equalled the annual output of between 200 and 2000 high-temperature chimneys. C.D.

A88-13967
GEOMORPHOLOGIC STUDIES ON SRI LANKA WITH SPECIAL EMPHASIS ON THE NORTHWEST COAST
HERMAN TH. VERSTAPPEN (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 1, 1987, p. 1-17. Research supported by the Stichting der Nederlandse Universiteiten en Hogescholen voor Internationale Samenwerking. refs

A88-13968
PRODUCTION OF THE GEOMORPHOLOGIC MAP OF SRI LANKA
TON MANK and CONNIE BLOK (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 1, 1987, p. 18-22.

The complex production of a geomorphologic map of Sri Lanka is described. The map contains four groups of information: geomorphologic units, other geomorphologic features, lithology and topography. To maintain legibility, visually distinct levels were created. An overview is given of the steps involved in the construction and reproduction of the map. Author

A88-14053
RECENT DEVELOPMENTS IN THE U.S. GEOLOGICAL SURVEY'S LANDSAT IMAGE MAPPING PROGRAM
FREDERICK S. BROWNWORTH (USGS, Reston, VA) and WAYNE G. ROHDE (USGS, EROS Data Center, Sioux Falls, SD) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 12-18. refs

A88-15165#
PHOTOGRAMMETRIC MEASUREMENTS ON METRIC CAMERA IMAGES OF THE EASTERN ZAGROS MOUNTAINS (IRAN) FOR GEOLOGICAL STUDIES [PHOTOGRAMMETRISCHE MESSUNGEN AN METRIC CAMERA AUFNAHMEN IM OESTLICHEN ZAGROSGEBIRGE (IRAN) FUER GEOLOGISCHE FRAGESTELLUNGEN]
U. MUENZER, J. BODECHTEL, and M. KLEY (Muenchen, Universitaet, Munich, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 251-259. In German. refs

A88-15915*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REMOTE MINERALOGICAL AND VEGETATION MAPPING USING IMAGING SPECTROMETRY
JAMES KING, JR. and HARRY PRESS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 7 p.
(IAF PAPER 87-170)

Two airborne flight systems were developed for geological studies: the airborne imaging spectrometer (AIS) and the advanced visible and infrared imaging spectrometer. A satellite imaging spectrometer system, the high resolution imaging spectrometer, is currently being developed and is planned for flight on the proposed NASA Earth Orbiting System. Examples of the application of these instruments in mineral and vegetation studies are described. Experiments conducted with AIS over the Cuprite Mining District (Nevada) and the Owens Valley (California) demonstrate the power of this new approach to remote sensing. K.K.

A88-16817* Geological Survey, Denver, Colo.
RELATION OF THE SPECTROSCOPIC REFLECTANCE OF OLIVINE TO MINERAL CHEMISTRY AND SOME REMOTE SENSING IMPLICATIONS
TRUDE V. V. KING and W. IAN RIDLEY (USGS, Denver, CO) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Oct. 10, 1987, p. 11457-11469. USGS-supported research. refs
(Contract NSG-7462; NSG-7312)

High-resolution visible and near-IR diffuse spectral reflectance are used to systematically investigate apparent wavelength shifts as a function of mineral chemistry in the Fe/Mg olivine series from Fo(11) to Fo(91). The study also shows that trace amounts of nickel can be spectrally detected in the olivine structure. Significant compositional information can only be extracted at relatively high resolution, because the overall spectral characteristics of the olivines change only subtly as a function of the Fe/Mg ratio. This laboratory study is expected to aid in the interpretation of remotely sensed data from both terrestrial and extraterrestrial bodies. Terrestrial applications may include the recognition of ultramafic, ultrabasic, and basaltic terrains which in themselves may have mineral potential. Among extraterrestrial applications, the asteroids are obvious candidates for further examination. Some permutations of Fe-Mg-Ni relations in olivines are discussed as they apply to the interpretation of asteroid surfaces and other extraterrestrial bodies. Author

A88-16821
THE DOWNWARD CONTINUATION OF MAGSAT CRUSTAL ANOMALY FIELD OVER SOUTHEAST ASIA
JOSE ACHACHE, ABDESLAM ABTOUT, and JEAN-LOUIS LE MOUEL (Paris VI, Universite, France) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Oct. 10, 1987, p. 11584-11596. refs
(Contract CNES-85-1232)

A general method for the local downward continuation at ground level of geopotentials measured by low-orbiting satellites at different altitudes is proposed. Such a continuation is the inverse solution of the external Dirichlet problem. The stability of the

solution with respect to the altitude and the distribution of data points is discussed. Principal component analysis is shown to perform well and leads to a stable solution. The method proposed has the advantage of being directly applicable to measured data points which are not evenly spaced and at different altitude. As an illustration, it is applied to Magsat data over southeast Asia. Two independent maps of the vertical component of the anomaly field at a constant altitude near ground level are derived for dawn (descending orbits) and dusk (ascending orbits) data separately. The two maps reveal similar anomalies, and confirm the correlation of the Magsat-derived anomaly field with the mosaic structure of the continental crust in southeast Asia. Stable continental blocks are associated with positive anomalies, and intervening collision belts correspond to well-defined negative anomalies. A very prominent low is observed above the Himalaya and extends over the Tibet plateau, confirming an anomalous crustal and thermal structure of the plateau. Author

A88-17029
FIRST RESULTS OF THE IUGS-UNESCO PROGRAMME ON GEOLOGICAL APPLICATIONS OF REMOTE SENSING (GARS) IN EASTERN AFRICA
CLAUDE BARDINET, ALAIN LE PAGE, ISABELLE ROGGERI (Nice, Universite, France), JEAN KLERKX, JOHANN LAVREAU (Musee Royal de l'Afrique Centrale, Tervuren, Belgium) et al. (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 19-23. Research supported by the Committee on Data for Science and Technology, International Union of Geological Sciences, and UNESCO. refs

The first phase of the GARS program on the Kibaran belt of eastern Africa is a follow-up of the CODATA project on multisatellite thematic mapping in Tanzania. An interpretation of a Thematic Mapper image has been carried out in terms of vegetation, soils, structure and lithology, for identification of targets that will be controlled on ground. The second phase (1987-1988) will focus on lithologic discrimination on the Kibaran formations in central Burundi. Author

A88-17037
THE USE OF LANDSAT IMAGERY IN STRUCTURAL STUDIES OF MIDDLE MOROCCO
M. BENSAID (Ministere de l'Energie et des Mines, Direction de la Geologie, Rabat, Morocco) and A. MAHMOOD (National School of Mining Engineering, Rabat, Morocco) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 87-94. Sponsorship: Agency for International Development. refs
(Contract AID PROJECT 936-5542)

A88-17038
UTILIZATION OF SPOT FOR MINERAL EXPLORATION, WITH SPECIAL REFERENCE TO WESTERN AFRICA
D. ROUSSELOT (Bureau de Recherches Geologiques et Minieres, Orleans, France) and C. WEBER (Groupement pour le Developpement de la Teledetection Aerospatiale, Toulouse, France) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 95-97, 99.

SPOT 1 satellite imagery have proved to be of great use in mineral exploration due to the ease of identification obtained for secondary structural features with its 10-20 m ground resolution, the ability to quantify the dip of bedding and the thickness of layers, etc., by means of stereoscopy, and the great flexibility of acquisition offered in the case of programs requiring multitemporal data. Attention is given to the illustrative cases of gold prospecting in Burkina Faso and a reconnaissance study in Mali. SPOT is noted to bridge the gap between Landsat regional information and data supplied by aerial photography. O.C.

A88-18295
A CANADIAN PERSPECTIVE ON THE APPLICATION OF SATELLITE REMOTE SENSING TO REGIONAL GEOBOTANY
BILL BRUCE (Canada Centre for Remote Sensing, Ottawa) and JOHN K. HORNSBY (Intera Technologies, Ltd., Ottawa, Canada) Geocarto International (ISSN 1010-6049), vol. 2, Sept. 1987, p. 53-59. refs

In recent years, developments in remote sensing and related technologies have led to a resurgence of interest in the concept of geobotany. Interest in these techniques has been particularly keen in Canada since most active mineral exploration areas are vegetation covered. The spatial accuracy and spectral precision of data from remote sensors have improved substantially to the point where reliable and reproducable analysis can be made of vegetation condition and properties as they relate to a variety of geological controls and influences. This paper establishes the distinction between regional or 'background' geobotany and spectral or 'target' geobotany. It also describes and illustrates with case examples how techniques of regional geobotany can be applied by geologists, in support of mineral exploration activities, within operational constraints. Author

A88-18956
MAGNETIZATION GAPS ASSOCIATED WITH TEARING IN THE CENTRAL AMERICA SUBDUCTION ZONE
JEAN-LOUIS COUNIL and JOSE ACHACHE (Paris, Institut de Physique du Globe, France) Geophysical Research Letters (ISSN 0094-8276), vol. 14, Nov. 1987, p. 1115-1118. CNES-CNRS-supported research. refs

Vector magnetic anomaly maps derived at sea-level from Magsat data show a large positive anomaly above the Middle America Trench. Relative highs and lows correlate with variations in the seismicity of the subducted Cocos plate. These anomalies can only be modeled assuming complete demagnetization of the slab near seismic discontinuities. It is proposed that demagnetization is necessarily associated with tearing of the plate. Magnetic anomalies indicate tearing of the Cocos plate beneath Mexico and near Panama, but further east than previously proposed on the basis of seismic data. Although the demagnetization process is likely to be related to the temperature increase, it is shown that thermal diffusion is not sufficient to produce the observed anomaly and that the slab must be heavily fractured in the vicinity of teared zones. Author

A88-19565
OBLIQUE METALLOGENIC ZONES IDENTIFIED IN SPACE IMAGERY OF THE SOUTHERN TIEN-SHAN TERRITORY [KOSOSEKUSHCHIE METALLOGENICHESKIE ZONY, VYIAVLENNYE PRI DESHIFRIROVANII KOSMICHESKIKH SNIMKOV NA TERRITORII IUZHNOGO TIAN'-SHANIA]
N. T. KOCHNEVA, G. A. TANANAEVA, and R. A. BELOV (AN SSSR, Institut Geologii Rudnykh Mestorozhdenii, Petrografii, Mineralogii i Geokhimii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 41-46. In Russian. refs

A new type of poorly discernible oblique metallogenic zone has been identitifed on satellite remote-sensing imagery. The typical features of these zones are described for different landscapes in the southern Tien-Shan territory. It is found that the oblique zones affect the location of ore mineralization. B.J.

A88-19566
STRUCTURE OF THE EASTERN PART OF THE TURKESTAN RANGE AS SEEN ON SPACE PHOTOGRAPHS [STROENIE VOSTOCHNOI CHASTI TURKESTANSKOGO KHREBTA PO KOSMOFOTOSNIMKAM]
I. G. TSUKORNIK, A. V. ALEKSEENKO, A. V. BEREZANSKII, and I. I. SOLOSHENKO (Iuzhno-Kirgizskaia Geologicheskaia Ekspeditsiia, Osh, Kirgiz SSR; L'vovskii Gosudarstvennyi Universitet, Lvov, Ukrainian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 47-52. In Russian. refs

Lineaments identified on space photographs of the eastern Turkestan Range are considered. The observed lineament zones correspond to latitudinally oriented Paleozoic structural-formational zones in the region. Submeridional zones indicating hidden deep-seated faults with an anti-Tien-Shan direction are also identified. B.J.

A88-19567
RECOGNITION OF CRUSTAL PLASTIC DEFORMATIONS WITH REFERENCE TO THE ALPINE-CARPATHIAN MOBILE BELT [VYIAVLENIE PLASTICHESKIKH DEFORMATSII KORY NA PRIMERE AL'PIISKO-KARPATSKOGO PODVIZHNOGO POIASA]
M. KALAFUT (Magyar Allami Foldtani Intezet, Budapest, Hungary) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 53-58. In Russian. refs

An analysis of low-resolution Meteor-satellite imagery has led to a new tectonic interpretation of the interrelationship of circular, arcuate, and linear elements in the Pannonian Basin and adjacent areas. The salient features include the helixlike structure of this formation and the contribution of plastic eddylike mantle flows transformed in the crust and the sedimentary cover. This approach is used to explain certain features of the regional structure and its dynamic and kinematic characteristics. B.J.

A88-19807
EVIDENCE OF TECTONIC CONTROL OF MINERALIZATION IN NIGERIA FROM LINEAMENT DENSITY ANALYSIS - A LANDSAT-STUDY
S. E. ANANABA (Federal University of Technology, Owerri, Nigeria) and D. E. AJAKAIYE (Jos, University, Nigeria) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1445-1453. refs

N88-12163# Nevada Univ., Reno. Mackay School of Mines.
APPLICATION OF SPOT-1 DATA TO MINERAL EXPLORATION IN NEVADA
JAMES V. TARANIK and MARCUS X. BORENGASSER *In* CNES, SPOT 1: First In-Flight Results p 167-172 1987
Avail: CEPADUES-Editions, Toulouse, France

Use of SPOT multispectral and panchromatic data for mineral exploration was tested. Analysis suggests that photointerpretation of SPOT panchromatic data can be easily accomplished at 1:50,000 scale, or larger if desired, but not larger than 1:25,000 scale. Panchromatic data can be utilized for field investigations when enlarged to 1:12,000 scale. Multispectral data can be used for photointerpretation at 1:100,000 scale, or larger if desired, but not larger than 1:50,000 scale. Multispectral data can be utilized effectively for field investigations when enlarged to 1:25,000 scale. Multispectral data are comparable to LANDSAT TM multispectral data, but SPOT has better spatial resolution which aids in discriminating rock sequences. The TM 1.6 micron band adds significant spectral data for geological investigations and the combination of 1.6 and 2.2 micron bands allows important geological information on clays, carbonates, and sulfates associated with rock sequences. This information could be extracted from SPOT-4 data, although current plans do not include the 2.2 micron band. ESA

N88-12164# Paris VI Univ. (France).
GEOLOGICAL INTERPRETATION OF A SPOT IMAGE OVER KENYA: THE GREGORY RIFT NETWORK OF FAULTS
J. CHOROWICZ, G. VIDAL, and J. P. RUDANT *In* CNES, SPOT-1: First In-Flight Results p 173-179 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

A SPOT image of the East African Rift was processed. Standard processing (stretching, anamorphose, color composition) and specialized processing (smoothing, filtering, decorrelation) provide very high quality images. Lithology mapping and fault analysis are possible. The resulting map is compared with two maps of the same type, obtained from analyzing respectively LANDSAT MSS and TM images. The high spatial resolution of the SPOT data and their good radiometric quality allow the drawing of a far more precise map. The tension gashes are visible and the sinuous track of the faults perfectly exposed. This map permits study of the structure of this intersection zone of two large tectonic families: the submeridian faults belonging to the main rift trend, Cenozoic in age; the NW-SE faults belonging to the Aswa lineament zone, reactivating a Precambrian structure, having a transform character during the rift evolution. ESA

N88-12165# Bureau de Recherches Geologiques et Minieres, Minieres, Paris (France).
EVOLUTION OF REMOTE SENSING UTILIZATION IN GEOLOGICAL MAPPING AND ORE EXPLORATION: EXAMPLE IN ZIMBABWE
J. Y. SCANVIC *In* CNES, SPOT 1: First In-Flight Results p 181-185 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

The remote sensing survey of the Lomagundi (Zimbabwe) basin where copper and gold mineralizations are known, using SPOT is described. The copper metallotecte is disturbed by a complex tectonic which suggests difficulties for further exploitation. The proposed geological and structural mapping improves the knowledge of the metallotecte, making possible the discovery of new occurrences in the field. The discovery of a possible gold metallotecte along the Jaspe formations orients geochemical prospections. Adapted data processing enables mapping of specific ferruginous alterations. ESA

N88-12859# Los Alamos National Lab., N. Mex.
A MINERAL RECONNAISSANCE SAMPLING MANUAL FOR COSTA RICA: CENTRAL AMERICAN ENERGY AND RESOURCE PROJECT
S. BOLIVAR Jun. 1987 30 p In ENGLISH and SPANISH
(Contract W-7405-ENG-36)
(DE87-014997; LA-10945-M) Avail: NTIS HC A03/MF A01

This manual describes field procedures for the collection of stream-sediment and rock samples as part of the Mineral Resource Assessment of Costa Rica. It provides guidelines to be followed by personnel collecting, treating, or otherwise handling samples taken as part of this program. The objectives of the manual are to ensure that all samples are collected uniformly and consistent techniques are employed throughout the program. If this is done, the data from this study can be used to identify areas with potential for mineralization. This manual can also be used as a guideline for future geochemical sampling programs in Costa Rica. DOE

N88-13758*# Nevada Univ., Reno. School of Mines.
EFFECTIVE USE OF PRINCIPAL COMPONENT ANALYSIS WITH HIGH RESOLUTION REMOTE SENSING DATA TO DELINEATE HYDROTHERMAL ALTERATION AND CARBONATE ROCKS
SANDRA C. FELDMAN *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 48-55 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 08B

Methods of applying principal component (PC) analysis to high resolution remote sensing imagery were examined. Using Airborne Imaging Spectrometer (AIS) data, PC analysis was found to be useful for removing the effects of albedo and noise and for isolating the significant information on argillic alteration, zeolite, and

carbonate minerals. An effective technique for using PC analysis using an input the first 16 AIS bands, 7 intermediate bands, and the last 16 AIS bands from the 32 flat field corrected bands between 2048 and 2337 nm. Most of the significant mineralogical information resided in the second PC. PC color composites and density sliced images provided a good mineralogical separation when applied to a AIS data set. Although computer intensive, the advantage of PC analysis is that it employs algorithms which already exist on most image processing systems. Author

N88-13766*# Brown Univ., Providence, R. I. Dept. of Geological Sciences.

ABUNDANCE AND DISTRIBUTION OF ULTRAMAFIC MICROBRECCIA IN MOSES ROCK DIKE: QUANTITATIVE APPLICATION OF AIS DATA Abstract Only

JOHN F. MUSTARD and CARLE M. PIETERS *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 105-106 15 Aug. 1987

Avail: NTIS HC A09/MF A01 CSCL 08B

Moses Rock dike is a Tertiary diatreme containing serpentinized ultramafic microbreccia (SUM). Field evidence indicates the SUM was emplaced first followed by breccias derived from the Permian strata exposed in the walls of the diatreme and finally by complex breccias containing basement and mantle derived rocks. SUM is found primarily dispersed throughout the matrix of the diatreme. Moses Rock dike was examined with Airborne Imaging Spectrometer (AIS) to map the distribution and excess of SUM in the matrix and to better understand the nature of the eruption which formed this explosive volcanic feature. AIS data was calibrated by dividing the suite of AIS data by data from an internal standard area and then multiplying this relative reflectance data by the absolute bidirectional reflectance of a selected sample from the standard area which was measured in the lab. From the calibrated AIS data the minerals serpentine, gypsum, and illite as well as desert varnish and the lithologies SUM and other sandstones were identified. SUM distribution and abundance in the matrix of the diatreme were examined in detail and two distinct styles of SUM dispersion were observed. The two styles are discussed in detail. Author

N88-13767*# Stanford Univ., Calif. Dept. of Applied Earth Sciences.

EVALUATION OF AIS-2 (1986) DATA OVER HYDROTHERMALLY ALTERED GRANITOID ROCKS OF THE SINGATSE RANGE (YERINGTON) NEVADA AND COMPARISON WITH 1985 AIS-1 DATA

R. J. P. LYON *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 107-119 15 Aug. 1987

Avail: NTIS HC A09/MF A01 CSCL 08B

The Airborne Imaging Spectrometer-2 (AIS-2) flights along 2 subparallel lines (bearing 013) were designed to traverse 3 major rock assemblages - the Triassic sedimentary sequence; the granitoid rocks of the Yerington batholith and the Tertiary ignimbritic ash flow and ash fall tuffs. The first 2 sites are hydrothermally altered to a quartz-sericite-tourmaline mineralogy. The first AIS-2 data set showed numerous line dropouts and a considerable number of randomly distributed dark pixels. A second decommutation reduced the dropout essentially to near zero and the dark pixels by about 75 percent. Vertical striping was removed by histogram matching, column by column. A log residual spectrum was calculated which showed the departure of a 2 x 2 pixel area from the spatially and spectrally averaged scene. A 1:1 correlation was found with the log residual AIS-2 data and a large open pit area of gypsum. An area with known sericite agreed with the overflight data, and an area known to be free of any significant amount of O-H bearing materials showed no evidence of any in the AIS-2 log residuals. Author

N88-13768*# Durham Univ. (England). Dept. of Geological Sciences.

PRELIMINARY RESULTS FROM AN INVESTIGATION OF AIS-1 DATA OVER AN AREA OF EPITHERMAL ALTERATION: PLATEAU, NORTHERN QUEENSLAND, AUSTRALIA

STEVE MACKIN, TIM MUNDAY, and SIMON HOOK *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop 120-131 15 Aug. 1987

Avail: NTIS HC A09/MF A01 CSCL 08B

Airborne Imaging Spectrometer-1 (AIS-1) data were flown over undifferentiated sequences of acid to intermediate volcanics and intrusives; meta-sediments; and a series of partially lateritized sedimentary rocks. The area exhibits a considerable spectral variability, after the suppression of striping effects. Log residual, and Internal Average Relative Reflectance (IARR) analytical techniques were used to enhance mineralogically related spectral features. Both methods produce similar results, but did not visually highlight mineral absorption features due to processing artifacts in areas of significant vegetation cover. The enhancement of mineral related absorption features was achieved using a hybrid processing approach based on the relative reflectance differences between vegetated and non-vegetated surfaces at 1.2 and 2.1 micron. The result is an image with little overall contrast, but which enhances the more subtle spectral features believed to be associated with clays and epidote. The AIS data was subject to interactive analysis using SPAM. Clear separation of clay and epidote related absorption features was apparent, and the identification of kaolinite was possible despite detrimental spectral effects. Author

N88-13771*# Geological Survey, Reston, Va.

ANALYSIS OF AIRBORNE IMAGING SPECTROMETER DATA FOR THE RUBY MOUNTAINS, MONTANA, BY USE OF ABSORPTION-BAND-DEPTH IMAGES

DAVID W. BRICKEY, JAMES K. CROWLEY, and LAWRENCE C. ROWAN *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 143-147 15 Aug. 1987

Avail: NTIS HC A09/MF A01 CSCL 08B

Airborne Imaging Spectrometer-1 (AIS-1) data were obtained for an area of amphibolite grade metamorphic rocks that have moderate rangeland vegetation cover. Although rock exposures are sparse and patchy at this site, soils are visible through the vegetation and typically comprise 20 to 30 percent of the surface area. Channel averaged low band depth images for diagnostic soil rock absorption bands. Sets of three such images were combined to produce color composite band depth images. This relative simple approach did not require extensive calibration efforts and was effective for discerning a number of spectrally distinctive rocks and soils, including soils having high talc concentrations. The results show that the high spectral and spatial resolution of AIS-1 and future sensors hold considerable promise for mapping mineral variations in soil, even in moderately vegetated areas. Author

N88-13772*# Colorado Univ., Boulder. Center for the Study of Earth from Space.

MAPPING HYDROTHERMALLY ALTERED ROCKS IN THE NORTHERN GRAPEVINE MOUNTAINS, NEVADA AND CALIFORNIA WITH THE AIRBORNE IMAGING SPECTROMETER

FRED A. KRUSE *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 148-166 15 Aug. 1987

Avail: NTIS HC A09/MF A01 CSCL 08B

Seven flightlines of Airborne Imaging Spectrometer (AIS) data were analyzed for an area of hydrothermally altered rocks. The data were reduced to reflectance relative to an average spectrum, and an automated procedure was used to produce a color coded image displaying absorption band information. Individual spectra were extracted from the AIS images to determine the detailed mineralogy. Two alteration types were mapped based upon mineralogy identified using the AIS data. The primary alteration type is quartz sericite pyrite alteration which occurs in

northwest-trending zones in quartz monzonite porphyry. The AIS data allow identification of sericite (muscovite) based upon a strong absorption feature near 2.21 micron and weaker absorption features near 2.35 and 2.45 micron. The second alteration type occurs as a zone of argillic alteration associated with a granitic intrusion. Montmorillonite was identified based on a weak to moderate absorption feature near 2.2 micron and the absence of the two absorption features at longer wavelengths characteristic of sericite. Montmorillonite could be identified only where concentrations of sericite did not mask the montmorillonite spectrum. Author

N88-14484# Commission of the European Communities (Luxembourg).
REMOTE SENSING IN MINERAL EXPLORATION
D. W. COLLER, M. F. CRITCHLEY, J. M. DOLAN, C. MACDONAILL, and C. J. MURPHY 1986 175 p
(PB87-138558; EUR-10334-EN) Avail: NTIS HC E07/MF E07; customers in the European Community countries should apply to the Office for Official Publications of the European Communities, B.P. 2985, Luxembourg CSCL 08G

The contents of this report on Remote Sensing in Mineral Exploration include the following: Structural, remote sensing and multivariate correlation methods as aids to mineral exploration in Central Ireland; Analysis of LANDSAT imagery from East Greenland; Airborne remote sensing in East Greenland; Computer correlation of exploration data for the Pennine orefields; Remote sensing in South Greenland; Methodology for locating subsurface domes by remote sensing. Description of some of the results of the past research and development program of the European Community on primary raw materials (1978 to 1981) as well as more recent work concerning the development and application of remote techniques in mineral exploration, as well as some more recent work in the field are given. GRA

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OCEANOGRAPHY AND MARINE RESOURCES

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

A88-10698
USING LANDSAT MSS DATA FOR MEASURING ICE SHEET RETREAT
PETER KNIGHT, RUTH WEAVER, and DAVID SUGDEN (Aberdeen, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, July 1987, p. 1069-1074.

The western margin of the Greenland ice sheet near Jakobshavn has retreated rapidly during the past 100 years. A vegetation trim line which marks the position of the ice margin c. AD 1880 can accurately be identified from Landsat MSS imagery. The possibility of identifying other former ice margin positions from satellite data opens up exciting prospects for geomorphology, glaciology, and the study of global climatic and environmental change. Author

A88-10817* South Carolina Univ., Columbia.
COMPARATIVE OCEANOGRAPHY OF COASTAL LAGOONS
BJORN KJERFVE (South Carolina, University, Columbia) IN: Estuarine variability. San Diego, CA, Academic Press, 1986, 32 p. refs
(Contract NSF INT-79-11180; NSF INT-82-15374; DACW01-82-Q-0022; NAS5-28741)

The hypothesis that physical lagoon characteristics and variability depend on the channel connecting the lagoon to the adjacent coastal ocean is evaluated. The geographical, hydrological, and oceanographic characteristics of 10 lagoon systems are described and analyzed; these oceanographic features are utilized to classify the lagoon systems. Choked lagoons (Laguna Joyuda, Coorong, Lake St.Lucia, Gippsland Lakes, Lake Songkla/Thale Luang/Thale Noi, and Lagoa dos Patos) are prevalent on coasts with high wave energy and low tidal range; restricted lagoons (Lake Pontchartrain and Laguna de Terminos) are located on low/medium wave energy coasts with a low tidal range; and leaky lagoons (Mississippi Sound and Belize Lagoon/Chetumal Bay) are connected to the ocean by wide tidal passes that transmit oceanic effects into the lagoon with a minimum of resistance. The data support the hypothesis that the nature of the connecting channel controls system functions. I.F.

A88-10910
DETERMINATION OF THE SEA-SURFACE WIND SPEED USING RADAR DATA OBTAINED BY THE COSMOS-1500 SATELLITE [OPREDELENIE SKOROSTI PRIVODNOGO VETRA PO RADIOLOKATSIONNYM ISZ 'KOSMOS-1500']
G. V. VOL'PIAN and IU. G. SPIRIDONOV (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 3-11. In Russian. refs

The paper presents the methodology and an algorithm, based on the model of Bass et al. (1968), for calculating absolute values of the sea-surface wind speed above poorly illuminated oceanic regions from data obtained by spaceborne side-looking radar. A method is suggested for the relative physical calibration of radar image brightness using the available radar characteristics of multiyear sea ice. Using radar data obtained by Cosmos-1500, the algorithm was tested by processing two radar images: one, showing an ice-covered site of the sea surface and an ice-free site in the Spitsbergen Archipelago coastal region, an area of deep-cyclone winds; the other, showing a tropical storm (Ida-8313) near Japan. I.S.

A88-10911
DIAGNOSTICS OF THE VERTICAL STRUCTURE OF THE OCEAN UPPER LAYER FROM THE KINEMATICS OF THE SURFACE MANIFESTATIONS OF INTERNAL WAVES [DIAGNOSTIKA VERTIKAL'NOI STRUKTURY VERKHNEGO SLOIA OKEANA PO KINEMATIKE POVERKHNOSTNYKH PROIAVLENII VNUTRENNIKH VOLN]
B. A. NELEPO, G. K. KOROTAEV, V. N. KUDRIAVTSEV, and S. A. GRODSKII (AN USSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 12-25. In Russian. refs

The paper describes a method for determining the ocean surface vertical structure from the kinematic parameters of internal waves (IWs) obtained from remote measurements of sea-surface manifestations. The method enables the determination of the heat content of the upper sea layer, the effective depth of the thermocline, and the spatial variations of these two parameters. The integral parameters of this layer retrieved from radar data on large-scale IW manifestations in the tropical Atlantic are discussed. I.S.

A88-10913
STUDY OF THE SEA-SURFACE RADIO-BRIGHTNESS VARIATIONS IN THE REGION OF A TEMPERATURE FRONT [ISSLEDOVANIE VARIATSII RADIOIARKOSTI MORSKOI POVERKHNOSTI V OBLASTI TEMPERATURNOGO FRONTA]
V. B. VENSLAVSKII and V. S. ETKIN (AN SSSR, Institut Kosmicheskikh Issledovanii, Moscov, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 38-42. In Russian. refs

The effect of temperature variations on sea-surface radio-brightness data was investigated by measuring the radio brightness values at the region of a temperature front in the Pacific Ocean located at about 43 deg N and 170 deg E. The sea-surface radio brightness was measured at several wavelengths (1.5, 2, and 3.2 cm) by radiometers aboard a research vessel that also carried apparatus for measuring the sea-surface temperature and the wind velocity and direction. It is shown that the temperature front is associated with changes in the radio-brightness regression coefficient and the spread of the relative radio-brightness variations. I.S.

A88-11455 Centre National de la Recherche Scientifique, Grenoble (France).
SEA ICE TRACKING BY NESTED CORRELATIONS
MICHAEL FILY (CNRS, Laboratoire de Glaciologie et de Geophysique de l'Environnement, Grenoble, France) and D. A. ROTHROCK (Washington, University, Seattle) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-25, Sept. 1987, p. 570-580. NASA-Navy-ESA-supported research. refs

Spatial differences in sea ice displacement affect ice stress, ice production, and the mass balance of the ice cover. Concepts about the spatial structure of this field have been undernourished because of a paucity of data with high spatial detail and because of the tedium of extracting such measurements from images manually. A method is described that measures displacements from synthetic aperture radar digital imagery with fine spatial resolution, and does so fully automatically. Many small areas of ice common to two images are identified by correlating the two images. The strategy is to acquire a crude displacement field first from highly averaged images, and to refine this field with images of successively higher resolution. The median discrepancy between automatically and manually measured displacements is three pixels (0.075 km). The algorithm operates successfully on compact ice with large floes and modest rotation rates; it is believed it will prove applicable to most of the arctic ice cover throughout the year. Author

A88-11589
CONVECTIVE ACTIVITIES IN THE TROPICAL WESTERN PACIFIC AND THEIR IMPACT ON THE NORTHERN HEMISPHERE SUMMER CIRCULATION
TSUYOSHI NITTA (Meteorological Research Institute, Tsukuba, Japan) Meteorological Society of Japan, Journal (ISSN 0026-1165), vol. 65, June 1987, p. 373-390. refs

A88-12157
METHOD FOR THE AIRBORNE LASER SOUNDING OF THE SEA SURFACE [METOD LAZERNOGO ZONDIROVANIIA MORSKOI POVERKHNOSTI S BORTA SAMOLETA]
T. B. SHEVCHENKO and I. V. SHUGAN (AN SSSR, Institut Obshchei Fiziki, Moscow, USSR) (Vsesoiuznaia Konferentsiia po Optike Lazerov, 5th, Leningrad, USSR, Jan. 1987) Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia (ISSN 0367-6765), vol. 51, Aug. 1987, p. 1281-1284. In Russian. refs

A calculation method is developed for determining the statistical characteristics of laser glare from the sea surface with allowance for the motion of surface waves. The proposed method is used to calculate corrections for Black Sea and Pacific Ocean data. It is concluded that important information on the statistical characteristics of a random moving sea surface can be obtained from received 'glare' pulses. B.J.

A88-12308
AN AIR-SEA INTERACTION MODEL OF INTRASEASONAL OSCILLATIONS IN THE TROPICS
KERRY A. EMANUEL (MIT, Cambridge, MA) Journal of the Atmospheric Sciences (ISSN 0022-4928), vol. 44, Aug. 15, 1987, p. 2324-2340. refs
(Contract NSF ATM-85-13871)

A linear model of intraseasonal oscillations produced by the interaction of an atmosphere on an equatorial Beta-plane with a fixed ocean is presented. Convection is treated as a means of rapidly redistributing in the vertical heat acquired from the sea surface, rather than as a heat source in and of itself. The model produces a spectrum of equatorially trapped oscillating instabilities, among which is an eastward-propagating wavenumber one disturbance with an intrinsic phase speed in the range of 4-20 m/s, depending on the mean zonal wind, the surface exchange coefficients, the air-sea equivalent potential temperature difference, and the difference of absolute temperature across the depth of the lower troposphere. The three-dimensional structure of this mode is in excellent agreement with observations and recent numerical experiments concerning the 30-60 day oscillation. The phase speed and growth rate of the disturbances depend only on conditions at the equator, while their meridional structure varies with meridional gradients of mean zonal wind, sea surface temperature, and the depth of the moist convective layer. Momentum fluxes by the waves may serve to maintain mean easterlies at the equator. The model also predicts nongeostrophic oscillations with generally shorter periods of around one week. Author

A88-12762
INFLUENCE OF SOLAR VARIABILITY ON GLOBAL SEA SURFACE TEMPERATURES
GEORGE C. REID (NOAA, Aeronomy Laboratory, Boulder, CO) Nature (ISSN 0028-0836), vol. 329, Sept. 10, 1987, p. 142, 143. refs

Data on globally averaged SST over the past 120 yr are used here to show that solar irradiance may have varied in phase with the 80-90 yr cycle represented by the envelope of the 11-yr solar-activity cycle. As the last peak of this cycle occurred in 1955-60, the next minimum should be reached about the end of the century. By that time the solar irradiance will be reduced from its peak value by about 1 percent if the present decay rate of 0.019 percent per year is typical. C.D.

A88-12900* Woods Hole Oceanographic Institution, Mass.
TWO-YEAR MOORED INSTRUMENT RESULTS ALONG 152 DEG E
WILLIAM J. SCHMITZ, JR. (Woods Hole Oceanographic Institution, MA), PEARN P. NIILER (California, University, La Jolla), and CHESTER J. KOBLINSKY (NASA, Goddard Space Flight Center, Greenbelt, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Sept. 15, 1987, p. 10826-10834. NASA-supported research. refs
(Contract N00014-76-C-0197; N00014-84-C-0134; N00014-80-C-0440; NR PROJECT 083-400)

Results from a 2-year (nominal) deployment of a moored array along 152 deg E from 28 deg N to 41 deg N are presented, with emphasis on similarities and differences between settings (approximately year-to-year). Ten moorings and 38 instruments were involved, from the fall of 1980 to 1982. Current-temperature meters spanned the water column from 500- to 4000-m depths, with occasional instruments in the vicinity of 300 m and near the bottom (about 6000 m). Upper level features located in the center of the array near 35-36 deg N were generally stable relative to the axis of the Kuroshio Extension, varying from deployment to deployment with meanders in this flow regime. Some properties of the abyssal (about 4000 m) currents were comparatively more variable, with these changes not connected to meandering of the Kuroshio Extension in an obvious way. The vertical structure and frequency distributions of eddy kinetic energy were similar in shape and to some extent in amplitude from deployment to deployment, especially relative to meanders of the Kuroshio Extension, but translated in the opposite direction. Author

A88-13643
RESULTS OF IN SITU STUDIES IN THE NORWEGIAN ENERGY-ACTIVE ZONE [REZUL'TATY NATURNYKH ISSLEDOVANII V NORVEZHSKOI ENERGOAKTIVNOI ZONE]
G. V. ALEKSEEV, IU. V. NIKOLAEV, A. A. ROMANOV, V. A. ROMANTSOV, and E. I. SARUKHANIAN Itogi Nauki i Tekhniki, Seriia Atmosfera, Okean, Kosmos - Programma Razrezy (ISSN 0208-1245), vol. 7, 1986, p. 46-72. In Russian. refs

A88-13647
PRINCIPAL RESULTS OF THE SATELLITE REMOTE-SENSING OF THE OCEAN-ATMOSPHERE SYSTEM AND PROBLEMS INVOLVING THE INVESTIGATION OF HEAT AND MOISTURE TRANSFER IN THIS SYSTEM [OSNOVNYE REZUL'TATY DISTANTSIONNOGO ZONDIROVANIIA SISTEMY OKEAN-ATMOSFERA SO SPUTNIKOV I ZADACHI IZUCHENIIA TEPLO- I VLAGOOBMENA V SISTEME]
M. S. MALKEVICH Itogi Nauki i Tekhniki, Seriia Atmosfera, Okean, Kosmos - Programma Razrezy (ISSN 0208-1245), vol. 7, 1986, p. 145-165. In Russian. refs

Techniques for the remote sensing of the following parameters of the ocean and atmosphere are described: the ocean surface temperature with an error of about 1 C; and the ocean brightness coefficient and the optical properties of the atmosphere with an rms error of 10-15 percent. A spaceborne radiometer system has been designed which is capable of measuring reflected solar radiation and the self-emission of the ocean-atmosphere system with a required accuracy. The application of the techniques described in the Razrezy program for the investigation of heat and moisture transfer in the ocean-atmosphere system is discussed. B.J.

A88-13648
SYSTEMS FOR PROCESSING SATELLITE REMOTE-SENSING MEASUREMENTS TO OBTAIN DATA ON THE SEA SURFACE TEMPERATURE (STATUS, PROBLEMS, AND PROSPECTS) [SISTEMY OBRABOTKI DISTANTSIONNYKH IZMERENII S ISZ DLIA POLUCHENIIA DANNYKH O TEMPERATURE POVERKHNOSTI OKEANA /SOSTOIANIE, PROBLEMY, PERSPEKTIVY/]
A. I. BURTSEV, V. I. SOLOV'EV, A. B. USPENSKII, and V. M. SUTOVSKII Itogi Nauki i Tekhniki, Seriia Atmosfera, Okean, Kosmos - Programma Razrezy (ISSN 0208-1245), vol. 7, 1986, p. 165-189. In Russian. refs

Current trends in the development of satellite systems for the remote measurement of sea surface temperature (SST) are reviewed. Physical principles behind IR remote measurements of the SST are considered along with algorithms for the thematic processing of satellite data. Particular attention is given to the remote measurement of SST from the Meteor-2 satellite. In addition, ways to improve the satellite systems are considered, and future prospects for this field are briefly discussed. B.J.

A88-13649
SHIP SYSTEMS FOR THE COLLECTION AND PROCESSING OF SATELLITE REMOTE-SENSING DATA [SUDOVYE SISTEMY SBORA I OBRABOTKI DISTANTSIONNYKH IZMERENII S ISKUSS TVENNYKH SPUTNIKOV ZEMLI]
M. F. IVANOV, A. V. KAZANSKII, and S. V. VIKTOROV Itogi Nauki i Tekhniki, Seriia Atmosfera, Okean, Kosmos - Programma Razrezy (ISSN 0208-1245), vol. 7, 1986, p. 189-199. In Russian. refs

An automated system (called DISTERM) for the collection, storage, and processing of satellite remote-sensing data aboard ships is described. An algorithm for computing decade charts of sea surface temperature from a series of satelite IR photographs and from contact measurements is presented. Also considered are algorithms for computing the 'instantaneous' thermal structure of the sea surface via the digital processing of one or a small series of satellite photographs. B.J.

A88-13650
PROCESSING OF SATELLITE REMOTE-SENSING DATA ON THE OCEAN [OBRABOTKA REZUL'TATOV DISTANTSIONNOGO ZONDIROVANIIA OKEANA IZ KOSMOSA]
V. S. SUETIN Itogi Nauki i Tekhniki, Seriia Atmosfera, Okean, Kosmos - Programma Razrezy (ISSN 0208-1245), vol. 7, 1986, p. 199-210. In Russian. refs

The paper expounds the basic principles behind the extraction of information about ocean parameters from satellite remote sensing of the ocean-atmosphere system in the microwave, IR, and visible ranges. The processing of data obtained with the Cosmos-1151 and Intercosmos-21 satellites is considered, and corresponding theoretical models are examined. B.J.

A88-13651
CURRENT STATUS AND PROSPECTS OF RESEARCH ON THE NORTHWESTERN PACIFIC ACCORDING TO SATELLITE OBSERVATIONS [SOSTOIANIE I PERSPEKTIVY ISSLEDOVANII SEVERO-ZAPADNOI CHASTI TIKHOGO OKEANA PO DANNYM SPUTNIKOVYKH NABLIUDENII]
L. M. MITNIK and A. G. GRIBUNIN Itogi Nauki i Tekhniki, Seriia Atmosfera, Okean, Kosmos - Programma Razrezy (ISSN 0208-1245), vol. 7, 1986, p. 211-224. In Russian. refs

The paper examines the feasibility of the remote assessment of temperature fields and wave characteristics of the surface layer of the northwestern Pacific along with a number of atmospheric characteristics which depend on the intensity of ocean-atmosphere interaction processes. The investigation of the Kurushio energy-active zone is considered as an example. B.J.

A88-13652
THE SYSTEM FOR THE COLLECTION, PROCESSING, STORAGE, AND EXCHANGE OF DATA IN THE RAZREZY PROGRAM [SISTEMA SBORA, OBRABOTKI, KHRANENIIA I OBMENA DANNYMI PO PROGRAMME 'RAZREZY']
V. I. SMIRNOV, V. I. LAMANOV, V. A. ZHUKOV, V. I. MEL'NIKOV, and P. V. NUZHDIN Itogi Nauki i Tekhniki, Seriia Atmosfera, Okean, Kosmos - Programma Razrezy (ISSN 0208-1245), vol. 7, 1986, p. 226-238. In Russian.

A detailed description is given of the data collection, storage, processing and exchange system employed in the Razrezy program for the investigation of ocean-atmosphere interaction processes with the aim of elucidating short-term variations of climate. Examples of data collection for the Newfoundland, tropical Atlantic, Norwegian, and Kuroshio energy-active zones are presented. A table describing the hardware used on the Razrezy ships is presented. B.J.

A88-13653
INTERNATIONAL AND NATIONAL PROGRAMS FOR THE STUDY OF THE ROLE OF THE OCEAN IN VARIATIONS AND FLUCTUATIONS OF CLIMATE [MEZHDUNARODNYE I NATSIONAL'NYE PROGRAMMY PO IZUCHENIIU ROLI OKEANA V IZMENENIIAKH I V KOLEBANIIAKH KLIMATA]
A. IA. TOLKACHEV Itogi Nauki i Tekhniki, Seriia Atmosfera, Okean, Kosmos - Programma Razrezy (ISSN 0208-1245), vol. 7, 1986, p. 253-264. In Russian. refs

A88-13683
NATURAL FREQUENCIES AND VIBRATION MODES OF SPHERICAL SHELLS WITH ATTACHED MASSES [SOBSTVENNYE CHASTOTY I FORMY KOLEBANII SFERICHESKIKH OBOLOCHEK S PRISOEDINENNYMI MASSAMI]
V. N. REVUTSKII and A. I. TELALOV (AN USSR, Institut Mekhaniki, Kiev, Ukrainian SSR) Prikladnaia Mekhanika (ISSN 0032-8243), vol. 23, Sept. 1987, p. 62-67. In Russian.

Methods are presented for the theoretical and experimental determination of the natural frequencies and vibration modes of clamped spherical shells carrying concentrated masses. Determinations are made of the lower frequencies and modes of axisymmetrical vibrations of a spherical shell with an attached mass at its pole. It is shown that an increase in mass leads to a significant decrease in minimum natural frequency and a localization of the corresponding vibration modes. V.L.

A88-13976
OCEANOGRAPHY FROM SPACE; PROCEEDINGS OF THE TOPICAL MEETING OF THE 26TH COSPAR PLENARY MEETING, TOULOUSE, FRANCE, JUNE 30-JULY 11, 1986
J. F. R. GOWER, ED. (Institute of Ocean Sciences, Sidney, Canada) Meeting sponsored by COSPAR. Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, 146 p. For individual items see A88-13977 to A88-13998.

Papers are presented on algorithms for ocean color from space and application to CZCS data, an evaluation of the problems of chlorophyll retrieval from ocean color for case-2 waters, errors in the remotely sensed ocean reflectance, shallow sea dynamics from CZCS imagery, and the application of CZCS data to productivity and water quality studies in the northern Adriatic Sea. Consideration is given to the remote sensing of Coccolithophore blooms, CZCS-derived pigment concentration fields in Japanese coastal area, the inference of physical/biological dynamics from synthetic ocean color images, and the spatial variability of the ocean color field in CZCS imagery. In addition, attention is given to the observation of ocean color and fluorescence for primary production studies, new production and the ocean carbon fluxes, the remote observation of ocean color for the prediction of upper-ocean heating rates, the estimation of phytoplankton production by remote sensing, and limitations on relating ocean surface chlorophyll to productivity. I.S.

A88-13977* National Aeronautics and Space Administration, Washington, D.C.
FUTURE U.S. OCEAN COLOR MISSIONS - OCI, MODIS AND HIRIS
C. O. DAVIS (NASA, Washington, DC) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 3-5, 7-9. refs

NASA has been working to develop an Ocean Color Imager (OCI). The Earth Observing Satellite Company (EOSAT) is considering flying an ocean and land wide-field color instrument which would meet specified requirements on Landsat 6 or 7 planned for launch in 1989 and 1991, respectively. It would provide eight ocean color channels for improved atmospheric correction and in-water algorithms, global coverage and near real-time data for operational uses. In the mid 1990's NASA is planning to fly a Moderate Resolution Imaging Spectrometer (MODIS) and a High Resolution Imaging Spectrometer (HIRIS) as part of the Earth Observing System on the Polar Platform of the Space Station. These instruments are array spectrometers which would provide full spectral resolution in the visible and infrared. This opens the possibility of separating different groups of phytoplankton, suspended sediments and other substances in the water. Author

A88-13978
ALGORITHMS FOR OCEAN COLOUR FROM SPACE AND APPLICATION TO CZCS DATA
P. Y. DESCHAMPS (Laboratoire d'Etudes et de Recherches en Teledetection Spatiale, Toulouse, France) and M. VIOLLIER (CNRS; Institut Francais de Recherches pour L'Exploitation de la Mer, Brest, France) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 11-19. refs

The equations used for ocean color and atmospheric correction algorithms are described. Their efficiency is tested by using CZCS data controlled with in situ observations. For the chlorophyll concentrations greater than 1 mg/cu m, the algorithms are very sensitive to the absolute radiometric sensor calibration and to the knowledge of the wavelength dependence of the aerosol scattering. In this case, favorable comparisons between satellite and in situ chlorophyll concentrations are only obtained for the price of careful adjustments of the algorithm parameters on a scene basis. Plans for future ocean color sensors should consider a remedy for these probleme. Author

A88-13979
AN INVERSE TECHNIQUE FOR REMOTE DETECTION OF SUSPENDED MATTER, PHYTOPLANKTON AND YELLOW SUBSTANCE FROM CZCS MEASUREMENTS
J. FISCHER and R. DOERFFER (GKSS-Forschungszentrum Geesthacht GmbH, Federal Republic of Germany) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 21-23, 25, 26. refs

The success of remote sensing applications not only depends on instrumental configurations, but also strongly on data interpretation. For the retrieval of phytoplankton, suspended matter and yellow substance from multispectral radiance measurements, the radiative transfer equation is solved with a matrix operator code and inverted by an optimization procedure. A first attempt for an application to CZCS measurements over the North Sea indicates the advantage of the inverse technique. Author

A88-13980
AN EVALUATION OF THE PROBLEMS OF CHLOROPHYLL RETRIEVAL FROM OCEAN COLOUR, FOR CASE 2 WATERS
S. SATHYENDRANATH (National Institute of Oceanography, Goa, India), L. PRIEUR, and A. MOREL (Paris VI, Universite, Villefranche-sur-Mer, France) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 27-30. refs
(Contract ESA-4726/81/F/DD/SC)

A88-13981
ERRORS IN THE REMOTELY SENSED OCEAN REFLECTANCE
S. KEEVALLIK and A. HEINLO (AN ESSR, Institut Astrofiziki i Fiziki Atmosfery, Tartu, Estonian SSR) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 31-35.

An approximate method has been described for determination of the optical properties of the ocean surface from the reflected short-wave radiance at the top of the atmosphere. The nonscattered and singly-scattered components of the radiation field have been taken into account exactly, the multiply-scattered components approximately. The calculations for a real atmospheric model have been compared with the results of an exact method for solving the radiation-transfer equation. On the basis of the elaborated algorithm, the sensitivity of the value of the remotely sensed spectral albedo of the ocean to the variations in optical thickness, single scattering albedo, and aerosol phase function has been described, as well as the influence of vertical inhomogeneity of the atmosphere. Author

A88-13982
SHALLOW SEA DYNAMICS FROM CZCS IMAGERY
S. R. BOXALL and I. S. ROBINSON (Southampton, University, England) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 37-46.
(Contract NERC-GR3/5024)

A88-13984
SPATIAL/TEMPORAL VARIABILITY OF ALGAL BIOMASS AND POTENTIAL PRODUCTIVITY IN THE MAURITANIAN UPWELLING ZONE, AS ESTIMATED FROM CZCS DATA
A. BRICAUD, A. MOREL, and J. M. ANDRE (Paris VI, Universite, Villefranche-sur-Mer, France) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 53-62. Research supported by the Institut Francais de Recherches pour l'Exploitation de la Mer and CNRS. refs
(Contract CNES-84-1243)

A88-13985
CZCS AS AN AID FOR UNDERSTANDING MODALITIES OF THE PHYTOPLANKTON PRODUCTIVITY DURING UPWELLING OFF SENEGAL
C. DUPOUY (Institut Francais de Recherches pour l'Exploitation de la Mer, Brest, France) and H. DEMARCQ (Dakar-Thiaroye, Centre de Recherche Oceanographique, Dakar, Senegal) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 63-71. refs

A88-13986
REMOTE SENSING OF COCCOLITHOPHORE BLOOMS
S. B. GROOM (Imperial College of Science and Technology, London, England) and P. M. HOLLIGAN (Marine Biological Association, Plymouth, England) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 73-78. refs

CZCS and AVHRR images have been used to study the spatial, temporal and spectral development of coccolithophore blooms in the NE Atlantic. It is suggested that variations in color and reflectance in the images are due to differences in the relative concentrations of coccolithophore cells and detached plates. Also the formation and disappearance of an intense bloom in the English Channel is related to changes in water-column stability during the spring-neap tidal cycle. Author

A88-13987
CZCS-DERIVED PIGMENT CONCENTRATION FIELDS IN JAPANESE COASTAL AREA
H. FUKUSHIMA, Y. SUGIMORI (Tokai University, Shimizu, Japan), and K. HIRAMATSU (Japan Fisheries Agency, Far Seas Fisheries Research Laboratory, Shimizu, Japan) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 79-82. refs

A88-13988
SATELLITE OBSERVED DYNAMICS OF CHLOROPHYLL AND SUSPENDED SEDIMENTS IN A SHALLOW, HIGH LATITUDE EMBAYMENT
N. G. MAYNARD, V. BARALE, and J. SVEJKOVSKY (California, University, La Jolla) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 83-88. Navy-supported research. refs

A88-13989* Institute of Ocean Sciences, Victoria (British Columbia).
INFERENCE OF PHYSICAL/BIOLOGICAL DYNAMICS FROM SYNTHETIC OCEAN COLOUR IMAGES
J. EERT (Interact Research and Development Corp., Victoria, Canada), G. HOLLOWAY, J. F. R. GOWER, K. DENMAN (Institute of Ocean Sciences, Sidney, Canada), and M. ABBOTT (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California, University, La Jolla) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 89-93.

High resolution numerical experiments with well resolved eddies are performed including advection of a biologically active plankton field. Shelf wave propagation and bottom topographic features are included. The resulting synthetic ocean color fields are examined for sensitivity to the (known) underlying physical dynamics. Author

A88-13990
SPATIAL VARIABILITY OF THE OCEAN COLOR FIELD IN CZCS IMAGERY
V. BARALE and C. C. TREES (California, University, La Jolla) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 95-97, 99, 100. refs

The mesoscale ocean color field has been investigated by means of a statistical approach to the analysis of Coastal Zone Color Scanner imagery. A quantitative assessment of ocean color was provided by deriving large scale, high resolution images of the diffuse attenuation coefficient at 490 nm, K 490, for several open-ocean areas in the North Atlantic and North Pacific (around 30, 40, and 60 deg N). Linear trends, power spectra, and structure functions were determined for one-dimensional transects extracted from the images. These results can be interpreted as a composite statistical signature of the oceanic regions examined. In light of the relationship between ocean optical properties and concentration of dissolved and suspended materials in the water, the statistical parameters obtained provide an insight into the relative intensity and scales of patchiness of water constituents, and of the planktonic environment. Author

A88-13991
ON THE USE OF THE SOLAR-STIMULATED FLUORESCENCE SIGNAL FROM CHLOROPHYLL A FOR AIRBORNE AND SATELLITE MAPPING OF PHYTOPLANKTON
J. F. R. GOWER (Institute of Ocean Sciences, Sidney, Canada) and G. A. BORSTAD (Borstad Associates, Ltd., Sidney, Canada) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 101-106. refs

A88-13993
OBSERVATION OF OCEAN COLOR AND FLUORESCENCE FOR PRIMARY PRODUCTION STUDIES
YONGYAO DING (State Oceanic Administration, First Institute of Oceanography, Qingdao, People's Republic of China) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 111-115. refs

A88-13995
NEW PRODUCTION AND THE OCEAN CARBON FLUXES
J. F. MINSTER and V. GARCON (CNES, Toulouse, France) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 121-126. refs

A88-13996
REMOTE OBSERVATION OF OCEAN COLOUR FOR PREDICTION OF UPPER OCEAN HEATING RATES
MARLON R. LEWIS (Dalhousie University, Halifax, Canada) and TREVOR C. PLATT (Bedford Institute of Oceanography, Dartmouth, Canada) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 127-130. refs

The magnitude and variability in the vertical distribution of solar heating of the ocean is controlled by the concentration of pigments imaged by the Coastal Zone Color Scanner. The vertical heating profile influences the thermal structure and dynamics of the upper ocean on time-scales from the diurnal to the climatic, and can potentially be predicted from estimation of attenuance from remote observation of ocean color. Examples are given from a frontal region and the equatorial ocean. It is concluded that such observations would make a significant contribution to outstanding questions of the day in physical oceanography and climate research. Author

A88-13997
ESTIMATION OF PHYTOPLANKTON PRODUCTION BY REMOTE SENSING
TREVOR C. PLATT (Bedford Institute of Oceanography, Dartmouth, Canada) and MARLON R. LEWIS (Dalhousie University, Halifax, Canada) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 131-135. refs

A88-13998* New York Univ., New York.
LIMITATIONS ON RELATING OCEAN SURFACE CHLOROPHYLL TO PRODUCTIVITY
TYLER VOLK (New York University, NY) (COSPAR, Plenary Meeting, 26th, Topical Meeting on Oceanography from Space, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 2, 1987, p. 137-140. refs
(Contract NAGW-850)

An important potential use of ocean color chlorophyll data is to determine other important properties of the marine biosphere, such as primary productivity, new production, and particulate fluxes at spatial scales larger and temporal scales longer than those possible with ground-based observations. Such determinations will likely progress from relatively simple empirical correlations to algorithms that are actually predictive models of ecosystem dynamics. As an example, this paper demonstrates how an empirical correlation between nitrate concentration and new production can be understood by a simple productivity model. Several models are then constructed to examine the functional relationship between total production and surface chlorophyll. The empirical correlation is substantially different than the analogous relation in the model. Understanding the relationship between surface chlorophyll and productivity on a global scale will probably require families of models for various marine ecosystems.
Author

A88-14431#
BATHYMETRY CALCULATIONS WITH LANDSAT 4 TM IMAGERY UNDER A GENERALIZED RATIO ASSUMPTION
R. KENT CLARK (South Alabama, University, Mobile, AL), TEMPLE H. FAY (Southern Mississippi, University, Hattiesburg), and CHARLES L. WALKER (U.S. Navy, Naval Ocean Research and Development Activity, Bay Saint Louis, MS) Applied Optics (ISSN 0003-6935), vol. 26, Oct. 1, 1987, p. 4036-4038. Navy-sponsored research. refs

The principal steps of two methods for bathymetric calculations from multispectral imagery (i.e., the linear multiband model, and the two-band ratio algorithm) are outlined. Applying the models to calculation of the ocean depth from the Landsat TM4 imagery of an area in the Carribean Sea. It was found that although both algorithms underestimated the depth in shallow water and overestimated in deep water, the linear multiband method yielded somewhat better results. Moreover, this method (unlike the two-band ratio method) does not require the clustering and classification routines to discriminate areas of similar bottom reflectance, and a considerable savings in CPU processing time is realized. I.S.

A88-14453
AN OCEANOGRAPHER IN SPACE - THE NEXT STEP
PAUL E. LA VIOLETTE (U.S. Navy, Naval Ocean Research and Development Activity, Bay Saint Louis, MS), CHARLES S. YENTSCH (Bigelow Laboratory for Ocean Sciences, West Boothbay Harbor, ME), and JOHN R. APEL (Johns Hopkins University, Laurel, MD) EOS (ISSN 0096-3941), vol. 68, March 3, 1987, p. 121, 130, 131.

U.S. Navy plans for oceanographic research from the Space Shuttle are surveyed, summarizing the findings of the Ad Hoc Oceanographic Committee on the use of Shuttles in Oceanography sponsored by the Office of the Chief of Naval Research. Consideration is given to process-oriented studies in collaboration with ground-based laboratories, repeated surveys of known ocean processes or events, and the search for unknown ocean phenomena. Topics addressed include submesoscale baroclinic eddies, oceanic phytoplankton, generation and propagation of internal solitons, bioluminescence, river-ocean interactions, and surface effects. Also discussed are instrument requirements (hand-held cameras, Shuttle-bay multicamera battery, low-light-level camera, multispectral scanner, optical spectrometer/fluorometer, and SAR) and the need for interagency coordination of research programs. T.K.

A88-14743
REDISTRIBUTION OF MOISTURE BETWEEN OCEANS THROUGH THE SNOW COVER OF CONTINENTS (WITH REFERENCE TO THE NORTHERN HEMISPHERE) [PERERASPREDELENIE VLAGI MEZHDU OKEANAMI CHEREZ SNEZHNYI POKROV MATERIKOV /NA PRIMERE SEVERNOGO POLUSHARIIA/]
V. M. KOTLIAKOV, N. M. ZVERKOVA, L. P. CHERNOVA, and A. N. KRENKE (AN SSSR, Institut Geografii, Moscow, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 295, no. 6, 1987, p. 1460-1464. In Russian. refs

A88-14877 California Univ., San Diego, La Jolla.
METHANE OXIDATION AND METHANE FLUXES IN THE OCEAN SURFACE LAYER AND DEEP ANOXIC WATERS
B. B. WARD, K. A. KILPATRICK (California, University, La Jolla), P. C. NOVELLI, and M. I. SCRANTON (New York, State University, Stony Brook) Nature (ISSN 0028-0836), vol. 327, May 21, 1987, p. 226-229. NSF-NASA-supported research. refs

Measured biological oxidation rates of methane in near-surface waters of the Cariaco Basin are compared with the diffusional fluxes computed from concentration gradients of methane in the surface layer. Methane fluxes and oxidation rates were investigated in surface waters, at the oxic/anoxic interface, and in deep anoxic waters. It is shown that the surface-waters oxidation of methane is a mechanism which modulates the flux of methane from marine waters to the atmosphere. I.S.

A88-14890
COMPARISON OF A NEW RADAR OCEAN IMAGING MODEL WITH SARSEX INTERNAL WAVE IMAGE DATA
DENNIS HOLLIDAY, GAETAN ST-CYR, and NANCY E. WOODS (R&D Associates, Marina Del Ray, CA) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1423-1430. refs

Good agreement is demonstrated between both L-band and X-band Sarsex internal-wave image data and the predictions of a new radar ocean imaging model that incorporates Bragg, specular, and composite scattering effects. It then follows that a two-step hydrodynamic modulation process, as hypothesized by Hughes and Gower (1983), Thompson and Gasparovic (1986), and Watson (1986), does not appear to be required to explain why the Sarsex L-band and X-band internal-wave image modulations are comparable. Author

A88-15156#
FILTERING OF ALTIMETER MEASUREMENTS AND ELIMINATION OF TIME-VARIABLE OCEAN CURRENTS, USING SEASAT DATA AS AN EXAMPLE [FILTERUNG VON ALTIMETERMESSUNGEN UND ELIMINATION ZEITVARIABLER MEERESSTROEMUNGEN AM BEISPIEL VON SEASAT-DATEN]
PETER ARNOLD (Bonn, Universitaet, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 95-113. In German.

Techniques for processing satellite altimetry data for use in geoid determination or the analysis of ocean-current-induced sea-surface inclination are described and demonstrated. A least-squares filtering method is introduced and shown to remove the colored noise typical of the altimetry data while preserving the significant features. This method is then applied to Seasat

data from seven repetitive tracks over the Kuroshio current in the North Pacific, obtained over a 21-d period in fall 1978. The results are presented graphically, and it is found that the time-variable topography can be separated out, providing a local correction to the geoid. T.K.

A88-15167#
POSSIBILITIES FOR MONITORING OCEAN POLLUTION WITH REMOTE-SENSING METHODS [MOEGLICHKEITEN ZUR UEBERWACHUNG DER MEERESVERSCHMUTZUNG MIT FERNERKUNDUNGSMETHODEN]
DIETHER SCHMIDT (Deutsches Hydrographisches Institut, Hamburg, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 319-348. In German. BMFT-supported research. refs

The use of aerial and satellite remote-sensing images to monitor the extent and concentration of chemical pollution in the ocean is described, summarizing the results of feasibility studies carried out in the FRG since 1971. The emphasis is on a series of experiments performed in a dumping area (in the North Sea near Helgoland) for acid wastes from TiO2 production. Digitally processed aerial images are found to provide accurate information on the distribution of iron compounds and the chemical changes taking place in the sea water, and the spatial distribution is also captured in Landsat images. Also considered are Landsat images of the Baltic showing massive accumulations of decaying blue-green algae during summer 1975. The need for further experiments with close cooperation between remote-sensing experts and marine chemists is indicated. T.K.

A88-15170#
THE USE OF SATELLITE RADAR IMAGES FOR OCEAN SURVEYING AND NAVIGATION [ANWENDUNG VON RADAR-SATELLITENBILDERN FUER DIE SEEVERMESSUNG UND FUER DIE SCHIFFAHRT]
INGO HENNINGS (GKSS-Forschungszentrum Geesthacht GmbH; Bremen, Universitaet, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 447-454. In German. refs

Theoretical and practical aspects of ocean-bottom characterization from conventional and synthetic-aperture radar images are briefly reviewed. Consideration is given to the relaxation-time theory of weak hydrodynamic interaction with EM radiation, mapping underwater sand banks and shoals, and monitoring deep-water shipping lanes near sand formations. Diagrams, graphs, and sample radar images are provided. T.K.

A88-15689
THE SPACEBORNE RADAR OBSERVATION OF ATMOSPHERIC INTERNAL GRAVITY WAVES [RADIOLOKATSIONNOE NABLIUDENIE IZ KOSMOSA ATMOSFERNYKH VNUTRENNIKH GRAVITATSIONNYKH VOLN]
IU. G. SPIRIDONOV, A. P. PICHUGIN, and V. P. SHESTOPALOV (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR; AN USSR, Institut Radiofiziki i Elektroniki, Kharkov, Ukrainian SSR) Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 296, no. 2, 1987, p. 317-320. In Russian. refs

It is shown that spaceborne radar observations over ocean regions can lead to new information on atmospheric internal gravity waves, making it possible to characterize them at the earth surface over large areas and at any time of the day irrespective of the presence of cloud cover. Radar and optical observations of internal gravity waves over the North Atlantic are considered as an example, and it is shown that the radar observes certain wave features that cannot be observed optically because of the presence of cloud cover. B.J.

A88-15893#
RADAR SYSTEMS OF THE TYPE EMPLOYED ONBOARD THE 'COSMOS-1500' SATELLITE AND THEIR REMOTE SENSING CAPABILITIES
V. I. DRANOVSKII and A. I. KALMYKOV (Glavkosmos, USSR) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 7 p.
(IAF PAPER 87-135)

Advances have been made in ocean and ice research with side-looking radars of the 'Cosmos-1500' series. The principles of determining the underlying surface parameters are based on the measurement of the scattered signal intensities. The precise parameter values of underlying surfaces are calculated by the established dependences relating the specific scattering cross-section to ocean and ice parameters. K.K.

A88-15895#
SYSTEM CONCEPT FOR WIDE-FIELD-OF-VIEW OBSERVATIONS OF OCEAN PHENOMENA FROM SPACE
MATTHEW R. WILLARD (Earth Observation Satellite Co., Lanham, CA) and ARAM M. MIKA (Hughes Santa Barbara Research Center, Goleta, CA) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 6 p.
(IAF PAPER 87-138)

Current plans for the implementation of the Sea Viewing Wide-Field Sensor mission, expected to fly on Landsat-6 in late 1990, are reviewed. The instrument is designed to provide ocean-color and sea-surface-temperature data, which will also be useful for land-based applications. The baseline sensor concept will provide daily coverage (at the equator), 1 km resolution, and six spectral bands in the VNIR and two in the LWIR. The discussion covers supporting research, user requirements, performance goals, implementation of requirements, spacecraft and ground segment, onboard data processing, and data products for research users. V.L.

A88-15919#
ON THE USE OF SATELLITE OBSERVATIONS OF THE TROPICAL ATLANTIC CLOUDINESS AND TEMPERATURE IN THE STUDIES OF CLIMATIC PROCESSES
G. S. DVORIANINOV, G. K. KOROTAEV, V. S. SUETIN, and G. A. CHEPURIN (AN USSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 3 p.
(IAF PAPER 87-176)

Graphs are presented of the temporal dependence of ocean surface temperature deviations and meridional displacements of ITCZ from their mean values over an 11-yr period of annual variations. The relationship between ITCZ wandering and ocean dynamics is studied. By allowing for the role of the tropics in the heat supply to the temperate and high latitudes, it is suggested that the position of the ITCZ axis can be a indicator of variations in the large-scale interaction between the atmosphere and the ocean. K.K.

A88-15921#
DETERMINATION OF GLOBAL COLOUR FIELD OF OCEAN WATERS USING REMOTE MEASUREMENTS FROM SATELLITE 'INTERKOSMOS-21'
G. K. KOROTAEV, V. S. SUETIN, and V. V. SUSLIN (AN USSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 7 p. refs
(IAF PAPER 87-178)

Multichannel spectrometer measurements performed on Interkosmos-21 made it possible to obtain data pertaining to various oceanic regions, atmospheric states, and lighting conditions. A table is presented of the mean square errors of water optical-type reconstruction using the measurements of various channel pairs. It is concluded that space measurements of the radiation of two wavelengths in the visual range makes it possible for the open-ocean water color to differ within the limits of a few gradations under varing atmospheric states and lighting conditions. K.K.

A88-16751* California Univ., Los Angeles.
SEQUENTIAL ESTIMATION AND SATELLITE DATA ASSIMILATION IN METEOROLOGY AND OCEANOGRAPHY
M. GHIL (California, University, Los Angeles; New York University, NY) IN: Variational Methods in Geosciences. Amsterdam and New York, Elsevier Science Publishers, 1986, 10 p. refs
(Contract NSG-5130; NAG5-713)

The role of dynamics in estimating the state of the atmosphere and ocean from incomplete and noisy data is discussed and the classical applications of four-dimensional data assimilation to large-scale atmospheric dynamics are presented. It is concluded that sequential updating of a forecast model with continuously incoming conventional and remote-sensing data is the most natural way of extracting the maximum amount of information from the imperfectly known dynamics, on the one hand, and the inaccurate and incomplete observations, on the other. K.K.

A88-16802
MORPHOMETRIC VARIABILITY WITHIN THE AXIAL ZONE OF THE SOUTHERN JUAN DE FUCA RIDGE - INTERPRETATION FROM SEA MARC II, SEA MARC I, AND DEEP-SEA PHOTOGRAPHY
ELLEN S. KAPPEL (Lamont-Doherty Geological Observatory, Palisades, NY) and WILLIAM R. NORMARK (USGS, Menlo Park, CA) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Oct. 10, 1987, p. 11291-11302. USGS-supported research. refs
(Contract NOAA-NA-82AAH00014; NSF OCE-83-15330; N00014-84-C-0132)

A88-16823*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL OF OCEAN BASIN CRUSTAL MAGNETIZATION APPROPRIATE FOR SATELLITE ELEVATION ANOMALIES
HERMAN H. THOMAS (NASA, Goddard Space Flight Center, Greenbelt, MD) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Oct. 10, 1987, p. 11609-11613. refs

A model of ocean basin crustal magnetization measured at satellite altitudes is developed which will serve both as background to which anomalous magnetizations can be contrasted and as a beginning point for studies of tectonic modification of normal ocean crust. The model is based on published data concerned with the petrology and magnetization of the ocean crust and consists of viscous magnetization and induced magnetization estimated for individual crustal layers. Thermal remanent magnetization and chemical remanent magnetization are excluded from the model because seafloor spreading anomalies are too short in wavelength to be resolved at satellite altitudes. The exception to this generalization is found at the oceanic magnetic quiet zones where thermal remanent magnetization and chemical remanent magnetization must be considered along with viscous magnetization and induced magnetization. Author

A88-17472* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
ON THE CHOICE OF ORBITS FOR AN ALTIMETRIC SATELLITE TO STUDY OCEAN CIRCULATION AND TIDES
MICHAEL E. PARKE, ROBERT H. STEWART, DAVID L. FARLESS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), and DAVID E. CARTWRIGHT (NASA, Goddard Space Flight Center, Greenbelt, MD; Institute of Oceanographic Sciences, Wormley, England) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Oct. 15, 1987, p. 11693-11707. NERC-supported research. refs

The choice of an orbit for satellite altimetric studies of the ocean's circulation and tides requires an understanding of the orbital characteristics that influence the accuracy of the satellite's measurements of sea level and the temporal and spatial distribution of the measurements. The orbital characteristics that influence accurate calculations of the satellite's position as a function of time are examined, and the pattern of ground tracks laid down on the ocean's surface as a function of the satellite's altitude and inclination is studied. The results are used to examine the aliases in the measurements of surface geostrophic currents and tides. Finally, these considerations are used to specify possible orbits that may be useful for the upcoming Topex/Poseidon mission. C.D.

A88-17475
IMAGING BY X BAND RADAR OF SUBSURFACE FEATURES - A NONLINEAR PHENOMENON
KLAARTJE VAN GASTEL (Koninklijk Nederlands Meteorologisch Instituut, De Bilt, Netherlands) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Oct. 15, 1987, p. 11857-11865. ZWO-supported research. refs

A hydrodynamic model is presented which can predict, for high wave numbers of 260/m and above, the large modulations observed in imaging of bottom topography and internal waves in the X and K radar bands at low wind speeds. The model presumes the modulation to be due solely to divergences and convergences of the mean current field. The effect of bottom topography or internal waves is described by a slowly varying surface current. Refraction, wind, nonlinear interactions, and dissipation are taken to govern the spectrum. Essential to this model are the inclusion of exact second-order nonlinear effects and the use of a broad spectrum. It is suggested that, to describe the large observed decreases of the energy level at L band, it is necessary to include third-order nonlinearities and smaller wave numbers. C.D.

A88-17786
THE OCEAN FROM SPACE AND IN THE LABORATORY [OKEAN IZ KOSMOSA I V LABORATORII]
KONSTANTIN NIKOLAEVI FEDOROV (AN SSSR, Institut Okeanologii, Moscow, USSR) Priroda (ISSN 0032-874X), Sept. 1987, p. 46-57. In Russian. refs

Satellite remote-sensing studies have indicated that the motion of ocean surface waters is more variable than previously thought. This paper describes hydrophysical laboratory experiments designed to explain this rapid variability and to relate it to slow processes occurring beneath the ocean surface. The experiments were aimed at studying the various sources of kinetic energy responsible for the generation of turbulence and mixing beneath the surface layer. Particular attention is given to the formation of mushroom-shaped currents. B.J.

A88-19452
PRINCIPAL DEVELOPMENTAL CHARACTERISTICS OF THE ICE-FORMATION PROCESSES IN THE ANTARCTIC OCEAN [OSNOVNYE ZAKONOMERNOSTI RAZVITIIA LEDOVYKH PROTSESSOV IUZHNOGO OKEANA]
A. A. ROMANOV Problemy Arktiki i Antarktiki (ISSN 0555-2468), no. 62, 1986, p. 28-35. In Russian. refs

The Antarctic Ocean ice cover concentrates at the border of the Antarctic Continent and is partially contained by the Antarctic Circumpolar Current. The general direction of the ice drift is west to north-west. The total area of the Antarctic ice drifts changes radically during the year, from the 20.2 mln sq km level in winter to the 3.2 mln sq km level in summer, with minimal interannual differences in the February-March period, and maximal fluctuations during the November-December period, i.e. the period of the rapid breakup of the ice cover. The paper presents the values for the areas of individual Antarctic ice massifs for the months from November to March, together with the average and maximal and minimal monthly values of drifting-ice areas for the period between 1964 and 1980. I.S.

A88-19455
SOME CHARACTERISTICS OF ICE MOVEMENT IN THE ARCTIC BASIN FROM THE DATA OF AUTOMATIC FGGE BUOYS [NEKOTORYE OSOBENNOSTI DVIZHENIIA L'DOV V ARKTICHESKOM BASSEINE PO DANNYM AVTOMATICHESKIKH BUEV PGEP]
S. M. LOSEV, IU. A. GORBUNOV, and I. IU. KULAKOV Problemy Arktiki i Antarktiki (ISSN 0555-2468), no. 62, 1986, p. 77-88. In Russian. refs

The characteristics of ice movement in the entire Arctic Basin were obtained simultaneously from the data yielded by multiple automatic FGGE buoys. The paper presents maps of daily ice drift, the statistical characteristics of large-scale cyclonic and anticyclonic circulations, and data on the monthly ice-drift characteristics in the Arctic Ocean for the period of March 1979 to January 1980. Special attention is given to the changes of the ice movement in the circulation midstream and the statistical characteristics of the ice-drift velocity in different regions of the circulation midstream. I.S.

A88-19456
INVESTIGATION OF ICE MOVEMENT IN THE ARCTIC OCEAN USING AUTOMATIC FGGE BUOYS [IZUCHENIE DVIZHENIIA L'DOV V SEVERNOM LEDOVITOM OKEANE S POMOSHCH'IU AVTOMATICHESKIKH BUEV PGEP]
IU. A. GORBUNOV, I. IU. KULAKOV, and S. M. LOSEV Problemy Arktiki i Antarktiki (ISSN 0555-2468), no. 62, 1986, p. 96-103. In Russian. refs

Data obtained from tracing the drifting movements of each of the 21 automatic FGGE buoys parachuted into the Acrctic basin during January, February, and October 1979 are presented. The buoy data supplied information on the coordinates of the buoy drift, the speed of the drift, the values of the drift divergence for different time periods, the characteristics of the deformation of the ice cover, and the normalized autocorrelation function of the drift divergence. The results indicate that the ice-drift pattern in the Arctic Ocean is much more complex than has been assumed earlier. It is shown that the anticyclonic circulation of ice not only changes its position and intensity but, in some periods, can be totally absent. In some regions of the Arctic Basin, cyclonic circular motions of ice fields were recorded. I.S.

A88-19502
THE EFFECT OF WIND WAVES ON THE RADAR-REFLECTION CHARACTERISTICS OF THE SEA SURFACE [VLIIANIE VETROVOGO VOLNENIIA NA KHARAKTERISTIKI RADIOLOKATSIONNYKH OTRAZHENII POVERKHNOST'IU MORIA]
S. A. VELICHKO, A. I. KALMYKOV, IU. A. SINITSYN, and V. N. TSYMBAL (AN USSR, Institut Radiofiziki i Elektroniki, Kharkov, Ukrainian SSR) Radiofizika (ISSN 0021-3462), vol. 30, no. 7, 1987, p. 840-851. In Russian. refs

The relationship between the characteristics of a radar signal scattered by the sea surface and the parameters of wind waves and surface wind is investigated for incidence angles far from grazing ones. The effect of developing wind waves on the structure of the scattered signal is analyzed, and good agreement between calculations and experimental data is found. It is shown that wind-wave parameters can be evaluated effectively using sidelooking radars of the Cosmos-1500 type. B.J.

A88-19561
CORRELATION BETWEEN SPECTRAL RADIANCE AND PHYTOPLANKTON CONCENTRATION IN THE OCEAN [IZUCHENIE SPEKTRAL'NOI IARKOSTI AKVATORII OKEANA S SODERZHANIEM FITOPLANKTONA]
A. F. SID'KO (AN SSSR, Institut Biofiziki, Krasnoyarsk, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 3-11. In Russian. refs

It is shown that phytoplankton chlorophyll concentrations in the ocean can be determined from spectral-radiance curves obtained through remote sensing. Data were obtained in the surface layers of several regions in the Pacific Ocean and Sea of Japan. The most informative spectral region for oligotrophic areas is the short-wave range (430-440 nm), while the most informative region for meso- and eutrophic areas of pelagic and coastal zones is the longer-wave region of 670-690 nm. B.J.

A88-19562
REMOTE DETERMINATION OF CHLOROPHYLL CONCENTRATION IN THE OCEAN USING AN OPTICAL PULSE RADAR [DISTANTSIONNOE OPREDELENIE KONTSENTRATSII KHLOROFILLA V OKEANE S POMOSHCH'IU OPTICHESKOGO IMPUL'SNOGO LOKATORA]
I. M. LEVIN and K. S. SHIFRIN (AN SSSR, Institut Okeanologii, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 12-19. In Russian. refs

A88-19563
TEXTURE ANOMALIES OF WIND WAVES ON SEA-SURFACE IMAGES [STRUKTURNYE ANOMALII VETROVOGO VOLNENIIA NA IZOBRAZHENIIAKH POVERKHNOSTI MORIA]
M. KH. RAFAILOV (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Kosmoaerometodov, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 20-27. In Russian. refs

Texture anomalies of statistically quasi-homogeneous wind waves can serve as indicators of various hydrophysical phenomena in the ocean. Texture analysis based on spatial-frequency spectra as moving statistics is highly sensitive to anomalies, yields a metric of texture changes within an anomaly, and makes possible real-time investigations. This approach can be used for the interpretation of both aerial photographs and radar imagery. B.J.

A88-19564
CORRELATION BETWEEN SEA-SURFACE WIND FIELDS AND CLOUD COVER ACCORDING TO SATELLITE DATA IN THE VISIBLE, IR, AND MICROWAVE RANGES [VZAIMOSVIAZ' POLEI PRIVODNOGO VETRA I OBLACHNOSTI PO DANNYM SPUTNIKOVOGO ZONDIROVANIIA V VIDIMOM, IK- I SVCH-DIAPAZONAKH]
L. M. MITNIK, G. I. DESIATOVA, V. V. KOVBASIUK, G. V. VOL'PIAN, and A. G. GRIBUNIN (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow; AN SSSR, Tikhookeanskii Okeanologicheskii Institut, Vladivostok, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 28-40. In Russian. refs

The brightness of Cosmos-1500 radar sea images and surface-wind velocity variations estimated using these data are correlated with cloud-cover structure seen on satellite photographs. This correlation is examined for macroscale atmospheric processes (cyclones and fronts) and mesoscale processes (convective and orographic eddies and chains of eddies, and convective cells and streaks). B.J.

A88-19569
LINEAR REGRESSION ANALYSIS OF THE RELATIONSHIP BETWEEN COSMOS-1151 POLARIZATION MEASUREMENTS OF MICROWAVE EMISSION AND SEA SURFACE TEMPERATURE [LINEINYI REGRESSIONNYI ANALIZ ZAVISIMOSTI MEZHDU POLIARIZATSIONNYMI IZMERENIIAMI MIKROVOLNOVOGO IZLUCHENIIA S ISZ 'KOSMOS-1151' I TEMPERATUROI POVERKHNOSTI OKEANA]
V. S. SUETIN and IU. B. RATNER (AN USSR, Morskoi Gidrofizicheskii Institut, Sevastopol, Ukrainian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 66-69. In Russian. refs

A88-19718
ESTIMATING TROPICAL PACIFIC RAINFALL USING DIGITAL SATELLITE DATA
CRAIG E. MOTELL and BRYAN C. WEARE (California, University, Davis) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 26, Oct. 1987, p. 1436-1446. refs

A88-19784
OCEAN TIDAL PARAMETERS FROM STARLETTE DATA
P. MOORE (Aston, University, Birmingham, England) Bulletin Geodesique (ISSN 0007-4632), vol. 61, no.3, 1987, p. 223-234. Sponsorship: Research suppoorted by the Ministry of Defence, Department of Trade and Industry, SERC, and NERC. refs

Starlette was launched in 1975 in order to study temporal variations in the earth's gravity field; in particular, tidal and earth rotation effects. For the period April 1983 to April 1984 over 12,700 normal points of laser ranging data to Starlette have been subdivided into 49 near consecutive 5-6 day arcs. Normal equations for each arc as obtained from a least-squares data reduction procedure, were solved for ocean tidal parameters along with other geodetic and geodynamic parameters. The tidal parameters are defined relative to Wahr's body tides and Wahr's nutation model and show fair agreement with other satellite derived results and those obtained from spherical harmonic decomposition of global ocean tidal models. Author

A88-19808
EVALUATION OF THE POTENTIAL OF THE THEMATIC MAPPER FOR MARINE APPLICATION
S. TASSAN (CEC, Physics Div., Ispra, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1455-1478. refs

The potential of the Thematic Mapper (TM) on board Landsat-5 for marine applications has been investigated with reference to the well-known performance of the Coastal Zone Color Scanner of Nimbus-7. The study consisted of (a) a sensitivity analysis, considering such fundamental error sources as retrieval algorithm sensitivity, atmospheric correction, instrument noise and signal digitalization and (b) the interpretation of a TM scene by the procedure suggested in (a). The evidence provided by the experimental test validated the positive conclusions of the theoretical work, indicating that the analysis of TM bands 1 to 4 data should be capable of yielding quantitative information of satisfactory quality on fundamental water quality parameters, such as chlorophyll (i.e., phytoplankton) and suspended sediment concentrations. Author

A88-19809 Bergen Univ. (Norway).
A MODEL FOR RETRIEVING TOTAL SEA ICE CONCENTRATION FROM A SPACEBORNE DUAL-POLARIZED PASSIVE MICROWAVE INSTRUMENT OPERATING NEAR 90 GHZ
EINAR SVENDSEN (Bergen, Universitetet, Norway), CHRISTIAN MAETZLER (Bern, Universitaet, Switzerland), and THOMAS C. GRENFELL (Washington, University, Seattle) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1479-1487. Research supported by the Norges Teknisk-Naturvitenskapelige Forskningsrad, Universitetet i Bergen, Universitaet Bern, U.S. Navy, and NASA. refs

An algorithm has been developed for estimating total ice concentration from spaceborne high-frequency passive microwave instrumentation. The algorithm is intended for use with the coming Special Sensor Microwave/Imager (SSM/I) data giving a spatial resolution of 12 km. It is based on radiation physics and detailed millimeter wave surface signature measurements and can therefore be applied to other similar data. However, due to large effects on the signals caused by time varying atmospheric conditions and radiation properties of the ice, the algorithm is made self-adjusting. The atmospheric effects are implicitly treated as a smooth function of the ice concentration with tie points over open ocean and 100 percent ice for each orbit. This means that the main errors are due to patches of heavy clouds and ice floes with atypical radiation properties. An error analysis indicates possible errors of the order of 5 percent for concentrations representative for the Arctic Basin, increasing with decreasing concentration. Author

A88-19815
REMOTE SENSING OF PHYTOPLANKTON - AN ATTEMPT FROM THE LANDSAT THEMATIC MAPPER
R. M. DWIVEDI and A. NARAIN (Indian Space Research Organisation, Space Applications Centre, Ahmedabad, India) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1563-1569. refs

In order to attempt remote sensing of phytoplankton, an atmospheric correction scheme using Landsat TM bands 1, 2, and 4 was developed, and data were corrected for atmospheric effects due to Rayleigh scattering and aerosols. Phytoplankton pigment mapping was accomplished via substitution of corrected radiances in the TM bands 1 and 2 into a biooptical algorithm developed for the area off Azhikal in the Arabian Sea. The method is used to produce a C map showing near-surface concentrations of phytoplankton pigments, in addition to a K map showing the pigment distribution in one attenuation length. R.R.

A88-20252* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DATA ACCESS FOR SCIENTIFIC PROBLEM SOLVING
JAMES W. BROWN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Problem solving environments for scientific computing. Amsterdam, North-Holland, 1987, p. 33-46. refs

An essential ingredient in scientific work is data. In disciplines such as Oceanography, data sources are many and volumes are formidable. The full value of large stores of data cannot be realized unless careful thought is given to data access. JPL has developed the Pilot Ocean Data System to investigate techniques for archiving and accessing ocean data obtained from space. These include efficient storage and rapid retrieval of satellite data, an easy-to-use user interface, and a variety of output products which, taken together, permit researchers to extract and use data rapidly and conveniently. Author

A88-20253* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE APPLICABILITY OF SATELLITE ALTIMETRY DATA TO TIDAL MODELS
MICHAEL E. PARKE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) ASCE, National Conference on Hydraulic Engineering, Williamsburg, VA, Aug. 3-7, 1987, Paper. 6 p. refs

The characteristics of satellite altimetry data are reviewed, and techniques for incorporating them into numerical tide models are discussed. The relationship between the geocentric tides observed by satellites and the ocean tides measured by gages or predicted by models is explored, and particular attention is given to the differences between deep-water, shelf, and estuarine tidal regimes. It is concluded that a separate tidal solution should always be performed before assimilating satellite data, including calculation of the tides along a single repeated ground track in the case of shelf and estuarine regions. The potential value of the altimetry to be provided by Topex/Poseidon (scheduled launch in 1991) is indicated. T.K.

N88-10457# East Anglia Univ., Norwich (England). Climatic Research Unit.
DETECTION OF CO2-INDUCED CLIMATE CHANGE Progress Report, 16 Jul. 1986 - 15 Jul. 1987
T. M. L. WIGLEY and P. D. JONES Jul. 1987 18 p
(Contract DE-FG02-86ER-60397)
(DE87-013127; DOE/ER-60397/T1) Avail: NTIS HC A03/MF A01

Progress in the following areas is reported: (1) Southern Hemisphere temperature data; (2) updating of gridded land-based surface air temperature data sets for both hemispheres; (3) use of satellite data in estimating monthly mean surface air temperatures; (4) comparison of UKMO and COADS marine temperature data sets; (5) amalgamation of land and marine (UKMO) temperature data sets; (6) analysis of gridded mean sea

level pressure data; (7) regional validation of general circulation models; and (8) detection studies. DOE

N88-10466# Office of Naval Research, Arlington, Va.
SATELLITE AND SYNOPTIC STUDIES OF CHEMICAL FRONTS IN THE CALIFORNIA CURRENT AND COASTAL UPWELLING ZONE Final Technical Report
EUGENE D. TRAGANZA 31 May 1987 40 p
(Contract N00014-85-K-0054)
(AD-A183909) Avail: NTIS HC A03/MF A01 CSCL 08C

A number of at sea experiments were conducted to investigate the significance of chemical fronts as sites of chemical exchange and primary production. Satellite IR images were used to detect upwelling systems and to predict the subsurface chemical structure of fronts from the surface thermal pattern. Surface jets (giant plumes) were discovered along with distinctively structured eddy-like features which were named cyclonic upwelling systems. GRA

N88-11225# National Marine Fisheries Service, Woods Hole, Mass. Fisheries Center.
NOAA'S (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION'S) NORTHEAST MONITORING PROGRAM (NEMP): A REPORT ON PROGRESS OF THE FIRST FIVE YEARS (1979-84) AND A PLAN FOR THE FUTURE
R. N. REID, M. C. INGHAM, and J. B. PEARCE May 1987
155 p
(PB87-210100; NOAA-TM-NMFS-F/NEC-44) Avail: NTIS HC A08/MF A01 CSCL 13B

The Northeast Monitoring Program (NEMP) was initiated at the beginning of Fiscal Year (FY) 1980 (1 October 1979) by NOAA. The objective is to coordinate and focus monitoring and research activities of NOAA studies of the marine environment in coastal and offshore waters of the northeastern United States. The pilot phase of the NEMP was from FY80 through FY84. The four major research program components are: water quality; sediments and benthos; trace contaminants in tissues; and biological effects. GRA

N88-11362*# Ohio State Univ., Cleveland. Dept. of Geodetic Science and Surveying.
SPHERICAL HARMONIC EXPANSION OF THE LEVITUS SEA SURFACE TOPOGRAPHY
THEODOSSIOS ENGELIS Oct. 1987 49 p
(Contract NAG5-781)
(NASA-CR-181448; NAS 1.26:181448; REPT-385) Avail: NTIS HC A03/MF A01 CSCL 08C

Prior information for the stationary sea surface topography (SST) may be needed in altimetric solutions that intend to simultaneously improve the gravity field and determine the SST. For this purpose the oceanographically derived SST estimates are represented by a spherical harmonic expansion. The spherical harmonic coefficients are computed from a least squares adjustment of the data covering the majority of the oceanic regions of the world. Several tests are made to determine the optimum maximum degree of solution and the best configuration of the geometry of the data in order to obtain a solution that fits the data and also provides a good spectral representation of the SST. Author

N88-11364# Office of Technology Assessment, Washington, D.C.
MARINE MINERALS: EXPLORING OUR NEW OCEAN FRONTIER Summary Report
Jul. 1987 44 p
(PB87-217725; OTA-O-343) Avail: NTIS HC A03/MF A01 CSCL 08A

The report on exploring the Exclusive Economic Zone (EEZ) for its mineral potential is in response to a joint request from the House Committee on Merchant Marine and Fisheries and the House Committee on Science, Space and Technology. It examines the current knowledge about the hard mineral resources within the EEZ, explores the economic and security potential of seabed resources, assesses the technologies available to both explore for and mine those resources, identifies issues that face the Congress and the executive branch, and finally presents options to the Congress for dealing with these issues. GRA

N88-12175# Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
USE OF SPOT IMAGES FOR COASTAL DEVELOPMENT AND INVENTORY OF AQUACULTURAL SITES IN NEW CALEDONIA (ALIAS PROJECT). FIRST RESULTS [UTILISATION DES IMAGES SPOT POUR L'AMENAGEMENT LITTORAL ET L'INVENTAIRE DES SITES AQUACOLES EN NOUVELLE CALEDONIE (PROJECT ALIAS). RESULTATS PRELIMINAIRES]
L. LOUBERSAC, A. GROTTE, and M. VIOLLIER *In* CNES, SPOT 1: First In-Flight Results p 267-273 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

The use of level 2 multispectral SPOT data for the inventory of tropical shrimp aquaculture sites is presented. Results based on spectroradiometric measurements on the validation of a methodology are exposed. A preliminary form of products is proposed. ESA

N88-12176# Societe Europeenne de Propulsion, Puteaux (France). Image Processing Div.
CONTRIBUTION OF SPOT DATA TO THE PHYSIOGRAPHIC STUDY OF COASTAL ENVIRONMENT: LA POINTE D'ARCAY AND L'ANSE DE L'AIGUILLON (FRANCE)
PHILIPPE REBILLARD and FERNAND VERGER (Centre National de la Recherche Scientifique, Paris, France) *In* CNES, SPOT 1: First In-Flight Results p 275-280 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

Data from SPOT for two coastal environment of fast evolution were coregistered to LANDSAT MSS, TM, SAR data. The comparison of the coregistered data set brings new thematic information related to the coastal environment. ESA

N88-12177# Dakar Univ. (Senegal). Inst. Fondamental d'Afrique Noire.
COASTAL DYNAMICS OF THE MOUTH OF THE SALOUM (SENEGAL) [LA DYNAMIQUE LITTORALE A L'EMBOUCHE DU SALOUM (SENEGAL)]
AMADOU TAIROU DIAW and YVES-FRANCOIS THOMAS (Ecole Normale Superieure, Paris, France) *In* CNES, SPOT 1: First In-Flight Results p 281-283 1987 In FRENCH
Avail: CEPADUES-Editions, Toulouse, France CSCL 18/64

Multispectral SPOT imagery was used to study a littoral characterized by a complicated hydrology involving high salinity, slowly flowing river, constantly moving sandbanks, and extremely mobile subtidal channels. The interactions of depth, turbidity, and the nature of the bottom often limit classifications from multiband data. However, spectral bands taken individually allow phenomena to be distinguished (e.g., suspensions, erosion, and swell). ESA

N88-12181# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Optische Fernerkundung.
THE DISTINCTION BETWEEN DIFFERENT WATER MASSES USING OPTICAL REMOTE SENSING APPLIED TO DATA FROM THE ALBORAN SEA EXPERIMENT 1982 Thesis - Trier Univ.
KLAUS W. BARROT, HEINZ VANDERPIEPEN, and VOLKER AMANN Oct. 1986 68 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-48; ISSN-0171-1342; ETN-87-90594) Avail: NTIS HC A04/MF A01; DFVLR, Cologne, West Germany DM 25

Data sets from different remote sensing instruments were used to monitor the in flow of Atlantic water through the Straits of Gibraltar into the western Mediterranean Sea. Besides the data from the Advanced Very High Resolution Radiometer and the NOAA8 satellite, those from the Coastal Zone Color Scanner on Nimbus 7 were used to measure and interpret ocean color, and to compare the results with data collected from airborne radiometry and shipborne ground truth. It is concluded that dynamic processes

in the sea can often be monitored and interpreted better using ocean color rather than sea surface temperature. ESA

N88-12235# Naval Polar Oceanography Center, Washington, D.C.
EASTERN - WESTERN ARCTIC SEA ICE ANALYSIS 1986 Annual Reference Report No. 13, period ending 1986
Aug. 1987 107 p
(AD-A184016) Avail: NTIS HC A06/MF A01 CSCL 08L

Approximaztely 7-days' analysis of sea ice data, prepared by the Naval Polar Oceanography Center, Suitland, MD. is presented. Included are ice concentrations and ice thickness (age). GRA

N88-12836# Joint Publications Research Service, Arlington, Va.
COMPLEX FOR OCEAN STUDY FROM SPACE AND HYDROACOUSTIC STATIONS
In its USSR Report: Earth Sciences p 9 22 Jul. 1986 Transl. into ENGLISH from Sovetskaya Estoniya (Tallinn, USSR), 18 Feb. 1986 p 1
Avail: NTIS HC A05/MF A01

In collaboration with other USSR academy and industry institutes, the Institute of Automation and Control Processes (IAPU) is working on the development of information support for oceanological research. In particular, research is being done on principles of remote study of the ocean from space stations and hydroacoustic stations. In connection with this, the development of a software-hardware complex called DISTERM is being completed; it is intended for automated gathering, storage and processing of data from hydrometeorological observations made on ships and satellites. A copy of this system was installed on the scientific research ship Akademik Sergey Korolev, where experiments with its operation are being conducted. The use of DISTERM is expected to provide information which scientists, weather forecasters and fishermen need quickly. Author

N88-12840# Joint Publications Research Service, Arlington, Va.
EXPERIMENTAL STUDY OF TURBULENT DIFFUSION PARAMETERS IN OCEAN Abstract Only
V. V. ANIKIYEV, O. V. ZAYTSEV, T. V. ZAYTSEVA, and V. V. YAROSH *In its* USSR Report: Earth Sciences p 16-17 22 Jul. 1986 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 21, no. 11, Nov. 1985 p 1226-1229
Avail: NTIS HC A05/MF A01

In research on turbulent diffusion in the ocean carried out in the Black Sea, North Sea, Baltic Sea and in the Atlantic Ocean it was impossible to deduce any universal laws of development of spots or streams of tracers being used to ascertain patterns of turbulent diffusion. In each case these patterns are highly dependent on hydrometeorological and morphometric parameters. A dependence of rate of expansion of such spots on wave height and velocity of the mean current was noted. Bottom relief, shore configuration and structure of currents exert a marked influence on spot configuration in coastal and shallow water areas. In the coastal waters of Japan, China and South Korea tidal currents are also a highly important factor. The same is true of monsoons, passage of typhoons and powerful currents. All these factors were taken into account in studying the laws of turbulent diffusion in the coastal region of the Sea of Japan and in the open part of the Pacific Ocean by release of dye. Spot evaluation was investigated using an aerial survey and a towed submersible fluorometer. The law expressing the increase in effective area with time obtained earlier for the coastal zone was confirmed, but the increase in anisotropy was slower. The role of velocity gradients in spot diffusion was less in the tropical parts of the ocean than in coastal zones. Author

N88-12846# Joint Publications Research Service, Arlington, Va.
INFLUENCE OF SECONDARY EDDY CURRENTS ON SCATTERING OF ADMIXTURE IN ZONAL FLOW Abstract Only
V. N. YEREMEYEV, L. M. IVANOV, I. A. NEYELOV, and V. I. SMELYANSKIY *In its* USSR Report: Earth Sciences p 28 22 Jul. 1986 Transl. into ENGLISH from Izvestiya Akademii Nauk SSSR: Fizika Atmosfery i Okeana (Moscow, USSR), v. 22, no. 1, Jan. 1986 p 78-86
Avail: NTIS HC A05/MF A01

Data on the drift of Sofar floats can be used for finding dynamic characteristics of the ocean in the range of synoptic-spatial scales, but there are serious difficulties in the interpretation of these data. The contribution of movements of different scales to the drift of such floats is difficult to discriminate and certain assumptions must be made concerning the statistical nature of float movements in order to ascertain the energy and other characteristics of hydrodynamic fields along the trajectories of floats. An effort has been made to overcome these difficulties. The approach used was numerical analysis of movement and an admixture in nonstationary eddy fields. It was important to take into account that in the prediction of drifting floats an important role is played by baroclinically unstable currents of a jet character and the secondary eddy currents generated by them. The study was based on hydrodynamic fields computed using a numerical model describing an unstable zonal flow for analysis of dispersal of tracer particles. Numerical experiments were conducted for time intervals of about 5 to 6 months, comparable with the lifetime of an individual eddy. Computations were made in a grid with intervals 20 km with examination of five layers with depths of 100 to 2,000 m and a time interval of 20 min. Two processes of eddy disappearance were found: decay of eddies into zonal currents and decay of large eddies into smaller ones. It was found that some characteristics of the eddy field can be determined from Sofar data. Conclusions can be drawn concerning the barotropization of the eddy field. Zones of upwelling and subsidence of water masses in eddies can be determined. Author

N88-12858# Technical Research Centre of Finland, Espoo. Rakenneteknilkan Lab.
HUURRE EXPEDITION TO THE NORTH POLE IN 1984
O. P. NORDLUND 1987 57 p
(PB87-220935; VTT/RN-685; ISBN-951-38-2668-6) Avail: NTIS HC A04/MF A01 CSCL 08L

Five research papers based on the experiences and measurements made during and after the Huurre Expedition to the North Pole in 1984 are reported. Two deal with snow studies. Snow samples were collected and analyzed for inorganic ions and organochlorine pollutants. Another report deals with ice research. Ice observations were made by man and satellite. Two final studies deal with the human body. One researches clothing and heat loss from the body. The other treats the cold acclimatization of the three explorers. GRA

N88-12860# Naval Postgraduate School, Monterey, Calif.
A MULTIBODY DYNAMIC ANALYSIS OF THE N-ROSS (NAVY REMOTE OCEAN SENSING SYSTEM) SATELLITE ROTATING FLEXIBLE REFLECTOR USING KANE'S METHOD M.S. Thesis
NATALIE F. HEFFERNAN Jun. 1987 128 p
(AD-A184452) Avail: NTIS HC A07/MF A01 CSCL 22B

The Navy Remote Ocean Sensing System (N-ROSS) satellite is being developed to supply accurate data on ocean parameters for fleet operations. A Low Frequency Microwave Radiometer (LFMR), a large flexible reflector attached to an angled flexible boom, is a sea surface temperature sensor on this satellite which rotates at 15 rpm. The dynamic interaction between the reflector and the boom, and the effects of the reflector orientation and flexibility on the pointing error of the LFMR during a spin-up procedure are investigated by performing dynamic simulations. Dynamical equations of this flexible multibody system are formulated using Kane's method. Efficient computer simulations were achieved by developing a FORTRAN program and using Dynamic Simulation Language (DSL). GRA

N88-13804# Naval Postgraduate School, Monterey, Calif.
ESTIMATION OF MARINE BOUNDARY LAYER DEPTH AND RELATIVE HUMIDITY WITH MULTISPECTRAL SATELLITE MEASUREMENTS M.S. Thesis
RICHARD J. KREN Jun. 1987 74 p
(AD-A184881) Avail: NTIS HC A04/MF A01 CSCL 04B

This study presents a technique for estimating marine boundary layer depth and relative humidity structure from satellite inferred measurements of aerosol optical depth, total water vapor and sea surface temperature. The data originates from radiance measurements by channels 1, 4 and 5 of NOAA's AVHRR instrument. The technique assumes that the atmospheric optical depth and total water vapor are primarily confined within the boundary layer, and that the layer is well-mixed. These inputs are combined through the relative humidity dependent variables of extinction and vapor density. Relative humidity is parameterized as an increasing linear function with height, resulting in an equation for the near surface relative humidity. This equation is solved, enabling estimation of boundary layer depth and humidity structure. The technique is iterative in nature, requiring 5 to 10 iterations for convergence. GRA

N88-13805# Naval Ocean Systems Center, San Diego, Calif.
VARIFRONT 3 EXPEDITION DATA REPORT (USNS DE STEIGUER CRUISE 1202-82). BIOLUMINESCENCE, HYDROGRAPHIC, NUTRIENT, AND SATELLITE DATA FROM THE GULF OF CALIFORNIA (NOVEMBER-DECEMBER 1981) Final Report
STEPHEN H. LIEBERMAN and SUZANA POTUZNIK Oct. 1986 105 p Prepared in cooperation with San Diego State Univ., Calif.
(AD-A185011; NOSC/TD-992) Avail: NTIS HC A06/MF A01 CSCL 08C

This report presents data from the expedition Varifront 3, which measured stimulated planktonic bioluminescence and related physical, chemical, and biological parameters. Satellite imagery of sea surface temperature and chlorophyll was also collected. The study established a data base to develop correlates for a productive model of the distribution and intensity of planktonic bioluminescence in surface and near-surface ocean waters. GRA

N88-14340# National Oceanic and Atmospheric Administration, Washington, D. C. National Environmental Satellite, Data and Information Service.
AVHRR/HIRS (ADVANCED VERY HIGH RESOLUTION RADIOMETER/HIGH RESOLUTION INFRA-RED SOUNDER) OPERATIONAL METHOD FOR SATELLITE BASED SEA SURFACE TEMPERATURE DETERMINATION
C. WALTON Mar. 1987 67 p
(PB88-107594; NOAA-TR-NESDIS-28) Avail: NTIS HC A04/MF A01 CSCL 14B

A technique is described which was used operationally to produce sea surface temperatures from the NOAA polar orbiting satellites between 1976 and 1981. The single window channel technique used before 1976 is described in NOAA Technical Memorandum NESS 78 while the multiple window channel technique (MCSST) applied since 1981 is well documented in the scientific literature. The report bridges the gap between these two periods and provides a continuous record of the evolution of one of NOAA's primary satellite derived meteorological products. GRA

N88-14465# Joint Publications Research Service, Arlington, Va.
STATISTICAL STRUCTURE OF TEMPERATURE FIELD OVER SOUTH PACIFIC OCEAN Abstract Only
V. A. VASILYEV, L. V. VASILYEVA, and A. V. KONDRATYEV *In its* USSR Report: Earth Sciences p 30 22 May 1987 Transl. into ENGLISH from Vestnik Leningradskogo Universiteta, Seriya 7: Geologiya, Geografiya (Leningrad, USSR), no. 4, Dec. 1986 p 106-109
Avail: NTIS HC A06/MF A01

An attempt is made, using the South Pacific ocean as an example, to study the vertical statistical structure of the January temperature field based on daily satellite radiometer soundings of the atmosphere over a period of five years for 15 isobar surfaces over the Pacific. The behavior of the calculated quantitative characteristics is studied in several latitude zones. It is found that in an area with a sparse network of aerologic stations, such as the South Pacific, the statistical structure of the temperature field can be analyzed using satellite radiometric sounding data. The quantitative and qualitative agreement of the data from such aerologic stations and satellites is good. Author

N88-14469# Joint Publications Research Service, Arlington, Va.
MATHEMATICAL-CARTOGRAPHIC MODELING OF ECONOMIC UTILIZATION OF ATLANTIC OCEAN Abstract Only
YE. A. SIGOLAYEVA and V. S. TIKUNOV *In its* USSR Report: Earth Sciences p 36 22 May 1987 Transl. into ENGLISH from Geografiya i Prirodnyye Resursy (Novosibirsk, USSR), no. 4, Oct. - Dec. 1986 p 113-121
Avail: NTIS HC A06/MF A01

An economic regionalization of the Atlantic Ocean is attempted, based on published data on the economic utilization of the ocean. The economic utilization of a water area is determined by coastal population, location of production facilities and ports, degree of utilization of mineral and power resources, intensity of fishing, and marine transport. Maps showing accessibility of an area to coastal populations, distribution of biomass in the ocean, density of shipping, level of pollution by oil film, and the locations of oil and gas bearing basins are given. Author

N88-14580# World Climate Programme, Geneva (Switzerland).
REPORT OF THE SECOND SESSION OF THE WORKING GROUP ON SEA ICE AND CLIMATE
Apr. 1987 104 p Session held in Seattle, Wash., 27-31 Oct. 1987 Prepared in cooperation with the International Council of Scientific Unions, Rome, Italy
(WCP-127; WMO/TD-127; ETN-88-90769) Avail: NTIS HC A01; print copy available from WMO, Geneva, Switzerland

Sea ice modeling; atmospheric forcing fields; ocean forcing; sea ice data for verification of climate models; southern hemisphere circulation of atmosphere, ocean, and sea ice; a project to study the Greenland Sea; and sea ice remote sensing were discussed. ESA

N88-14595# Trondheim Univ. (Norway). Hydroteknisk Lab.
FORECAST OF CURRENT PATTERNS FOR AN EDDY TRACKING EXPERIMENT IN THE NORWEGIAN COASTAL CURRENT
T. A. MCCLIMANS 29 Dec. 1986 13 p Prepared in cooperation with Selskapet for Industriell og Teknisk Forskning, Trondheim, Norway
(PB87-224853; ISBN-82-595-4625-6; STF60-A86164) Avail: NTIS HC E03/MF E03 CSCL 08J

A 2 week forecast of the physical conditions in the Norwegian Coastal Current was made in Norwegian Hydrotechnical Laboratory's laboratory model of the northern North Sea. The model was previously calibrated and tested against measurements from 1982. The forecast is compared with a satellite thermal image one week into the future. A forecasted eddy was about 25 km to the north of an observed eddy, which appears to be due to a mismatch between the location of the laboratory source and the computed boundary conditions. A hindcast to determine the cause of observed discrepancies during the second week of the forecast is proposed. GRA

N88-14597# Rome Univ. (Italy). Dipartimento di Fisica.
PRELIMINARY REPORT OF HYDROLOGICAL MEASUREMENTS CARRIED OUT IN THE SOUTHERN ADRIATIC SEA: PALMA 86 CAMPAIGN [RAPPORTO PRELIMINARE SUI RISULTATI DELLE MISURE IDROLOGICHE ESEGUITE IN ADRIATICO MERIDIONALE: CAMPAGNA PALMA 86]
FRANCESCO BIGNAMI, NICOLA CONENNA (Bari Univ., Italy), MARCO OSTILI, GABRIELLA PALMIERI, BARBARA PALOMBO, ALESSANDRA ROTUNDI, SILVIA SCHIARINI, ENRICO SIENI, and ENRICO ZAMBIANCHI 23 Apr. 1987 81 p In ITALIAN
(PREPRINT-555; ETN-88-91268) Avail: NTIS HC A05/MF A01

The results of an oceanographic campaign carried out as part of the physical oceanography of the Eastern Mediterranean project are presented. The goal is the study of ocean circulation, its causes, and impact. The measurement system includes a CTD bathymeter, a Loran C system, and a data acquisition system based on Zilog Z80 microprocessor. ESA

N88-14599# Arctec, Inc., Columbia, Md.
NAVARIN BASIN ICE DRIFT PROGRAM Final Report, Mar. 1986 - Jan. 1987
Jan. 1987 39 p
(Contract DTMA91-84-C-41032)
(PB88-104021; MA-RD-760-87048) Avail: NTIS HC A03/MF A01 CSCL 08C

Two drifting ice stations were specially designed and constructed by ARCTEC, Inc., consisting of a LORAN-C receiver, an ARCTEC Data Acquisition and Telemetry System (ARCDATS-1) and a GOES transmitter. The stations were deployed by ARCTEC, Inc. on March 20, 1986 in the Bering Sea in the vicinity of St. Lawrence Island using a Nome-based helicopter. The LORAN-C ice drift stations demonstrated good performance over the ARGOS system used the previous year. Under the sponsorship of PMEL, access to the GOES satellite was obtained. This proved to be a more reliable data transmission system than the previously used ARGOS system. GRA

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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.

A88-11570
RETRIEVAL OF WATER VAPOR PROFILES VIA PRINCIPAL COMPONENTS - OPTIONS AND THEIR IMPLICATIONS
ALAN E. LIPTON and THOMAS H. VONDER HAAR (Colorado State University, Fort Collins) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 26, Aug. 1987, p. 1038-1042. refs
(Contract NOAA-NA-84AAH00020)

Principal components have been widely used in regression retrieval of atmospheric parameters, but when applied to water vapor concentrations their use entails special problems. Two of these problems are discussed, and results of retrieval experiments designed to alleviate them are presented. The experiments employed High-Resolution Infrared Radiation Sounder satellite data in conjunction with radiosonde observations. It was found that mixing ratio is a less appropriate parameter for principal component-based retrieval than is a mean-saturation adjusted mixing ratio. Also, retrieval accuracy was enhanced by identifying the optimum numbers of eigenvectors to use when transforming the water vapor profiles and the satellite brightness temperatures, respectively, into their principal components. In these studies, three eigenvectors were optimal for representation of water vapor, implying that HIRS-2 data are capable of retrieving at least third-order vertical resolution in water vapor profiles. In addition, principal component-based retrieval was compared with standard multiple regression, and it was found that a hybrid of the two methods gave the greatest retrieval accuracy. Author

A88-11571
COMBINATION OF MANUALLY DIGITIZED RADAR AND GOES IR FOR REAL-TIME DISPLAY OF RAINFALL INTENSITY
PAUL H. HEINEMANN, DAVID J. MARTSOLF, JOHN F. GERBER (Florida, University, Gainesville), and DANIEL L. SMITH (NOAA, National Weather Service, Fort Worth, TX) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 26, Aug. 1987, p. 1046-1049. refs

Manually Digitized Radar (MDR) and Geostationary Operational Environmental Satellite (GOES) thermal infrared (IR) data were merged to form a higher-resolution radar/IR product than that represented by the MDR. The combination MDR/IR maps were processed into a color coded map form and disseminated on a real-time basis through a computer network to users in the Florida agricultural community. Author

A88-11574*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OPTIMIZED RETRIEVALS OF PRECIPITABLE WATER FROM THE VAS 'SPLIT WINDOW'
DENNIS CHESTERS, WAYNE D. ROBINSON, and LOUIS W. UCCELLINI (NASA, Goddard Space Flight Center, Greenbelt, MD) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 26, Aug. 1987, p. 1059-1066. NASA-supported research. refs

Precipitable water fields have been retrieved from the VISSR Atmospheric Sounder (VAS) using a radiation transfer model for the differential water vapor absorption between the 11- and 12-micron 'split window' channels. Previous moisture retrievals using only the split window channels provided very good space-time continuity but poor absolute accuracy. This note describes how retrieval errors can be significantly reduced from plus or minus 0.9 to plus or minus 0.6 gm/sq cm by empirically optimizing the effective air temperature and absorption coefficients used in the two-channel model. The differential absorption between the VAS 11- and 12-micron channels, empirically estimated from 135 colocated VAS-RAOB observations, is found to be approximately 50 percent smaller than the theoretical estimates. Similar discrepancies have been noted previously between theoretical and empirical absorption coefficients applied to the retrieval of sea surface temperatures using radiances observed by VAS and polar-orbiting satellites. These discrepancies indicate that radiation transfer models for the 11-micron window appear to be less accurate than the satellite observations. Author

A88-11592
AN INSTANTANEOUS DELINEATION OF CONVECTIVE RAINFALL AREAS USING SPLIT WINDOW DATA OF NOAA-7 AVHRR
TOSHIRO INOUE (Meteorological Research Institute, Tsukuba, Japan) Meteorological Society of Japan, Journal (ISSN 0026-1165), vol. 65, June 1987, p. 469-481. refs

The use of split window data measured by NOAA-7 AVHRR to delineate a convective rainfall area is examined. The areas between 33-39 deg N and 135-141 deg E on July 11 and 27, 1984 are studied. The applicability of the delineation method is evaluated in terms of the probability of detection (POD), the false alarm ratio (FAR), the percent error, the areal bias, the error factor, and the rms. It is observed that the rainfall areas obtained by the satellite are defined as those covered by cumulus or cumulonimbus clouds whose tops exceed the 700-mb level. The satellite rainfall areas estimates are compared with the radar rainfall data and rainfall estimates obtained with the conventional IR method. It is noted that there is good correlataion between the satellite and radar data; however, the delineation estimates obtained with the split window method are better than those of the conventional IR method by 12 percent for the POD and 13 percent for the FAR. I.F.

A88-15166#
CALCULATION OF FLOODS USING LANDSAT MSS DATA [BERECHNUNG VON HOCHWAESSERN MIT LANDSAT-MSS-DATEN]
WOLFRAM MAUSER (Freiburg, Universitaet, Freiburg im Breisgau, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 277-285. In German. refs

The use of satellite remote-sensing data in the computation of flood hydrographs (with the SCS TR-20 model, 1972) is demonstrated for the case of the Dreisam basin in the southern Black Forest near Freiburg (FRG). Landsat MSS images are analyzed to obtain information on land use; soil conditions; soil water and infiltration; and terrain altitude, slope, and exposure. The image-interpretation methods and the construction of the precipitation-runoff model are explained, and the results of flood predictions for different possible degrees of deforestation are presented in extensive graphs. T.K.

A88-15169#
NEAR-REAL-TIME APPLICATION OF NOAA/AVHRR SATELLIE DATA BY THE GERMAN HYDROGRAPHIC INSTITUTE USING A DFVLR REMOTE TERMINAL - RESULTS AND PERSPECTIVES FROM A PILOT STUDY [NAHE-ECHTZEIT-NUTZUNG VON NOAA/AVHRR-SATELLITENDATEN IM DEUTSCHEN HYDROGRAPHISCHEN INSTITUT MIT HILFE EINES 'DEZENTRALEN TERMINALS' DER DFVLR - ERGEBNISSE UND PERSPEKTIVEN EINES PILOTPROJEKTS]
K. STRUEBING, K. HUBER (Deutsches Hydrographisches Institut, Hamburg, Federal Republic of Germany), T. KOENIG, and W. RATTEI (DFVLR, Cologne, Federal Republic of Germany) IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 375-384, 547-558. In German. refs

A88-16395#
USE OF ENHANCED IR/VISIBLE SATELLITE IMAGERY TO DETERMINE HEAVY SNOW AREAS
SAMUEL K. BECKMAN (NOAA, National Severe Storms Forecast Center, Kansas City, MO) Monthly Weather Review (ISSN 0027-0644), vol. 115, Sept. 1987, p. 2060-2087. refs

Interpretation techniques are established which relate heavy snow (100 mm or more in a 12 h period) areas to real-time infrared and visible geostationary satellite imagery. An initial collection of cases totaled about 75 during the period from the fall of 1979 to the spring of 1984. The main area of concern extended from the Rockies to the Appalachians. By using conventional surface and upper air data and numerical model output from the LFM-II, relationships were established between heavy snow occurrences and cloud patterns in the satellite imagery. The different cloud patterns and flow regimes suggest a classification of heavy snow events into four main types: High Plains cyclogenesis, northwest and southwest flow short-wave troughs, and orographic. Each type has preferred geographical locations, common snowfall durations, storm totals, and band widths and lengths. The snowfall maximum with each storm is influenced by the strength and movement of the system and the structure of the moist layer. Subtle mesoscale features on the satellite imagery are shown to relate to the local snowfall maximum. Real-time analysis and forecasting techniques are discussed. The heavy snow threat is assessed by a three-step analysis method. An example demonstrates how future trends in heavy snow can be predicted. Author

A88-16401
AN ALGORITHM FOR RAIN RATE ESTIMATION BY MOS-1 MSR
MASAHARU FUJITA and YUJI MIYAGAWA (Ministry of Posts and Telecommunications, Radio Research Laboratory, Kashima, Japan) Institute of Electronics, Information and Communication Engineers, Transactions (ISSN 0913-574X), vol. E70, Aug. 1987, p. 699-702. refs

Microwave brightness temperatures expected to be measured by MOS-1 MSR over rain are calculated theoretically over the ocean background. The influence of ocean surface wind is evaluated by using a composite rough surface model. An algorithm for rain rate estimation by MOS-1 MSR is developed for each season of a year based on the theoretical calculation. Author

A88-16432* Colorado State Univ., Fort Collins.
SIMULATION OF RADAR REFLECTIVITY AND SURFACE MEASUREMENTS OF RAINFALL
V. CHANDRASEKAR and V. N. BRINGI (Colorado State University, Fort Collins) Journal of Atmospheric and Oceanic Technology (ISSN 0739-0572), vol. 4, Sept. 1987, p. 464-478. refs
(Contract DAAL03-86-K-0117)

Raindrop size distributions (RSDs) are often estimated using surface raindrop sampling devices (e.g., disdrometers) or optical array (2D-PMS) probes. A number of authors have used these measured distributions to compute certain higher-order RSD moments that correspond to radar reflectivity, attenuation, optical extinction, etc. Scatter plots of these RSD moments versus disdrometer-measured rainrates are then used to deduce physical relationships between radar reflectivity, attenuation, etc., which are measured by independent instruments (e.g., radar), and rainrate. In this paper RSDs of the gamma form as well as radar reflectivity (via time series simulation) are simulated to study the correlation structure of radar estimates versus rainrate as opposed to RSD moment estimates versus rainrate. The parameters N0, D0 and m of a gamma distribution are varied over the range normally found in rainfall, as well as varying the device sampling volume. The simulations are used to explain some possible features related to discrepancies which can arise when radar rainfall measurements are compared with surface or aircraft-based sampling devices.
Author

A88-17033
INTERTROPICAL CONVECTION AND RAINFALL - DELINEATION OF THE RELATION FOR WEST AFRICA FROM MAY 11 TO AUGUST 20, 1985
B. GUILLOT, B. BELLEC, and J. P. LAHUEC (Centre de Meteorologie Spatiale, Lannion, France) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 59-66. In French. refs

From May 11 to August 20, 1985, an attempt at monitoring convective clouds over West Africa was carried out in Lannion by ORSTOM and the Centre de Meteorologie Spatiale. Since most of the rain in Sudanese countries is the result of convective activity, it was assumed that measuring the occurrences of cold top clouds with Meteosat II IR data could give a good relation with synoptic station rainfall data. The comparison of visible and IR data gave a threshold of -40 C. Five scenes were computed daily (9 h, 12 h, 15 h, 18 h, 24 h) during 102 days, and homogeneous areas were identified according to zonal climatic features and topography. Author

A88-17036
FLOOD MONITORING IN SOUTH AMERICA FROM THE LANDSAT NOAA AND NIMBUS SATELLITES
D. R. WIESNET and M. DEUTSCH (Satellite Hydrology, Inc., Vienna, VA) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 77-84. Research supported by the Organization of American States. refs

From late 1982 to late 1983, severe flooding occurred in the Parana River Valley of South America. NOAA satellite AVHRR data archives for this period were sparse due to infrequent coverage and frequent cloudiness. Nimbus-7 Coastal-Zone Color Scanner CZCS data, however, were found to yield imagery superior to those of the AVHRR due both to higher resolution and multiple bands in the visible. The comparative disadvantages of CZCS data are their piecemeal coverage and their slow processing rate; with higher processing rates, they could furnish excellent flood-monitoring capabilities worldwide. O.C.

A88-17120
DUAL-POLARIZATION RADAR ESTIMATION OF RAINFALL PARAMETERS COMPARED WITH GROUND-BASED DISDROMETER MEASUREMENTS - OCTOBER 29, 1982 CENTRAL ILLINOIS EXPERIMENT
KULTEGIN AYDIN, HALDUN DIRESKENELI, and THOMAS A. SELIGA (Pennsylvania State University, University Park) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. GE-25, Nov. 1987, p. 834-844. refs
(Contract NSF ATM-80-03376; DAAL03-87-K-0031)

A88-17632
SITE DIVERSITY MEASUREMENTS WITH RADIOMETERS AT 20 AND 30 GHZ
J. R. LARSEN (Telecom Denmark, Denmark) IN: International Conference on Antennas and Propagation, 5th, York, England, Mar. 30-Apr. 2, 1987, Proceedings. Part 2 . London, Institution of Electrical Engineers, 1987, p. 133-136.

Measurements obtained over 3 1/4 years at eight different site distances are used to determine long-term rain attenuation statistics on slant paths at 20 and 30 GHz. Rain cells producing 1-10 dB of attenuation seem to have an extension, suggesting that little improvement would be achieved by increasing the site distance from 30 to 50 km. Comparison of worst month and annual results shows that, for shorter distances, the improvements are the greatest on an annual basis, indicating that the rain cells of the worst months cover larger distances than the rain cells in general. R.R.

A88-19181
AN IMPROVED PREDICTION METHOD FOR RAIN ATTENUATION IN SATELLITE COMMUNICATIONS OPERATING AT 10-20 GHZ
M. YAMADA, Y. KARASAWA, M. YASUNAGA (Kokusai Denshin Denwa Co., Ltd., Tokyo, Japan), and B. ARBESSER-RASTBURG (INTELSAT, Washington, DC) Radio Science (ISSN 0048-6604), vol. 22, Nov. 1987, p. 1053-1062. refs

Several prediction methods for rain attenuation are evaluated using a common long-term data base (total 124 sets of measurements) for oblique propagation paths with frequencies of from 10 to 20 GHz, and an improved prediction method reflecting the evaluation results performed is proposed. The evaluation results indicate that CCIR methods give relatively high precision, although in this respect, there is not such a great difference from other methods. The method proposed here includes a rain area size parameter as a function of rain rate for 0.01 percent of the time so as to minimize the prediction error. It is verified that the method thus obtained gives the best precision for predicting rain attenuation on earth-to-space propagation paths at 10-20 GHz. Author

A88-20292
CHARACTERISTICS OF GREAT LAKES AND OHIO RIVER VALLEY STATES CONVECTIVE FLASH FLOOD EVENTS IN GOES IMAGERY
THEODORE W. FUNK (NOAA, Synoptic Analysis Branch, Washington, DC) IN: Conference on Weather Modification, 11th, and Conference on Hydrometeorology, 7th, Edmonton, Canada, Oct. 6-8, 1987, Preprints. Boston, MA, American Meteorological Society, 1987, p. 159-164. refs

GOES satellite imagery is an invaluable data source for detecting and monitoring the evolution of synoptic and mesoscale cloud patterns. This study utilized GOES imagery to detect and monitor satellite characteristics associated with heavy rainfall and flash flood producing convective systems. This paper presents the results of the study for convective events that occurred in the Great Lakes and Ohio River Valley states from 1981-1983. Similar investigations have evaluated flash flood cases for the Eastern Region (Fleming et al., 1984), Western Region (Fleming and Spayd, 1986), and a few other states. Each convective event was categorized into the type of satellite-observed convective system, time of year, time of day of heaviest rainfall, and minimum cloud top temperature during the period of heaviest precipitation. Author

A88-20293
PRECIPITATION DETECTION OVER LAND WITH SATELLITE MICROWAVE DATA
YANG CHENGGANG (State Meteorological Administration, Beijing, People's Republic of China) and ANDREW TIMCHALK (NOAA, Satellite Applications Laboratory, Washington, DC) IN: Conference on Agricultural and Forest Meteorology, 18th and Conference on Biometeorology and Aerobiology, 8th, West Lafayette, IN, Sept. 14-18, 1987, Preprints. Boston, MA, American Meteorological Society, 1987, p. 94-96. refs

In this study, the sensitivity of the Microwave Sounding Unit (MSU) channels in detecting precipitation over land was evaluated using NOAA satellite data collected over the United States. All four MSU channel brightness temperatures were statistically screened for possible useful relationships with precipitation, with special attention given to the sensitivity of the median filter algorithm of Nappi et al. (1986) in detecting precipitation areas and rain rates. The MSU channel 2 (Ch 2, 53.74 GHz) was found to be the most useful channel for detecting precipitation over land. The median filter anomaly value (MFA2) calculated using the median filter algorithm was found to be correlated with an effective rain rate, with coefficients as high as 0.6 over land during the spring and summer cases. However, in the winter cases, when convection was relatively weak and rain rates were low, the MFA2 algorithm showed no skill in detecting precipitation. Other limitations of the algorithm are pointed out. I.S.

N88-10430*# Environmental Research Inst. of Michigan, Ann Arbor.
SPATIAL CHARACTERIZATION OF ACID RAIN STRESS IN CANADIAN SHIELD LAKES Progress Report, 1 Feb. - 1 Aug. 1987
FRED J. TANIS 1987 20 p
(Contract NAS5-28779)
(NASA-CR-181136; NAS 1.26:181136; REPT-189400-25-L)
Avail: NTIS HC A03/MF A01 CSCL 13B

An analysis was performed to interpret the spatial aspects of lake acidification. Three types of relationships were investigated based upon the August to May seasonal scene pairing. In the first type of analysis ANOVA was used to examine the mean Thematic Mapper band one count by ecophysical strata. The primary difference in the two ecophysical strata is the soil type and depth over the underlying bedrock. Examination of the August to May difference values for TM band one produced similar results. Group A and B strata were the same as above. The third type of analysis examined the relationship between values of the August to May difference from polygons which have similar ecophysical properties with the exception of sulfate deposition. For this case lakes were selected from units with sandy soils over granitic rock

types and the sulfate deposition was 1.5 or 2.5 g/sq m/yr.
Author

N88-10431*# Environmental Research Inst. of Michigan, Ann Arbor.
SPATIAL CHARACTERIZATION OF ACID RAIN STRESS IN CANADIAN SHIELD LAKES Progress Report, 1 Aug. 1986 - 1 Feb. 1987
FRED J. TANIS 1987 14 p
(Contract NAS5-28779)
(NASA-CR-180577; NAS 1.26:180577; REPT-189400-24-L)
Avail: NTIS HC A03/MF A01 CSCL 13B

The acidification of lake waters from airborne pollution is of continental proportions both in North America and Europe. A major concern of the acid rain problem is the cumulative ecosystem damage to lakes and forest. The number of lakes affected in northeastern U.S. and on the Canadian Shield is though to be enormous. How seasonal changes in lake transparency are related to annual acidic load was examined. The relationship between variations in lake acidification and ecophysical units was also examined. The utility of Thematic Mapper based observations to measure seasonal changes in the optical transparency in acid lakes was investigated. The potential for this optical response is related to a number of local ecophysical factors with bedrock geology being, perhaps, the most important. Other factors include sulfate deposition, vegetative cover, and terrain drainage/relief. The area of southern Ontario contains a wide variety of geologies from the most acid rain sensitive granite quartzite types to the least sensitive limestone dolomite sediments. Annual sulfate deposition ranges from 1.0 to 4.0 grams/sq m. Author

N88-10454# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Sciences Group.
ESTIMATION FROM SATELLITE IMAGERY OF SUMMERTIME RAINFALL OVER VARIED SPACE AND TIME SCALES
C. G. GRIFFITH Apr. 1987 116 p
(PB87-203246; NOAA-TM-ERL-ESG-25) Avail: NTIS HC A06/MF A01 CSCL 04B

Rainfall estimates for the central United States, inferred from the thermal infrared channel of the Geostationary Operational Environmental Satellite (GOES) for August 1979, are compared with gage rainfalls over hourly and daily time frames. Area-averaged amounts are computed for the region 90.25 to 108.25 deg W and 30.5 to 45.75 deg N, which extends roughly from the Rocky Mountains to the Mississippi River and from the North Dakota-South Dakota border into central Texas, covering 3,600,000 sq km. Point values within this region are also compared. Estimates are made with two versions of the satellite technique. One incorporates cloud life cycle information derived from a sequence of images; the other uses area and temperature information from a single source. GRA

N88-11265# Atmospheric Environment Service, Downsview (Ontario). Cloud Physics Research Div.
NOWCASTING RAIN/SNOW TRANSITIONS AND FREEZING RAIN
RONALD E. STEWART *In* ESA, Mesoscale Analysis and Forecasting p 155-161 Aug. 1987 Sponsored by the Federal Panel on Energy Research and Development
Avail: NTIS HC A99/MF A01; print copy avail. EPD, ESTEC, Noordwijk, The Netherlands Dfl 80

The microscale and subcyclonic scale characteristics associated with precipitation types in winter storms are reviewed. Techniques employing satellite, radar, and surface observations for improving the nowcasting of precipitation types in winter storms are suggested. ESA

N88-11283# Atmospheric Environment Service, Downsview (Ontario).
EVALUATION OF THE RAINSAT PRECIPITATION ANALYSIS SYSTEM IN REAL-TIME USE
PATRICK KING and TSOI-CHING YIP *In* ESA, Mesoscale Analysis and Forecasting p 263-268 Aug. 1987
Avail: NTIS HC A99/MF A01; print copy avail. EPD, ESTEC, Noordwijk, The Netherlands Dfl 80

Data from April to September are used to assess the performance of the Rainsat system for the analysis and short range forecasting of precipitation, beyond the range of the radar. Summary statistics for the whole period and for individual months are used to assess overall performance. Radar data and surface data are used to validate the Rainsat products. Rainsat uses a statistical relationship between visible and infrared brightness and rain detected by radar. This relationship was updated approximately monthly during the period of study. Comparisons between these relationship over periods of time illustrate the variability of the satellite/rain relationship over these time scales and in different synoptic situations. ESA

N88-12162# Centre National d'Etudes Spatiales, Toulouse (France).
FLOOD MONITORING USING SPOT
DAMIEN LEPOUTRE *In* CNES, SPOT 1: First In-Flight Results p 159-164 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

The expected availability of satellite images over the GHARB flood plains (Morocco) was studied during flood seasons using a Markovian cloud cover evolution model based on 20 yr data and simulations of the capabilities of satellites. One flood was studied using a SPOT HRV XS image. Valuable information is provided: overflow localization, flow path for the control of structures, soil erosion for the leveling process, and effectiveness of protection works. A map of submerged lands with associated figures for various management areas was produced, helping the decision making process in relation to production losses. Managers can compare the information to image expected availability, allowing them to decide whether to invest or not in satellite remote sensing technology for flood monitoring. The ability to quickly program SPOT is a decisive factor. ESA

N88-12179# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
THE USE OF SPOT IMAGES FOR WATER RESOURCES SURVEYS. THE EXAMPLES OF THE KASSERINE AREA (TUNISIA) AND THE JEBEL AMOUR (ALGERIA)
DIRK DEHOOP, ATILA SESOREN, and CAESAR VOUTE *In* CNES, SPOT 1: First In-Flight Results p 293-304 1987
Avail: CEPADUES-Editions, Toulouse, France

Use of SPOT images to survey water resources in data rich and data sparse semi arid regions is described. One area has surface water and ground water, the other mainly surface runoff. The SPOT images are useful for mapping geological features, vegetation, land use, drainage patterns, catchment areas, and archeological traces. ESA

N88-12180# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Abteilung Fernerkundung.
EVALUATION OF DIGITAL, MULTITEMPORAL LANDSAT 5 THEMATIC MAPPER DATA FOR THE DETERMINATION OF THE AERIAL SNOWCOVER EXTENT AND SPECTRAL SEPARATION OF VARIOUS SURFACE TYPES IN THE INNER OETZTAL (WEST GERMANY) WITH SPECIAL REGARD TO THE SIGNIFICANCE OF AERIAL SNOWCOVER INFORMATION FOR WATER RESOURCES MANAGEMENT Thesis - Ludwig-Maximilians-Univ.
UTE GUCK Oct. 1986 170 p In GERMAN; ENGLISH summary
(DFVLR-FB-86-46; ISSN-0171-1342; ETN-87-90593) Avail: NTIS HC A08/MF A01; DFVLR, Cologne, West Germany DM 74.50

The spectral behavior of snow in high mountain reliefs, measured by the LANDSAT thematic mapper (TM) at several times, was investigated. The aerial snowcover extent was determined using the supervised maximum likelihood classification. Contrast stretching and ratioing were performed for easier visual interpretation. Histograms and principal component analysis were used for statistical evaluation. The potential of TM bands to separate clouds from snow and for a multispectral classification of the major vegetation types is demonstrated. The combination of bands 2, 3, 4, and 5 proves to be sufficient for all classifications. While the spectral bands of the TM are suited for snow type discrimination, problems arise for radiometric resolution due to dynamic range limitations. ESA

N88-12832# Joint Publications Research Service, Arlington, Va.
COMPUTER MODELING AIDS STUDIES OF PRECIPITATION FORMATION Abstract Only
V. KORNEYEV *In its* USSR Report: Earth Sciences p 1 22 Jul. 1986 Transl. into ENGLISH from Izvestiya (USSR), no. 82(21524), 23 Mar. 1986 p 3
Avail: NTIS HC A05/MF A01

Cloud physics research in progress at the Central Aerological Observatory (USSR) is described along with the methods utilized for the studies. Scientists are trying to determine the ratio of ice crystals to cloud volume which is optimal for the formation of precipitation. Methods being used in this research include both field observations and laboratory experiments, including digital modeling of clouds. Such experiments have been necessitated by the complexity of measurements which must be made inside clouds and the limited capabilities of equipment available for this purpose. Airborne equipment alone cannot provide all of the information which researchers need. Computer modeling has made it possible to clarify many aspects of precipitation formation processes in extensive cloud fields associated with cyclones. Author

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A88-10921
STATISTICAL CHARACTERISTICS OF THE CONTRAST OF IMAGES OBTAINED THROUGH A THREE-DIMENSIONALLY NONUNIFORM ATMOSPHERE [STATISTICHESKIE KHARAKTERISTIKI KONTRASTA IZOBRAZHENIIA, POLUCHAEMOGO CHEREZ TREKHMERNO-NEONORODNUIU ATMOSFERU]
VALENTIUK, A. N. (AN BSSR, Institut Fiziki, Mogilev, Belorussian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 91-99. In Russian. refs

A three-dimensionally nonuniform atmospheric model is developed that makes it possible to analyze the specific features of imaging through the atmosphere and to calculate the statistical characteristics of contrast in these images. Relative contrast fluctuations over the images are expressed as functions of the mean number of atmospheric nonuniformities per finite-length distance and of the variance of optical thickness fluctuations. I.S.

A88-10922
CLUSTER ANALYSIS AND IDENTIFICATION OF MULTISPECTRAL IMAGES [KLASTER ANALIZ I RASPOZNAVANIE MNOGOZONAL'NYKH IZOBRAZHENII]
A. M. CHIZHEVSKII and D. E. MINSKII (Institut Soiuzgiprovodkhoz, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), May-June 1987, p. 100-108. In Russian. refs

The paper describes methods for the processing of multispectral remote images by means of cluster analysis and identification procedures. Multidimensional histograms are constructed, and insignificant information is filtered out to save computer resources. Algorithms and tests are used to identify subclusters on the basis of multidimensional histograms and to combine the subclusters into clusters. Solutions of the cluster algorithms are then applied to calculate covariant matrices and to construct a 'look-up-table' in which every radiance vector is placed in relation to the number of a cluster. The use of these methods was shown to significantly increase the speed of image processing without loss of precision in final results. I.S.

A88-11473
APPLICATIONS OF DIGITAL IMAGE PROCESSING IX; PROCEEDINGS OF THE MEETING, SAN DIEGO, CA, AUG. 20-22, 1986
ANDREW G. TESCHER, ED. (Technology Concepts Associates, Claremont, CA) Meeting sponsored by SPIE. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 697), 1986, 372 p. No individual items are abstracted in this volume.
(SPIE-697)

Papers are presented on image compression by quadtree decomposition and truncation; surface distortion measure for motion compensated image coding; a video image digitizer for PC-based image processing systems; high-resolution digitization of photographic images with an area CCD; and the measurement of the Landsat TM modulation transfer function using a two-dimensional target array. Topics discussed include texture segmentation; image analysis using hit-or-miss transforms with resolution pyramids; fast quadtree decomposition using histograms; motion detection using the statistical properties of a video image; and a very low bandwidth, unattended imager for surveillance applications. Consideration is given to scene matching using edge direction histograms; luminance, hue, and saturation processing of digital color images; three-dimensional motion estimation from

projections; pattern recognition relevant to multiaperture optics; robotics with computer vision; and maximum entropy image restoration. I.F.

A88-11564
THE RELATIONSHIP BETWEEN INCIDENT AND DOUBLE-WAY TRANSMITTANCES - AN APPLICATION FOR THE ESTIMATE OF SURFACE ALBEDO FROM SATELLITES OVER THE AFRICAN SAHEL
B. PINTY (Clermont-Ferrand II, Universite, France) and D. TANRE (Lille I, Universite, Villeneuve-d'Ascq, France) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 26, Aug. 1987, p. 892-896. refs

The inference of surface reflectances from satellite observations requires the knowledge of the double-way transmittance through the atmosphere. Since the existing pyranometer networks routinely provide measurements of the incident transmittance over sensitive climatic regions, it would be useful for subsequent applications to relate this ground-based measurement to the corresponding double-way transmittance. A variety of satellite radiance simulations corresponding to clear sky conditions has been made in order to derive a suitable parameterized expression between the two quantities. The accuracy of this expression when making use of additional meteorological observations is shown and discussed. Finally, the derived expression is used to improve a method recently proposed by Pinty et al. for retrieving surface albedo over the African Sahel from Meteosat radiances. Author

A88-12332* Georgia Univ., Athens.
STEREOCORRELATION OF LANDSAT TM IMAGES
MANFRED EHLERS and R. WELCH (Georgia, University, Athens) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 53, Sept. 1987, p. 1231-1237. refs
(Contract NAS5-27383; DFG-EH-85/1-1)

A digital elevation model (DEM) developed from Landsat TM images of a rugged terrain area in north Georgia by automated stereocorrelation techniques yielded an rms error (z), RMSE(z), value of + or - 42 m. Based on the B/H ratio of 0.18 for the Landsat data, this Z-error corresponds to a planimetric correlation accuracy of about + or - 0.3 pixels, confirming that precise correlation can be achieved with operational satellite data. Contours at a 100-m interval interpolated from the DEM show a deviation of + or - 33 m from reference contours obtained from existing 1:24,000-scale maps. The 28.5-m pixel resolution and the weak B/H ratio impose limitations on the accuracy that can be achieved with Landsat TM data. However, it is anticipated that RMSE(z) values of + or - 10 m or less can be achieved with SPOT-1 panchromatic stereo images of 10-m resolution recorded at B/H ratios of 0.5 to 1.0. DEMs generated by stereocorrelation techniques can be used to create orthoimages, perspective views, and topographic map products. Author

A88-12738
DESIGN CONSIDERATIONS FOR HIGH-SPEED TRANSFORM IMAGE COMPRESSION
GOSTA LEMNE and BO JOHANSSON (Ericsson Radio Systems, AB, Stockholm, Sweden) IN: Airborne reconnaissance X; Proceedings of the Meeting, San Diego, CA, Aug. 19, 20, 1986 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 55-61. refs

Near real-time reconnaissance is limited by the capacity of the operator and data-rate of the recording and/or transmission systems. This paper concerns the data-rate problem, but some methods of reducing the operator workload, made possible by high image compression ratio, are presented briefly. The emphasis is on the special problems of the airborne reconnaisance application, and the trade-offs that must be introduced when very high data rate and image quality are demanded. Author

A88-12744
DISPLAY AND EXPLOITATION OF HIGH-RESOLUTION RECONNAISSANCE IMAGERY
ALAN P. KREMA and VICTOR J. SZEPLAKI (Recon/Optical, Inc., CAI Div., Barrington, IL) IN: Airborne reconnaissance X; Proceedings of the Meeting, San Diego, CA, Aug. 19, 20, 1986 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 106-110.

High-resolution reconnaissance imagery is much higher in resolution and bandwidth than can be displayed on CRT monitors. There are many requirements for using CRT monitors as image display devices. Image reduction must occur to display the full field of view, high-resolution image on a CRT. Two-dimensional arithmetic averaging is preferred over pixel subsampling as the reduction method. A sensor evaluation system is presented which performs averaging, and results from the KS-87 Electro-Optical (EO) camera are shown. Author

A88-12748
IMAGING THROUGH THE ATMOSPHERE FOR AIRBORNE RECONNAISSANCE
N. S. KOPEIKA (Negev, University, Beersheba, Israel) IN: Airborne reconnaissance X; Proceedings of the Meeting, San Diego, CA, Aug. 19, 20, 1986 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 132-139. refs

Turbulence, atmospheric background, and aerosol forward scattering MTFs are presented and analyzed with regard to both low elevation rpv and high elevation reconnaissance applications. Turbulence is seen to limit image quality only at very high spatial frequencies where degradation effects are likely to take place anyway as a result of vibrational and diffraction effects. Background and aerosol MTFs limit low spatial frequency contrast as well. However, this can be overcome somewhat by proper selection of imaging wavelength. This analysis can aid in sensor selection for system design from the standpoints of both wavelength selection and sensor resolution. Author

A88-13013
THREE-DIMENSIONAL X-RAY MICROTOMOGRAPHY
BRIAN P. FLANNERY, HARRY W. DECKMAN, KEVIN L. D'AMICO (Exxon Research and Engineering Co., Annandale, NJ), and WAYNE G. ROBERGE (Rensselaer Polytechnic Institute, Troy, NY) Science (ISSN 0036-8075), vol. 237, Sept. 18, 1987, p. 1439-1444. refs

The new technique of X-ray microtomography nondestructively generates three-dimensional maps of the X-ray attenuation coefficient inside small samples with approximately one percent accuracy and with resolution approaching one micrometer. Spatially resolved elemental maps can be produced with synchrotron X-ray sources by scanning samples at energies just above and below characteristic atomic absorption edges. The system consists of a high-resolution imaging X-ray detector and high-speed algorithms for tomographic image reconstruction. The design and operation of the microtomography device are described, and tomographic images that illustrate its performance with both synchrotron and laboratory X-ray sources are presented. Author

A88-13549
SATELLITE-DERIVED MAPS OF SNOW COVER FREQUENCY FOR THE NORTHERN HEMISPHERE
KENNETH F. DEWEY (Nebraska, University, Lincoln) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 26, Sept. 1987, p. 1210-1229. Research supported by the University of Nebraska and NOAA. refs

A satellite imagery-based Northern Hemisphere snow cover data archive was mapped for the period 1966-84. The maps were digitized in order to create the first hemispheric, spatially data-continuous climatologies of snow cover. Annual and monthly climatologies were created and compared to several standard or frequently referenced climatologies. Results of this analysis indicate that the satellite-based climatology provides a much more detailed climatology for the higher latitude and highland regions of the Northern Hemisphere. The satellite imagery-based maps, when

compared to the historical snow cover climatologies, indicated more extensive high-latitude snow cover concurrent with a northward shift in the southern extent of the climatological snow cover; this results in a narrower snow-transition zone. Author

A88-13969
COMPUTER-ASSISTED DETECTION OF LINEAR FEATURES FROM DIGITAL REMOTE SENSING DATA
KOERT SIJMONS (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) ITC Journal (ISSN 0303-2434), no. 1, 1987, p. 23-31. refs

Using digital remote sensing data as source information, it is difficult - with digital image processing techniques and pattern recognition methods - to detect and identify directly such linear topographic features as roads, railways, and rivers. Two-stage processing is necessary - low level to organize the raw data into some symbolic structure and high level for the contextual interpretations. Segmentation (i.e., the identification of larger structural elements) is done using various 3 x 3 subimage filters for the purpose of boundary line and region extraction. A conditional median filter is used to extract possible linear elements; noise elements are then identified and suppressed and the remaining linear elements are thinned to strings of single elements. The next stages, not dealt with in this study, would be bridging line gaps followed by further high level processing. Author

A88-13970
A COMBINATION OF PANCHROMATIC AND MULTISPECTRAL SPOT IMAGES FOR TOPOGRAPHIC MAPPING
MOHAMMED ESSADIKI (Institut Agronomique et Veterinaire, Rabat, Morocco) ITC Journal (ISSN 0303-2434), no. 1, 1987, p. 59-66. refs

Present technology provides the possibility of accelerating the production of the base maps urgently needed in developing countries. A new technique for combining SPOT satellite images with two different ground resolutions is described. Using various image processing methods, including enhancement techniques, a good quality image suitable for topographic mapping can be produced within a short time. Author

A88-14054
AN EVALUATION OF COMPUTER STORAGE METHODS FOR LANDSAT-DERIVED RASTER DATA
MICHAEL P. MEPHAM and STEVEN H. PAINE (Calgary, University, Canada) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 19-28. Research supported by the Alberta Bureau of Surveying and Mapping and NSERC. refs

Techniques for the storage of raw Landsat data, filtered data, and classified data are discussed using part of the Calgary, Canada image as a data image. Both the raw and filtered data are used in applications that require the entire image or a regular portion of the image at one time while the classified data can be utilized in a land related information system. Consideration is given to methods for data storage such as pixel by pixel and run-length encoding for the raw and filtered data; in the case of the classified data, techniques were developed to automatically derive bounding polygons of homogeneous areas. These algorithms are used to convert the data from raster to vector format. K.K.

A88-14057
LAVA FLOW ANALYSIS FROM DIGITIZED SHUTTLE PHOTOGRAPHY
BRUCE E. DAVIS (Hawaii, University, Hilo) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 121-131. refs

The extraction of lava flow information from the island of Hawaii using hand-held photography (HHP) is described. HHP has proven effective in delineating lava flow detail; digitized photographic data can be used to separate and investigate visually undifferentiated lava flows. A pattern of tonal changes reveals a predictable trend in the density of lichen growth and elevation on aa lava. K.K.

A88-14060* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ALASKA HIGH ALTITUDE PHOTOGRAPHY PROGRAM
EARL V. PETERSEN, MARTIN A. KNUTSON (NASA, Ames Research Center, Moffett Field, CA), and ROBERT E. EKSTRAND (Analytical Technology Applications Corp., Moffett Field, CA) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 193-198.

In 1978, the Alaska High Altitude Photography Program was initiated to obtain simultaneous black and white and color IR aerial photography of Alaska. Dual RC-10 and Zeiss camera systems were used for this program on NASA's U-2 and WB-57F, respectively. Data collection, handling, and distribution are discussed as well as general applications and the current status. K.K.

A88-14061
THE USGS NATIONAL MAPPING PROGRAM IN ALASKA - A STATUS REPORT
BRUCE Y. MCKENZIE and LOWELL E. STARR (USGS, Reston, VA) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 225-236.

The various production mapping activities sponsored by the National Mapping Program in Alaska are described as well as information and cartographic assistance activities. Consideration is given to major ongoing programs such as the 1:63,360-scale Primary Quadrangle Mapping Program, new and emerging mapping programs such as the Interim Land Cover Mapping Program, special mapping efforts such as side-looking airborne radar, and information and data service activities such as the National Cartographic Information Center. It is noted that the Survey has expanded its activities to work more closely with other Federal agencies, the Alaska State Mapping Advisory Committee, and other elements of the user community in Alaska. K.K.

A88-14064
QUICK-LOOK LANDSAT IMAGERY OF ALASKA
GRETA J. BURGER and JOHN M. MILLER (Alaska, University, Fairbanks) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 348-355. refs

Recent planned and unplanned applications of Quick-Look data are discussed in detail. Particular attention is given to ice observations, sediment, volcano watching, fire observations, river ice breakup and flooding hazards, and glacier-dammed lakes. It is concluded that the availability of custom enhanced data near real-time Landsat MSS imagery can greatly aid in the monitoring of dynamic geophysical events. K.K.

A88-14795#
DIGITAL PROCESSING TECHNIQUES AND MULTISPECTRAL CLASSIFICATION OF MICROWAVE REMOTE SENSING IMAGES
G. BENELLI, V. CAPPELLINI, E. DEL RE, and L. NIGRO (Firenze, Universita, Florence, Italy) Alta Frequenza (English Edition) (ISSN 0002-6557), vol. 55, Nov.-Dec. 1986, p. 365-372. refs
(Contract CNR-PSN-85-063)

Digital techniques for image processing and automatic classification in remote sensing applications are described. Digital filters, suitable for radar noise reduction, are first described. Some

algorithms using the Bayes rule or block distance for the automatic classification and discrimination of agricultural crops are presented. Microwave images, obtained by the European SAR campaign, are used to evaluate the performance of these processing algorithms. Author

A88-14799#
DIGITAL FILTERING OF APT IMAGES FROM NOAA SERIES SATELLITES
STEFANO BARONTI, ROBERTO CARLA, and VINCENZO M. SACCO (CNR, Istituto di Ricerca sulle Onde Elettromagnetiche, Florence, Italy) Alta Frequenza (English Edition) (ISSN 0002-6557), vol. 55, Nov.-Dec. 1986, p. 391-394. refs

Comparative tests of various filters have been conducted on NOAA/APT meteorological satellite images. It is demonstrated that the best results in terms of noise reduction and blurring effect have been obtained by weighted mean and extremal filters, while other techniques show a nonuniform behavior. It is concluded that these techniques are very useful for 'restoring' noisy received images in connection with the efficient utilization of APT analog data for many applications in which low resolution is acceptable and low cost is required. B.J.

A88-14886
TERRAIN RESOURCES SURVEYS BY VISUAL MONOSCOPIC AND STEREOSCOPIC INTERPRETATION OF FGEOS IMAGES
NIKOLAOS SILLEOS and THEODOROS ASTARAS (Salonika, University, Greece) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1335-1348. refs

Monoscopic and stereoscopic interpretation of FGEOS (First Generation Earth Observation Satellites) images were applied comparatively in order to divide the region of Central Peloponnesos (Greece) into physiographic units for thematic mapping concerning geomorphology, soils and land use. A stereo pair of Landsat-1 black and white prints and a false-color print at 1:250,000 scale were used in order (1) to construct a reconnaissance physiographic map, (2) to construct a land use map and (3) to reconsider the monoscopic interpretation techniques, because of the newly-developed SPOT stereo capability and 10 x 10 m ground resolution. The known problems reported from the FGEOS 79 x 79 m resolution could reduce the effectiveness of any interpretation method. However, the results show that the stereoscopic interpretation and physiographic analysis of satellite images improve the accuracy of boundaries and increase the number of mapping units, and consequently they are expected to minimize field work, laboratory analysis, field staff and the total cost of surveying. Author

A88-14887
RADIOMETRIC CORRECTION OF VISIBLE AND INFRARED REMOTE SENSING DATA AT THE CANADA CENTRE FOR REMOTE SENSING
F. J. AHERN, R. J. BROWN, J. CIHLAR, R. GAUTHIER, J. MURPHY (Canada Centre for Remote Sensing, Ottawa) et al. International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1349-1376. refs

The techniques employed at the CCRS for radiometric correction of airborne and satellite images of terrain features and vegetation cover are described and demonstrated in a review covering the period 1972-1986. Procedures examined include the optical sensor calibrations for Landsat MSS, Landsat TM, airborne MSS, airborne Multidetector Electrooptical Imaging Sensor II (MEIS-II), and ground-based instruments; scene corrections for Landsat MSS, Landsat TM, NOAA AVHRR, and airborne sensors; and current efforts to calibrate TM and SPOT sensors and MEIS-II and correct for atmospheric effects in VIR satellite and aircraft data. Also discussed are unsolved problems related to the intercomparison of data from the same sensor at different times, from different models of the same sensor, from different sensors of the same general type, and from radically different sensors. T.K.

A88-14888
DISCRIMINATION PROBLEMS FOR SATELLITE IMAGES
C. D. KERSHAW (Edinburgh, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1377-1383. refs

This paper discusses the pitfalls of classifying satellite images using automatic classifiers. The discussion is illustrated by application of quadratic and linear discrimination to high resolution data produced for the National Remote Sensing Centre campaign. Within the training set there is good discrimination between most land uses, but the lack of agreement between overall results of discrimination for the two discriminators shows that measures of accuracy based on accuracy within the training set can be misleading. Cross-validation of the quadratic discriminator and calculation of between and within the training set can be misleading. Cross-validation of the quadratic discriminator and calculation of between and within site measures of spectral variability also illustrate how the usual calculations may give overoptimistic measures of discrimination accuracy and spectral variability. Author

A88-14889
THE USE OF A MICROCOMPUTER FOR IMAGE ANALYSIS
S. ARANUVACHAPUN and D. E. WALLING (Exeter, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Sept. 1987, p. 1385-1397.
(Contract NERC-GR/3/5914)

An inexpensive microcomputer system has been configured to process and display Landsat-MSS digital data for higher education establishments. The system consists of a 16-bit processor with a maths co-processor, a 512-kbyte memory with 20-Mbyte fixed disk drive, 1.2-Mbyte diskette drive, keyboard and enhanced color monitor. A graphic development tool kit is installed to display an image. To enable data transfer to and from the mainframe computer, communication software is made available on both the microcomputer and the mainframe. This local work station is capable of carrying out both graphic work and image processing. Author

A88-15157#
CARTOGRAPHIC APPLICATION OF SPACE IMAGES [KARTOGRAPHISCHE NUTZUNG VON WELTRAUMBILDERN]
G. KONECNY IN: Utilization of remote sensing data in the Federal Republic of Germany; Seminar on Current Status, Garmisch-Partenkirchen, Federal Republic of Germany, Jan. 20-22, 1986, Reports . Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, p. 115-127. In German.

The use of satellite remote-sensing images and space photography in the construction of topographic maps of scale 1:50,000 or greater is discussed. The low cost of space-based images relative to aerial photography is pointed out, and the image size, resolution, and cartographic applicability of SPOT, Landsat MSS and TM, and Spacelab-1 Metric Camera (MC) images are compared. It is found that pixel sizes of 10 m and 5 m are required for 1:50,000 mapping with stereoscopic and monoscopic analysis, respectively; thus SPOT is the only automatic satellite image system providing adequate resolution. Better results are obtained using standard photogrammetric analysis equipment on MC photographs. The results of sample analyses of MC images of the northern FRG coast and flatlands and of mountainous terrain are summarized in tables and diagrams and characterized in detail. Consideration is also given to the potential resolution of more advanced MCs. T.K.

A88-15489#
THE AUSTRALIAN LANDSAT STATION AT X-BAND
DENNIS N. COOPER, B. F. PARSONS, G. G. MOOREY, R. A. KENNEDY, G. L. JAMES (CSIRO, Div. of Radiophysics, Sydney, Australia) et al. IN: National Space Engineering Symposium, 2nd, Sydney, Australia, Mar. 25-27, 1986, Preprints. Volume 1 . Barton, Australia/Brookfield, VT, Institution of Engineers, Australia/Brookfield Publishing Co., 1986, 13 p. refs

The ALS/CSIRO signal processing experiment was devised to gain experience in the acquisition and processing of high quality image data from the Thematic Mapper on the Landsat V satellite. This data is relayed to earth on an 8212.5-Mhz radio link at a rate of 85-Mb/s. The ALS 9.14-m-diameter antenna at Alice Springs is currently being modified by CSIRO to allow collection of this data on an experimental basis. The changes necessary and the expected system performance of the modified antenna are outlined. The aim was to obtain design and fabrication experience with a minimum of cost and with no impact on the normal MSS operations of the station. Design was based on a 2-yr lifetime and is far from an operational system. Author

A88-15896#
GROWTH OF REMOTE SENSING DATA PROCESSING AND DISTRIBUTION IN INDIA
B. L. DEEKSHATULU (National Remote Sensing Agency, Hyderabad, India) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 11 p.
(IAF PAPER 87-142)

The evolution and the current status of aircraft and satellite remote sensing data processing facilities in India are reviewed. These include complete processing facilities for MSS data of Landsat 2, 3, 4, and 5; TM data of Landsat 4 and 5; and SPOT and Indian Remote Sensing Satellite with a large amount of indigenously developed hardware and software. The types of data products available to the user and efforts in data management, distribution, and dissemination are also discussed. V.L.

A88-15897#
REMOTE SENSING SOFTWARE PACKAGE FOR SATELLITE IMAGE PROCESSING
T. HAJOS, G. BUTTNER, and M. KORANDI (Foldmeresi es Taverzekelesi Intezet, Budapest, Hungary) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 9 p. refs
(IAF PAPER 87-143)

A Remote Sensing Software Package (RSP) has been developed for analyzing multichannel satellite data using a microcomputer based system. The function set of RSP contains all the necessary modules for a per-point classification procedure: training, handling statistical files, clustering, classification, accuracy assessment and principal component transformation. The system-user communication is carried out by an efficient menu. To illustrate the capabilities of RSP a case study is presented on mapping natural vegetation in a water reservoir. Author

A88-15901#
AUTOMATIC COMPUTATION OF ELEVATION DATA OF SIDE-LAP AREA USING SYSTEM CORRECTED LANDSAT TM DATA
YUKIO MUKAI, TOSHIRO SUGIMURA, TETSUJI IIJIMA (Remote Sensing Technology Center of Japan, Tokyo), KOICHI AYABE, KAZUO TACHI (National Space Development Agency of Japan, Earth Observation Center, Hatayama) et al. IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 9 p.
(IAF PAPER 87-148)

Two Landsat scenes observed from two neighboring paths include a side-lap area located between the two scenes. A high mountain area located in the side-lap area was selected as a test site, and a method to compute elevations of the test site was developed using two system corrected Landsat TM data. The elevation of the corresponding points was computed by finding the nearest point between two lines of sight drawn from each satellite to each corresponding point. The error of elevation computation using this method was 117 m, which was examined at about 60 points selected for examining the accuracy of elevation computation. Author

A88-15905#
MAPPING OF WASTELAND OF INDIA - A CASE STUDY OF BANGALORE DISTRICT OF KARNATAKA
G. BEHERA, C. B. S. DUTT, P. P. NAGESWARA RAO, A. K. GUPTA, J. KRISHNAMURTHY (Indian Space Research Organization, National Natural Resources Management System, Bangalore, India) et al. IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 6 p.
(IAF PAPER 87-155)

The categories and techniques used by the Indian National Wasteland Development Board to classify and map wasteland areas are reviewed and illustrated with flow charts, diagrams, and sample maps. The mapping effort is being undertaken as part of a program to reclaim about 500 Ma/yr of wasteland; Landsat TM false-color imagery is used to construct maps of scale 1:50,000, with 14 land-use categories identified. Results of a test evaluation of a site near Bangalore in southern India are presented in detail; the overall accuracy of the map is found to be 90 percent. T.K.

A88-15910#
A STUDY ON THE ACCURACY OF LAND COVER CLASSIFICATION BY SAR IMAGE
YASUNORI NAKAYAMA, HIROSHI KIMURA, and YUKIO MUKAI (Remote Sensing Technology Center of Japan, Tokyo) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 8 p.
(IAF PAPER 87-160)

This report describes the investigation of land-cover classification accuracy from SAR image. The evaluation for frequency and polarization of SAR has been made using principal component analysis. The validity of texture analysis in land-cover classification of SAR was investigated using several kinds of textural feature images from SAR data. Land cover classification accuracy was investigated by comparing SAR classification results with TM classification results. The results of evaluation for frequency and polarization of SAR image indicate little relation among L, C, and X band data. By using texture analysis and increasing the number of textural features, the independence for each category on land cover classification of SAR image becomes higher. However, land cover classification results of SAR image are not necessarily the same as the TM ones. Therefore, it is necessary to select original detailed land cover categories of SAR considering the difference of roughness, water content, and others of land cover materials. Author

A88-16349
RASTER AND VECTOR PROCESSING FOR SCANNED LINEWORK
DAVID D. GREENLEE (USGS, EROS Data Center, Sioux Falls, SD) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 53, Oct. 1987, p. 1383-1387. refs

The conversion of raster linework to vector chains or arcs is investigated using various raster editing techniques. The techniques of thinning, filling, and node detecting are based on encoding the state of a 3 x 3 neighborhood surrounding each pixel into a single byte. These raster operations were applied to a digital elevation model and a portion of a topographic map. The automated parts of the raster-to-vector process are discussed. It is noted that by using several image-processing and vector-editing techniques, raster lines can be converted to vector arcs. I.F.

A88-17040
DIGITALLY PRODUCED LANDSAT MAP IMAGES
O. G. MALAN and A. D. LAMB (Council for Scientific and Industrial Research, National Physical Research Laboratory, Pretoria, Republic of South Africa) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 115-119. refs

Two experimental, digitally produced and enhanced, 1:250,000 scale Landsat mosaic maps are described. The first is a map of the Kingdom of Lesotho, produced in collaboration with the Lesotho Director of Surveys and Mapping. It consists of a mosaic of four contiguous Landsat scenes, collected on two consecutive days, digitally enhanced and overlaid with conventional map data (political boundaries, roads, etc.). The map is expected to provide useful information on topography, landforms, etc., for planning purposes. The second map, produced in collaboration with the South African Geological Survey, is an experimental map sheet of the Barberton area, consisting of a digital mosaic of two contiguous Landsat scenes. By means of a color space transformation, stratigraphic geological map information in digital form was combined with the terrain information as contained in the first principal component of the Landsat data. Author

A88-17193
ADJACENCY EFFECT PRODUCED BY THE ATMOSPHERIC SCATTERING IN THEMATIC MAPPER DATA
D. TANRE, P. DUHAUT, M. HERMAN (Lille I, Universite, Villeneuve-d'Ascq, France), and P. Y. DESCHAMPS (CNES, Laboratoire d'Etudes et de Recherches en Teledetection Spatiale, Toulouse, France) Journal of Geophysical Research (ISSN 0148-0227), vol. 92, Oct. 20, 1987, p. 12000-12006. CNRS-CNES-supported research. refs

Examination of TM data has shown that water spectral reflectances observed at the top of the scattering atmosphere are contaminated not only by an intrinsic atmospheric reflectance but also by the reflectance of the surrounding green vegetated land surface when the water surface has a small size. This last effect is called the adjacency (or background, or environment) effect. A theoretical formalism has been used to explain the effects and is validated by being able to simulate the TM-observed spectral reflectances. Further consequences for land-surface classification are discussed, as well as the impact of the adjacency effect on the method of using water surface for atmospheric correction. Author

A88-17924
REMOTE SENSING: PRINCIPLES AND INTERPRETATION (2ND EDITION)
FLOYD F. SABINS, JR. (Chevron Oil Field Research Co., La Habra, CA; California, University, Los Angeles) New York, W. H. Freeman and Co., 1987, 460 p. refs

New developments in remote sensing are discussed. The fundamentals are reviewed, and individual remote sensing systems are examined, including aerial photographs, manned satellite images, Landsat, thermal infrared images, and radar images. For each system, the physical properties and electromagnetic interactions of the material that control the imaging process, the design and operation of the imaging system, the characteristics of the images, and the guidelines for interpreting images are considered. Computer techniques for restoring and enhancing images and for extracting information are described, and practical applications of remote sensing to resource exploration, environmental applications, land use and cover analysis, and natural hazards are addressed. A variety of images covering two test sites are compared, demonstrating the advantages and drawbacks of various types of image for different applications. C.D.

A88-18290
MOSAICS - A SYSTEM TO PRODUCE STATE-OF-THE-ART SATELLITE IMAGERY FOR RESOURCE MANAGERS
J. P. FRIEDEL (MacDonald, Dettwiler and Associates, Richmond, Canada) and T. A. FISHER (Canada Centre for Remote Sensing, Ottawa) Geocarto International (ISSN 1010-6049), vol. 2, Sept. 1987, p. 5-12.

This paper describes the Multi-Observation Satellite Image Correction System (MOSAICS), a precision correction faacility for processing data from the Landsat MSS and TM sensors and from the SPOT Multi-Spectral Linear Array and Panchromatic Linear Array sensors at the Canada Centre for Remote Sensing. MOSAICS produces a wide range of product types, from completely raw to fully corrected with subpixel accuracy. Products are offered as full scenes in the spacecraft projection and as geocoded subscenes rotated to the UTM map projection. All products are offered as both Computer Compatible Tapes (CCTs) and films. CCTs are produced in the standard Landsat Ground Station Operator's Working Group format with the full range of options allowed by this family of formats. Film products are exposed directly on a color film recorder with a wide choice of radiometric enhancements including scene histogram enhancements, reflectance based enhancements and custom (user specified) enhancements. Author

A88-18296
TOPOGRAPHIC MAPPING FROM SATELLITE DATA - A CANADIAN POINT OF VIEW
JEAN R. R. GAUTHIER (Department of Energy, Mines and Resources, Ottawa, Canada) Geocarto International (ISSN 1010-6049), vol. 2, Sept. 1987, p. 61-66. refs

This paper describes the challenge posed by Canada's size to the Canadian map making community. Discussed first is the map maintenance problem. This is followed by an outline of the application of Landsat to map updating, including results achieved to date. The paper closed with a look to the near term future including the use of SPOT imagery. Author

A88-18866* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GEOBOTANICAL INVESTIGATION BASED ON LINEAR DISCRIMINANT AND PROFILE ANALYSES OF AIRBORNE THEMATIC MAPPER SIMULATOR DATA
MATHEW R. SCHWALLER (NASA, Goddard Space Flight Center, Greenbelt, MD) Remote Sensing of Environment (ISSN 0034-4257), vol. 23, Oct. 1987, p. 23-34. NASA-supported research. refs

This paper discusses the application of linear discriminant and profile analyses to detailed investigation of an airborne Thematic Mapper Simulator (TMS) image collected over a geobotanical test site. The test site was located on the Keweenaw Peninsula of Michigan's Upper Peninsula, and remote sensing data collection coincided with the onset of leaf senescence in the regional deciduous flora. Linear discriminant analysis revealed that sites overlying soil geochemical anomalies were distinguishable from background sites by the reflectance and thermal emittance of the tree canopy imaged in the airborne TMS data. The correlation of individual bands with the linear discriminant function suggested that the TMS thermal Channel 7 (10.32-12.33 microns) contributed most, while TMS Bands 2 (0.53-0.60 microns), 3 (0.63-0.69 microns), and 5 (1.53-1.73 microns) contributed somewhat more modestly to the separation of anomalous and background sites imaged by the TMS. The observed changes in canopy reflectance and thermal emittance of the deciduous flora overlying geochemically anomalous areas are consistent with the biophysical changes which are known or presumed to occur as a result of injury induced in metal-stressed vegetation. Author

A88-19361
METHODS AND TECHNIQUES FOR THE PROCESSING OF REMOTE-SENSING DATA ON ENVIRONMENT PARAMETERS [METODY I SREDSTVA OBRABOTKI AEROKOSMICHESKIKH DANNYKH O PARAMETRAKH PRIRODNOI SREDY. SERIIA B]
IU. K. KHODAREV, ED., V. A. STRIZHEVSKII, ED., and B. V. NEPOKLONOV, ED. Leningrad, Gidrometeoizdat (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Trudy, No. 27), 1986, 160 p. In Russian. No individual items are abstracted in this volume.

The work presents papers on hardware and software aspects of the reception, storage, and processing of aerial and satellite remote-sensing data. High-speed digital processor configurations for photographic and magnetic image recording are described. In addition, attention is given to the design of systems which can be used at a small station to receive remote-sensing data. B.J.

A88-19570
DETERMINATION OF THE SPATIAL STRUCTURE OF LIQUID-PRECIPITATION FIELDS FROM SPACE RADAR IMAGERY OBTAINED AT TWO ORTHOGONAL POLARIZATIONS [OB OPREDELENII PROSTRANSTVENNOI STRUKTURY POLEI ZHIDKIKH OSADKOV PO KOSMICHESKIM RADIOLOKATSIONNYM IZOBRAZHENIIAM NA DVUKH ORTOGONAL'NYKH POLIARIZATSIIAKH]
A. P. PICHUGIN, IU. G. SPIRIDONOV, and A. B. FETISOV (AN USSR, Institut Radiofiziki i Elektroniki, Kharkov, Ukrainian SSR; Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), July-Aug. 1987, p. 70-77. In Russian. refs

The relationship between the effective scattering area of the rain/earth surface system and the characteristics of liquid-precipitation fields is analyzed with particular reference to Cosmos-1500 sidelooking-radar imagery. It is shown that the precipitation intensity distribution can be retrieved with high spatial resolution using orthogonal polarizations of the receiver and the transmitter. This approach makes it possible to determine the spatial intensity distribution of precipitation over the world ocean and to measure the effective scattering area of the ocean surface in the presence of precipitation. B.J.

A88-19717
A PATTERN RECOGNITION TECHNIQUE FOR DISTINGUISHING SURFACE AND CLOUD TYPES IN THE POLAR REGIONS
ELIZABETH EBERT (Wisconsin, University, Madison) Journal of Climate and Applied Meteorology (ISSN 0733-3021), vol. 26, Oct. 1987, p. 1412-1427. refs
(Contract NSF ATM-85-05027)

This paper presents an automated pattern recognition algorithm which uses spectral and textural features to identify high-latitude surface and cloud types from visible, near-IR, and IR AVHRR satellite data. Eighteen surface and cloud types were classified using the maximum likelihood decision rule, which applies class conditional probability distribution functions based on statistical information about the population of each class. Eight hundred and seventy training samples were classified with a skill of 84 percent; 1800 artificial samples, created using a Monte Carlo technique, were classified with a skill of 92 percent, which represents the theoretical limit of class separability using the given features. I.S.

A88-19811* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE IMPACT OF SPECTRAL EMISSIVITY ON THE MEASUREMENT OF LAND SURFACE TEMPERATURE FROM A SATELLITE
F. BECKER (NASA, Goddard Space Flight Center, Greenbelt, MD) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1509-1522. refs

The effect of emissivity on the measurement of land surface (LS) temperature from satellite radiances using the split-window method is investigated. Formulas are derived to relate the LS temperatures to two brightness temperatures measured from space in the AVHRR 4 and AVHRR 5 channels, and their accuracies are discussed. Results indicate that to determine LS temperatures from a satellite, the spectral emissivity must be known to an accuracy on the order of 0.005 for the average and 0.0007 for the difference in order to obtain an error of the order of 0.5 K. R.R.

A88-19867
SELLING SPOT
FRANK COLUCCI Space (ISSN 0267-954X), vol. 3, Nov.-Dec. 1987, p. 12, 13, 15, 16.

While the largest single user of SPOT imagery in America is the U.S. government, the list of commercial applications for satellite imagery is growing. National security questions raised by the mass marketing of satellite imagery are discussed. There are several potential competitors for SPOT; however, it is believed that, outside the U.S., only the Soviets will be in the business before the mid-1990s. K.K.

A88-20271* Lunar and Planetary Inst., Houston, Tex.
USING THE LANDSAT THEMATIC MAPPER TO DETECT AND MONITOR ACTIVE VOLCANOES - AN EXAMPLE FROM LASCAR VOLCANO, NORTHERN CHILE
P. W. FRANCIS (Lunar and Planetary Institute, Houston, TX) and D. A. ROTHERY (Open University, Milton Keynes, England) Geology (ISSN 0091-7613), vol. 15, July 1987, p. 614-617. refs
(Contract NASW-4066; NAS5-28759)

The Landsat Thematic Mapper (TM) offers a means of detecting and monitoring thermal features of active volcanoes. Using the TM, a prominent thermal anomaly has been discovered on Lascar volcano, northern Chile. Data from two short-wavelength infrared channels of the TM show that material within a 300-m-diameter pit crater was at a temperature of at least 380 C on two dates in 1985. The thermal anomaly closely resembles in size and radiant temperature the anomaly over the active lava lake at Erta'ale in Ethiopia. An eruption took place at Lascar on Sept. 16, 1986. TM data acquired on Oct. 27, 1986, revealed significant changes within the crater area. Lascar is in a much more active state than any other volcano in the central Andes, and for this reason it merits further careful monitoring. Studies show that the TM is capable of confidently identifying thermal anomalies less than 100 m in size, at temperatures of above 150 C, and thus it offers a valuable means of monitoring the conditions of active or potentially active volcanoes, particularly those in remote regions. Author

N88-10416# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CONTRIBUTIONS TO GEODESY, PHOTOGRAMMETRY, AND CARTOGRAPHY. SERIES 2, NUMBER 45
1986 50 p
(ISSN-0469-4244; ETN-87-91099) Avail: NTIS HC A03/MF A01

A method resolving an ambiguity of measured distances by means of NAVSTAR GPS signals; the program Digital Situation Model, Measurement; and Digital Name Data Base Antarctic as a component of a landscape data base of the Antarctic are discussed.

ESA

N88-10418# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
THE PROGRAM DSMME: DIGITAL SITUATION MODEL, MEASUREMENT
HERMANN NEUBAUER *In its* Contributions to Geodesy, Photogrammetry, and Cartography. Series 2, Number 45 p 9-26 1986
Avail: NTIS HC A03/MF A01

An interactive measurement program for topographic maps of any scale is described. The map is treated as a continuous mosaic of segments of homogeneous land use, and not as a set of line elements. Consequently, the program must convert lines into edges and mesh these. This is done under operator control while viewing the stereoscopic model. To facilitate operation, the plotting

instrument was equipped with a menu board and a graphics display unit, and panel keys were reassigned. Substantial parts of the program are applied in practice. ESA

N88-10419# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
DIGITAL NAME DATA BASE ANTARCTIC AS A COMPONENT OF A LANDSCAPE DATA BASE OF THE ANTARCTIC
HEINZ SCHMIDT-FALKENBERG *In its* Contributions to Geodesy, Photogrammetry, and Cartography. Series 2, Number 45 p 27-41 1986
Avail: NTIS HC A03/MF A01

A German language data base of names for the Antarctic is discussed. Orthography of topographic/geographic names is reviewed. ESA

N88-10420# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
OBJECT-DEPENDENT ATMOSPHERIC INFLUENCE ON LANDSAT RECORDINGS
BERND-SIEGFRIED SCHULZ *In its* Contributions to Geodesy, Photogrammetry, and Cartography. Series 2, Number 45 p 43-48 1986
Avail: NTIS HC A03/MF A01

A method for determining object and direction-dependent radiometric effects caused by changes in the state of the atmosphere, showing as local interference on multispectral LANDSAT recording, was developed. Further radiometric effects, of comparatively high frequency and due to varying terrain inclinations, are suppressed by ascertaining object-dependent and area-specific mean gray values. The approach assumes that the sum of all positive and negative inclination within a specific area of analysis approximates 0, and that the mean of the related measured values reaches the value for horizontal terrain. Investigations on a LANDSAT-2 data set that almost entirely covers the area of a sheet of the General Topographic Map 1: 200,000 of the Federal Republic of Germany are summarized. ESA

N88-11203*# National Aeronautics and Space Administration, Washington, D.C.
HOW WE GET PICTURES FROM SPACE, REVISED EDITION
ROBERT HAYNES 1987 12 p Original contains color illustrations
(NF-151/7-87-REV; NAS 1.20:151/7-87-REV) Avail: NTIS HC A03/MF A01; also available SOD HC $1.00 as 033-000-01005-2 CSCL 05B

The past 25 years of space travel and exploration have generated an unprecedented quantity of data from planetary systems. Data gathered at close range, and from above the distorting effects of Earth's atmosphere, produce images far more detailed than pictures taken by even the largest Earth-bound telescopes. The techniques used to acquire and process these images are discussed briefly. B.G.

N88-11743# National Geodetic Survey, Rockville, Md.
GEOSAT ALTIMETER GEOPHYSICAL DATA RECORD USER HANDBOOK
R. E. CHENEY, B. C. DOUGLAS, R. W. AGREEN, L. MILLER, and D. L. PORTER Jul. 1987 35 p
(PB87-213336; NOAA-TM-NOS-NGS-46) Avail: NTIS HC A03/MF A01 CSCL 14B

In March 1985, the U.S. Navy altimeter satellite GEOSAT began generating a data set with unprecedented spatial and temporal coverage of the global oceans. The satellite carries a radar altimeter that provides a profile of sea level along the satellite ground track. Such records enable determination of sea level and its variability, and have application in many areas of geodesy and ocean dynamics. As suggested by the acronym GEOSAT, the satellite's primary purpose was improvement of the marine gravity field. Because of the value of this information to the U.S. military, the first 18 months of observations are classified. However, the geodetic mission ended September 30, 1986, and on October 1, a series of maneuvers was begun to alter the orbit to produce sea surface profiles within a few kilometers of previous released SEASAT data tracks. This orbit has a repeat period of about 17 days, and the mission is now referred to as the GEOSAT Exact Repeat Mission (ERM). The ERM officially became operational November 8, 1986. The contents of the report include the following: the GEOSAT altimeter mission; geophysical data records (ocean); geophysical data records (land and ice); and data analysis considerations. GRA

N88-12139# Compagnia Italiana Servizi Tecnici, Rome.
AN OVERVIEW OF REMOTE SENSING USERS' REQUIREMENTS
G. AVANZI and R. GRAZI *In* ESA, Commercial Opportunities for Remote Sensing with Polar Platforms p 55-57 Apr. 1987
Avail: NTIS HC A05/MF A01

User requirements in cartography and thematic mapping are discussed. Lack of education of the end users and lack of confidence in available performances of systems and information content of products are identified as weaknesses in the commercialization of value added services in remote sensing. ESA

N88-12143# Centre National d'Etudes Spatiales, Toulouse (France).
SPOT 1: FIRST IN-FLIGHT RESULTS
1987 336 p Partly in ENGLISH and FRENCH Lecture course presented in Toulouse, France, Dec. 1986 Original contains color illustrations
(ISBN-2-85428-177-2; ETN-87-90895) Avail: CEPADUES-Editions, Toulouse, France

Operational use of SPOT satellite imagery for urban research; mapping; water resources studies; geology and mineral exploration; agriculture; forestry; and coastal and oceanographic studies was discussed. Image processing and image commercialization were considered. ESA

N88-12144# Centre National d'Etudes Spatiales, Toulouse (France). SPOT Image.
DEVELOPMENT OF THE SPOT COMMERCIAL SERVICE: PRELIMINARY CONCLUSIONS AFTER SIX MONTHS OF OPERATIONS
ANDRE FONTANEL *In its* SPOT 1: First In-Flight Results p 11-17 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

After 6 months operation, 200,000 SPOT scenes were recorded and archived. Their characteristics, location, and cloud cover parameters are referenced in the central catalog on a 24 hr per day basis. The spacecraft operated with very few incidents, except tape recorder 1 which is in the standby position. Ground system operation is very smooth. Adjustments, however, were necessary for the payload scheduling activities, which directly depend on data collection needs expressed by the user community. The extremely versatile flexibility of the SPOT system with respect to imaging capabilities proved demanding in terms of conflicts management, imaging strategy, etc. Distribution of images to the user community worldwide is increasing, with digital data representing 44 percent of products. Production and management problems particularly in the areas of quick look quality and photographic production were treated. User response is extremely positive. ESA

N88-12146# SPOT Image Corp., Washington, D.C.
SPOT IMAGE CORPORATION: EARLY RESULTS
DAVID S. JULYAN *In* CNES, SPOT 1: First In-Flight Results p 25-31 1987
Avail: CEPADUES-Editions, Toulouse, France

Commercialization of SPOT satellite images in the United States is described. Customer reactions and possible competition are discussed. ESA

N88-12147# Canada Centre for Remote Sensing, Ottawa (Ontario).
THE CANADIAN SPOT PROGRAM
R. A. ONEIL *In* CNES, SPOT 1: First In-Flight Results p 33-40 1987
Avail: CEPADUES-Editions, Toulouse, France

The SPOT ground stations and operations center in Canada are described. The image production system is outlined. ESA

N88-12148# Institut Geographique National, Paris (France).
FIRST ASSESSMENT OF PROCESSING AND USE OF SPOT IMAGES BY THE INSTITUT GEOGRAPHIQUE NATIONALE
ALAIN BAUDOIN *In* CNES, SPOT 1: First In-Flight Results p 41-47 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

Use of SPOT images for cartography is described. Geometrical rectification gives images compatible with geographic information systems. Radiometric corrections are provided to generate true colors from multispectral imagery. Three dimensional synthetic images are produced from rectified images and thematic studies on land use cover, urban studies, forest fires inventories, etc. are underway. ESA

N88-12151# Centre National d'Etudes Spatiales, Toulouse (France).
DETECTOR NORMALIZATION
MARC LEROY *In its* SPOT 1: First In-Flight Results p 63-69 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

Residual errors in the SPOT detector normalization preprocessing are discussed. The specifications, the radiometric preprocessing algorithm, the methods of measurement of the normalization coefficients, and the results are presented. A method of deriving normalization coefficients using on-board calibration proves infeasible, but a method based on snow covered sites works. Analysis shows that residual errors are within specifications, and can be corrected. ESA

N88-12153# Centre d'Etudes et de Recherches, Toulouse (France).
MODULATION TRANSFER FUNCTION
D. LEGER *In* CNES, SPOT 1: First In-Flight Results p 79-82 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

The modulation transfer function (MTF) was assessed, in the panchromatic mode, using a visual comparison between SPOT images and images from a reference catalog, made using aerial high resolution photographs over cities. The photographs were digitized, deteriorated by application of known MTF, and put in SPOT format. The comparison indicates that the two HRV cameras are within the specifications. The calculation of the image frequency content when the two HRVs are in parallel viewing allowed direct comparison between the cameras. ESA

N88-12154# Centre National d'Etudes Spatiales, Toulouse (France).
INTRINSIC AND EXTRINSIC GEOMETRIC QUALITY
B. BOISSIN and J.-P. GARDELLE *In its* SPOT 1: First In-Flight Results p 83-91 1987
Avail: CEPADUES-Editions, Toulouse, France

The method used to check the viewing geometry of the SPOT satellite after launch and to estimate the geometric image quality is outlined. Results obtained during the first months of satellite operation show that the extrinsic and intrinsic quality of the SPOT products meet the specifications most of the time: infrared horizon disturbances may degrade level 1B image location (up to 2000 m). Anisomorphism may also be slightly over the specification. ESA

N88-12155# Institut Geographique National, Paris (France).
REGISTRATION OF SPOT IMAGES [LA SUPERPOSABILITE DES IMAGES SPOT]
D. PRADINES *In* CNES, SPOT 1: First In-Flight Results p 93-102 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

The in-flight tests of SPOT 1 satellite were used to control whether the system meets the specifications, designed to obtain an image quality compatible with thematic uses. Part of the controls was based on image geometry. Methods developed to test are: (1) multitemporal image registration which characterizes the quality of the level S products; and (2) multispectral registration which has an important role in the quality of color composite images, based on automatic correlation. In simultaneous acquisition of panchromatic and multispectral data, the registration of the two images is facilitated by the viewing geometry. This leads to an automatic algorithm to register the two images. In data acquisition with both instruments in twin mode, the geometric quality of the SPOT images gives the possibility of obtaining mosaics automatically from SPOT images keeping the geometric quality of the final product. ESA

N88-12156# Institut Geographique National, Paris (France).
EVALUATION OF SPOT STEREOSCOPIC POSSIBILITIES FOR CARTOGRAPHY
PATRICE DENIS, ANNE-CLAIRE DEGAUJAC, PATRICK GIGORD, and VINCENT RODRIGUEZ *In* CNES, SPOT 1: First In-Flight Results p 103-108 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

The stereoscopic capacities of SPOT 1 were checked using two test areas equipped with control points and check points before the launching of the satellite. Measures were performed on an analytical stereoplotter to check specifications (10 m) for height determination. Raw results lead to a mean square residual of 7.1 m and final results lead to a mean square residual of 5.3 m. The cartographic nature of SPOT is thus confirmed. ESA

N88-12167# Centre National de la Recherche Scientifique, Toulouse (France).
THE CONTRIBUTION OF SATELLITE DATA IN DRAWING UP MAPS USED IN RURAL DEVELOPMENT [L'APPORT DES DONNEES SATELLITAIRES DANS L'ETABLISSEMENT DES CARTES UTILISEES PAR LE DEVELOPPEMENT RURAL]
M. BRUNEAU and J. KILIAN *In* CNES, SPOT 1: First In-Flight Results p 197-202 1987 In FRENCH
Avail: CEPADUES-Editions, Toulouse, France

The use of satellite data to map rural land use in tropical regions is discussed. The physical and agricultural environments are considered. The physical milieu can be analyzed via a morphological map, derived from visual interpretation of aerial photographs and satellite imagery. The agricultural milieu is the greatest beneficiary of visual and numerical analysis of satellite data (particularly SPOT). ESA

N88-12186# Army Engineer Topographic Labs., Fort Belvoir, Va.
A REVIEW OF COMPUTER-ASSISTED PHOTO INTERPRETATION RESEARCH AT USAETL (US ARMY ENGINEER TOPOGRAPHIC LABORATORIES)
GEORGE E. LUKES 16 Jan. 1987 6 p
(AD-A184034; ETL-R100) Avail: NTIS HC A02/MF A01 CSCL 08B

A program in computer-assisted photo interpretation research (CAPIR) was initiated at the U.S. Army Engineer Topographic Laboratories (USAETL) in 1979. The primary objective was to develop and implement concepts to increase the productivity of the human photo interpreter tasked with extracting terrain data from aerial imagery. Early efforts focused on implementation of interactive software for direct capture of digital map data from stereo mapping and reconnaissance photography. The development of a hardcopy stereo workstation with integral computer graphic superposition has been essential to provide a suitable interactive, closed-loop environment for the photo

interpreter. This paper provides a brief introduction to the problem domain of terrain analysis and outlines the evolution of the CAPIR program emphasizing the special requirements for an effective man-machine interface. The application of current CAPIR technology to typical terrain data capture problems is discussed with selected examples of technology transfer and examples of new commercial photogrammetric instrumentation incorporating graphic superposition capabilities. Opportunities to extend CAPIR concepts to softcopy terrain analysis based on adaptation of digital image processing technology are then presented. Digital image source materials and potential softcopy processing advantages are discussed and key requirements for effective softcopy terrain analysis are summarized. GRA

N88-13759*# Autometric Corp., Inc., Falls Church, Va.
LAND COVER/USE CLASSIFICATION OF CAIRNS, QUEENSLAND, AUSTRALIA: A REMOTE SENSING STUDY INVOLVING THE CONJUNCTIVE USE OF THE AIRBORNE IMAGING SPECTROMETER, THE LARGE FORMAT CAMERA AND THE THEMATIC MAPPER SIMULATOR
MATTHEW HERIC, WILLIAM COX, and DANIEL K. GORDON *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 56-62 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 08B

In an attempt to improve the land cover/use classification accuracy obtainable from remotely sensed multispectral imagery, Airborne Imaging Spectrometer-1 (AIS-1) images were analyzed in conjunction with Thematic Mapper Simulator (NS001) Large Format Camera color infrared photography and black and white aerial photography. Specific portions of the combined data set were registered and used for classification. Following this procedure, the resulting derived data was tested using an overall accuracy assessment method. Precise photogrammetric 2D-3D-2D geometric modeling techniques is not the basis for this study. Instead, the discussion exposes resultant spectral findings from the image-to-image registrations. Problems associated with the AIS-1 TMS integration are considered, and useful applications of the imagery combination are presented. More advanced methodologies for imagery integration are needed if multisystem data sets are to be utilized fully. Nevertheless, research, described herein, provides a formulation for future Earth Observation Station related multisensor studies. Author

N88-13769*# Geological Survey, Denver, Colo.
CAUSES OF SPURIOUS FEATURES IN SPECTRAL REFLECTANCE DATA
ROGER N. CLARK and TRUDE V. V. KING *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop 132-137 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 08B

Several techniques are becoming common in the analysis of imaging spectrometer data that can lead to spurious absorption features or to changes in the position, width, and shape of actual absorption features. It is a common practice to calibrate AIS or other imaging spectrometer data by averaging each pixel along the flight line. The average is used to calibrate the spectral data by dividing the spectrum at each pixel by the average. If some pixels in the data set contain an absorption, then the average will also show an absorption. Some AIS data has had problems with wavelength stability from one scan line to the next which can produce spurious features with some analysis methods. If a pixel has a spectrum with an absorption having a different position or width than the spectrum used in a ratio, then the ratio can produce a spurious absorption at a different position and width than the true absorption feature. An average spectrum ratioed to each pixel will produce band shifts, and changes in width or shape. If continuum removal is performed by substraction rather than division, band positions can also be shifted. Author

N88-13770*# Geological Survey, Denver, Colo.
AUTOMATIC CONTINUUM ANALYSIS OF REFLECTANCE SPECTRA
ROGER N. CLARK and TRUDE V. V. KING *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 138-142 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 08B

A continuum algorithm based on a Segmented Upper Hull method (SUH) is described. An upper hull is performed on segments of a spectrum defined by local minima and maxima. The segments making a complete spectrum are then combined. The definition of the upper hull allows the continuum to be both concave and/or convex, adapting to the shape of the spectrum. The method performs multiple passes on a spectrum by segmenting each local maximum to minimum and performing an upper hull. The algorithm naturally adapts to the widths of absorption features, so that all features are found, including the nature of doublets, triplets, etc. The algorithm is also reasonably fast on common minicomputers so that it might be applied to the large data sets from imaging spectrometers. Author

N88-13774*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SCIENTIFIC AND OPERATIONAL REQUIREMENTS FOR TOMS DATA
ARLIN J. KRUEGER, ed. Dec. 1987 112 p Conference held in Greenbelt, Md., 10-11 Sep. 1986
(NASA-CP-2497; REPT-87B0206; NAS 1.55:2497) Avail: NTIS HC A06/MF A01 CSCL 04A

Global total ozone and sulfur dioxide data from the Nimbus 7 Total Ozone Mapping Spectrometer (TOMS) instrument have applications in a broad range of disciplines. The presentations of 29 speakers who are using the data in research or who have operational needs for the data are summarized. Five sessions addressed topics in stratospheric processes, tropospheric dynamics and chemistry, remote sensing, volcanology, and future instrument requirements. Stratospheric and some volcanology requirements can be met by a continuation of polar orbit satellites using a slightly modified TOMS but weather related research, tropospheric sulfur budget studies, and most operational needs require the time resolution of a geostationary instrument.

N88-13783*# Saint Louis Univ., Mo.
TROPICAL EASTERLY JET LOCATED USING TOMS DATA Abstract Only
WILLIAM C. BOLHOFER *In* NASA. Goddard Space Flight Center, Scientific and Operational Requirements for TOMS Data p 23 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 04A

The formative stages of the onset of the 1979 southwest monsoon was marked by a WNW-ESE oriented band of marine convection over the South Arabian Sea. This convection was first observed on June 10, 1979 using satellite cloud imagery. The marine convection appeared during a major acceleration of the upper troposphere easterly wind field. A composite vertical meridional cross-section of upper level winds for June 11, revealed the core of the Tropical Easterly Jet (TEJ) at 115 mb, 9.5 deg N. Time analysis of the upper level wind field over the Tropical Wind Observing Ship (TWOS) polygon show a lowering of both the pressure level of maximum wind and tropopause level with acceleration of the upper level easterlies. The tropopause was as much as 20 mb lower on the equatorial side of the TEJ. Streamline analysis of the maximum observed easterly winds over India did not reveal the horizontal position of the TEJ. Careful analysis of Total Ozone Mapping Spectrometer (TOMS) data for June 11, 1979 showed relatively high values of ozone south of India. It was observed that the latitudinal position of the TEJ on June 11, at approximately 70 deg E coincided with the northern edge of relatively high ozone values. Using this as a reference, the TEJ core was identified as far as NE Bay of Bengal (the limits of the available TOMS data). Author

N88-13787*# Control Data Corp., Minneapolis, Minn.
APPLICATION OF TOMS DATA TO WEATHER ANALYSIS MODELS Abstract Only
GREGORY D. NASTROM *In* NASA. Goddard Space Flight Center, Scientific and Operational Requirements for TOMS Data p 32 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 04B

Recent studies of the errors of analysis reflected by numerical weather analysis models are reviewed. Despite the improvements in data coverage and data ingestion methods in the past decade, it is found that significant errors of analysis persist. A case study comparison of Total Ozone Mapping Spectrometer (TOMS) data and aircraft data with the NMC analysis over the North Atlantic is used to illustrate the size of local errors encountered. The possibility of using TOMS images to locate meteorologically significant features such as troughs and ridges near the tropopause is discussed. Author

N88-13797*# Smithsonian Institution, Washington, D. C.
USE OF SATELLITE DATA IN VOLCANO MONITORING
LINDSAY MCCLELLAND *In* NASA. Goddard Space Flight Center, Scientific and Operational Requirements for TOMS Data p 71-76 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 04A

It is argued that Total Ozone Mapping Spectrometer (TOMS) data, especially data on sulfur dioxide detection in volcanic clouds, and weather satellite data complement each other. TOMS data is most useful for discovering previously unknown eruptions and indicating a minimum volume of SO sub 2 produced by a given eruption. Once an eruption has been reported, weather satellite data can be used to accurately monitor its progress. To be used effectively, these data need to be analyzed jointly and in real time. Toward this end, it is hoped that full and timely utilization can be made of existing TOMS data, a polar orbiting TOMS can be launched in the near future, and that TOMS type instruments can be included on future geostationary satellites. Author

N88-13809# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
MATCHING SEGMENTS FROM A MAP AND AN AERIAL IMAGE USING RELAXATION TECHNIQUES
EVA SALMERON and MAURICE MILGRAM 1986 14 p In FRENCH; ENGLISH summary
(SNIAS-872-422-103; ETN-88-91204) Avail: NTIS HC A03/MF A01

A method for the matching of an aerial image and an ordnance survey map is presented. Entities such as contrast lines are used. The method is based on probabilistic relaxation. Labels (image segments) are given to objects (map segments) using probabilities and constraints specific to the problem. The method leads to good results with real complex images comprising 100 map-segments and 200 image-segments. ESA

N88-13878# Naval Research Lab., Washington, D.C.
SOFTWARE DESIGN FOR AN AIRBORNE GRAVITY MEASUREMENT SYSTEM Final Report, 1 Jul. 1986 - 28 Feb. 1987
MARY F. PETERS, JOHN M. BROZENA, and J. D. CLAMONS 12 Aug. 1987 37 p
(AD-A185000; NRL-9049) Avail: NTIS HC A03/MF A01 CSCL 09B

This report describes the results of a software design study for an airborne gravity measurement system. The software is intended for data acquisition and monitoring aboard a fixed-wing aircraft over oceanic areas, and for the postflight processing required to compute gravity along a flight track. Various requirements of the postflight processing system are discussed. A method to compute gravity from airborne measurements is outlined; as some quantities can be derived from more than one measurement, alternative algorithms, to be used in cases of poor quality or missing data, are given. Author (GRA)

N88-14333*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AVIRIS GROUND DATA-PROCESSING SYSTEM
JOHN H. REIMER, JAN R. HEYADA, STEVE C. CARPENTER, WILLIAM T. S. DEICH, and MEEMONG LEE *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 61-72 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) has been under development at JPL for the past four years. During this time, a dedicated ground data-processing system has been designed and implemented to store and process the large amounts of data expected. This paper reviews the objectives of this ground data-processing system and describes the hardware. An outline of the data flow through the system is given, and the software and incorporated algorithms developed specifically for the systematic processing of AVIRIS data are described. Author

N88-14591# Naval Postgraduate School, Monterey, Calif.
AUTOMATED SATELLITE CLOUD ANALYSIS: A MULTISPECTRAL APPROACH TO THE PROBLEM OF SNOW/CLOUD DISCRIMINATION M.S. Thesis
ROBERT C. ALLEN, JR. Jun. 1987 114 p
(AD-A185672) Avail: NTIS HC A06/MF A01 CSCL 04B

An algorithm is developed and evaluated for discriminating among clouds, snow cover and clear land. The multispectral technique uses daytime images of AVHRR channels 1 (0.63 microns, 3 (3.7 microns) and 4 (11.0 microns). Reflectance is derived for channel 3 by using the channel 4 emission temperature to estimate and remove the channel 3 thermal emission. Separation of clouds from snow and land is based primarily on this derived channel 3 reflectance. Using this technique, observed relectance in channel 3 is 2 to 4 percent for snow, 3 to 10 percent for land, 2 to 27 percent for ice clouds and 8 to 36 percent for liquid clouds. These values overlap for thin cirrus and snow, so the routine than attempts analysis of cirrus based on its different transmissive properties between channels 3 and 4. Six images were analyzed and the total cloud cover was verified against a total of 110 conventional surface observations using the standard categories of clear, scattered, broken and overcast. The routine was quite successful, with the analyzed sky cover being within category for 55 percent of the stations, one category different for 33 percent, 2 categories different for 9 percent and 3 categories for 3 percent of the stations. A major remaining problem is discrimination between ice clouds and snow cover due to the great similarity of reflective properties of there two surfaces. GRA

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A88-11775
POTENTIAL OF REMOTE SENSING FOR THE STUDY OF GLOBAL CHANGE - COSPAR REPORT TO THE INTERNATIONAL COUNCIL OF SCIENTIFIC UNIONS (ICSU)
S. I. RASOOL, ED. Oxford and Elmsford, NY, Pergamon Press, Advances in Space Research (ISSN 0273-1177), vol. 7, no. 1, 1987, 103 p. refs

The potential of a space-based remote sensing and data system for the study of global change is assessed by the ICSU/COSPAR ad hoc group. Current status of satellite remote sensing and related data systems is examined, with comparisons made of the sensors and systems for NOAA-series polar-orbiting satellites and present and future GOES spacecraft. Presently available data are presented on temporal variations of solar flux, aerosol concentration, Arctic

and Antarctic sea ice, Greenland Ice Sheet, and Northern Hemisphere snow depth. It is shown that, in order to meet the goals of the Global Change Program, the program will need in situ data on long-term measurements of a multitude of parameters ranging from cloud cover, radiation balance, precipitation, and atmospheric and oceanic circulation to vegetation type and density, atmospheric trace gases, and oceaninc primary productivity and chemical and biological fluxes at the boundaries of land, oceanic, and atmosphere. I.S.

A88-12331
EVALUATION OF SPOT IMAGERY ON ANALYTICAL PHOTOGRAMMETRIC INSTRUMENTS
G. KONECNY, P. LOHMANN, H. ENGEL, and E. KRUCK (Hannover, Universitaet, Hanover, Federal Republic of Germany) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 53, Sept. 1987, p. 1223-1230. refs

A rigorous method for the geometric processing of SPOT images has been developed and implemented on analytical photogrammetric instruments. Level 1A film products, as delivered by SPOT IMAGE or other SPOT image distributors, may be used on these instruments to produce digital elevation models, orthophotos, or line maps. The method has been implemented and tested on the Zeiss Planicomp and Orthocomp hardware. A bundle adjustment program BINGO has been modified to handle CCD line scanner geometry for the restitution of the images. Results using a panchromatic SPOT stereo pair over the area of Marseille in the south of France are presented and discussed. Author

A88-12716
THE PERFORMANCE OF CCD ARRAY DETECTORS FOR APPLICATION IN HIGH-RESOLUTION TOMOGRAPHY
J. H. KINNEY, Q. C. JOHNSON (Lawrence Livermore National Laboratory, Livermore, CA), U. BONSE, R. NUSSHARDT (Dortmund, Universitaet, Federal Republic of Germany), and M. C. NICHOLS (Sandia National Laboratories, Livermore, CA) IN: X-ray imaging II; Proceedings of the Meeting, San Diego, CA, Aug. 21, 22, 1986 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1986, p. 43-50. refs
(Contract W-7405-ENG-48)

Charge coupled device arrays (CCDs) with low noise, small pixel size and high charge storage capacity are available at relatively low cost. Because of this, CCDs are finding increasing use in imaging applications. In this paper, the performance of a TI-4849 CCD array in an X-ray camera to be used for high-resolution synchrotron radiation tomography is discussed. The X-ray image is converted to visible light on a phosphor coated optical face plate which is imaged by a thermoelectrically cooled CCD. The measured modulation transfer function (high-contrast MTF) is presented for this system. The procedures for choosing and preparing the optimal phosphors for X-ray imaging are described. Advantages and limitations of CCD arrays over other detectors for tomographic applications are also discussed. Author

A88-12728
AIRBORNE RECONNAISSANCE X; PROCEEDINGS OF THE MEETING, SAN DIEGO, CA, AUG. 19, 20, 1986
PAUL HENKEL, ED. (General Dynamics Corp., Saint Louis, MO) and FRANCIS R. LAGESSE, ED. Meeting sponsored by SPIE. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 694), 1987, 176 p. For individual items see A88-12729 to A88-12751.
(SPIE-694)

The present conference on airborne reconnaissance considers topics in primary data collection system design, the management of reconnaissance sensor data, reconnaissance systems' research and development status, and the achievement of real-time intelligence. Attention is given to airborne minefield detection, forest fire detection, high speed transform image compression, data link design tradeoffs for electrooptical reconnaissance systems, and airborne reconnaissance sensor pods. Also discussed are millimeter-wave imaging sensors, an advanced CCD reconnaissance detector, recent developments in IR data processing, and the requirements of low altitude reconnaissance. O.C.

A88-12746
CONSIDERATIONS FOR A LOW-ALTITUDE RECONNAISSANCE SYSTEM
RALPH WIGHT (Fairchild Weston Systems, Inc., Syosset, NY) IN: Airborne reconnaissance X; Proceedings of the Meeting, San Diego, CA, Aug. 19, 20, 1986 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 119-123.

Use of solid-state detectors in systems to supplant photographic film-based sensors is described. Bandwidth limitations are shown to bound the collection capabilities of the new class of sensor. System trades are discussed, and a candidate type of low-altitude reconnaissance system described. Author

A88-12747
ADVANCED CCD RECONNAISSANCE DETECTOR
A. LAREAU (Recon/Optical, Inc., CAI Div., Barrington, IL) and C. CHANDLER (Ford Aerospace and Communications Corp., Aeronutronic Div., Newport Beach, CA) IN: Airborne reconnaissance X; Proceedings of the Meeting, San Diego, CA, Aug. 19, 20, 1986 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 124-129.

An advanced charged coupled device (CCD) reconnaissance detector has been designed, fabricated and integrated into several focal plane array (FPA) configurations. CAS-6254 is optimized for real-time, long-range, oblique reconnaissance (LOROP) applications. Its features include a small pixel size, high saturation level, variable length time delay and integrate (TDI) operation, high line rate, integrated support electronics and buttable ends. The device offers improvements to currently available devices by virtue of its 11-micron pixel size, burst ripple TDI operation and eight selectable TDI lengths between 1 and 64. The 24-mm chip has buttable ends to facilitate the fabrication of long FPA's with less than 3 missing pixels across each gap. The design criteria, architecture, fabrication details and performance are presented along with sample imagery taken by the device. Author

A88-12827
A FLUORESCENCE LIDAR FOR LAND AND SEA REMOTE SENSING
F. CASTAGNOLI, G. CECCHI, L. PANTANI, I. PIPPI, B. RADICATI (CNR, Istituto di Ricerca sulle Onde Elettromagnetiche, Florence, Italy) et al. IN: Laser radar technology and applications; Proceedings of the Meeting, Quebec, Canada, June 3-5, 1986 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1986, p. 212-216. CNR-supported research. refs

Research on the application of fluorescence lidars to the remote sensing of land and sea surfaces have been carried out using laboratory and computer simulations; they are mainly devoted to the selection of laser sources, the detection and characterization of oil spills, and the analysis of vegetation stresses. A prototype fluorescence lidar was designed and built with attention to the problems of operation aboard trucks, ships, and aircraft. The system is a rugged, lightweight, small-dimension one, having low power consumption. The lidar is able to record high resolution fluorescence spectra, and most of its data processing can be done aboard the moving platform. Author

A88-12828
INFRARED TECHNOLOGY XII; PROCEEDINGS OF THE MEETING, SAN DIEGO, CA, AUG. 19, 20, 1986
IRVING J. SPIRO, ED. (Aerospace Corp., El Segundo, CA) and RICHARD A. MOLLICONE, ED. (Analytic Decisions, Inc., Arlington, VA) Meeting sponsored by SPIE. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Volume 685), 1986, 234 p. For individual items see A88-12829 to A88-12847.
(SPIE-685)

The present conference on IR sensor technology considers topics in IR imaging, the simulation and modeling of IR images, IR technology developments in Britain, and novel IR sensor

applications. Attention is given to an imaging spectrometer for Mars investigation, the Space Shuttle IR Imaging Experiment, an IR scene composer for electronic vision applications, and practical results for sampling effects in CdHgTe focal-plane arrays. Also discussed are a dual-waveband imaging radiometer, thermal imaging sensors for submarine periscopes, the structure of the extended emission in the IR celestial background, and novel long-path transmissometry. O.C.

A88-12842
A DUAL WAVEBAND IMAGING RADIOMETER
S. P. BRAIM (Royal Signals and Radar Establishment, Malvern, England) and G. M. CUTHBERTSON (GEC Avionics, Ltd., Basildon, England) IN: Infrared technology XII; Proceedings of the Meeting, San Diego, CA, Aug. 19, 20, 1986 . Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1986, p. 129-137.

The Dual-Waveband Imaging Radiometer presented is a calibrated imager furnishing synchronous, simultaneous imagery in pixel-by-pixel overlay, from a single optical channel, and combines state-of-the-art modular FLIR performance with internal calibrated references that facilitate the measurement of apparent temperatures. All requisite radiometric and system status data is displayed in graphic form, and is overlayed on video recording to ease subsequent image analysis. The radiometer's design is entirely based on Class II UK Thermal Imaging Common Module elements for processing cards, power supply, scanner, detector lens, head amplifier, and motor drive. Class II systems are intrinsically TV-compatible. O.C.

A88-14051
AMERICAN SOCIETY FOR PHOTOGRAMMETRY AND REMOTE SENSING AND AMERICAN CONGRESS ON SURVEYING AND MAPPING, FALL CONVENTION, ANCHORAGE, AK, SEPT. 28-OCT. 3, 1986, TECHNICAL PAPERS
Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, 430 p. For individual items see A88-14052 to A88-14066.

The conference presents papers on recent developments in the U.S. Geological Survey's Landsat Image Mapping Program, an evaluation of computer storage methods for Landsat-derived raster data, Eosat, and engineering applications of thermal infrared imagery and impulse radar data for the analysis of ice integrity for transportation purposes. Other topics include the development of a geographic information data base for Pitkin County, Colorado using Landsat imagery and other ancillary data; lava flow analysis from digitized Shuttle photography; wetland vegetation change detection using high resolution aircraft MSS data; and the Alaska High Altitude Photography Program. Consideration is also given to Quick-Look Landsat imagery of Alaska; intermediate-scale vegetation mapping of Kanuti National Wildlife Refuge, Alaska using Landsat MSS digital data; and mapping forest cover with SIR-B data. K.K.

A88-14052
SPOT 3/4 - A FOLLOW-ON PROGRAM
G. BEGNI, B. BOISSIN, M. LEROY (CNES, Toulouse, France), and A. PODAIRE (Laboratoire d'Etudes et de Recherches en Teledetection Spatiale, Toulouse, France) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 7-11.

The SPOT 3/4 instruments which include modifications to the SPOT 1/2 instruments are described. Particular attention is given to the high-resolution visible IR instrument in which a new spectral band is added in the medium IR domain. The vegetation instrument was designed for local agricultural monitoring and the surveying of the ocean and coastal zones. K.K.

A88-14479
SATURATION EFFECTS IN THE SEASAT ALTIMETER RECEIVER
D. J. WINGHAM and C. G. RAPLEY (London, University College, Dorking, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Aug. 1987, p. 1163-1173. refs
(Contract ESTEC-6079/84-NL-PB(SC))

Some 10-15 percent of the Seasat altimeter returns over land and inland water, and a larger proportion of sea ice returns, are strongly peaked, in some cases resembling the instrument point target response. Many of these narrow-peaked pulses, from a wide variety of surface types, exhibit well-defined precursors. This paper demonstrates these precursors to be the result of instrument saturation. The response of the altimeter to narrow-peaked pulses is modeled theoretically. The consequences of saturation are shown to be well-defined pre- and postcursors whose delay depends upon the location of the narrow-peaked component within the altimeter range window, and the clipping of high amplitude events. Seventy-one Seasat pulses exhibiting precursors are examined and their location is shown to coincide with that predicted. It is concluded that, while great care must be taken in attempting a quantitative interpretation of narrow-peaked waveforms, their arrival time, and hence measured range, is unaffected by instrument saturation. Author

A88-14800#
THE MEASUREMENT OF EVAPOTRANSPIRATION USING INFRARED REMOTE SENSING METHODS
SIMONETTA PALOSCIA and PAOLO PAMPALONI (CNR, Istituto di Ricerca sulle Onde Elettromagnetiche, Florence, Italy) Alta Frequenza (English Edition) (ISSN 0002-6557), vol. 55, Nov.-Dec. 1986, p. 395-400. CNR-supported research. refs

A88-15152
UTILIZATION OF REMOTE SENSING DATA IN THE FEDERAL REPUBLIC OF GERMANY; SEMINAR ON CURRENT STATUS, GARMISCH-PARTENKIRCHEN, FEDERAL REPUBLIC OF GERMANY, JAN. 20-22, 1986, REPORTS [DIE NUTZUNG VON FERNERKUNDUNGSDATEN IN DER BUNDESREPUBLIK DEUTSCHLAND; STATUS-SEMINAR, GARMISCH-PARTENKIRCHEN, FEDERAL REPUBLIC OF GERMANY, JAN. 20-22, 1986, VORTRAEGE]
Seminar organized by DGLR; Sponsored by DGLR and BMFT. Bonn, Deutsche Gesellschaft fuer Luft- und Raumfahrt, 1986, 570 p. In German. For individual items see A88-15153 to A88-15174.
(DGLR BERICHT 86-01)

The analysis and application of satellite and airborne remote-sensing data are discussed in reviews and reports, with a focus on activities in the FRG. Applications to city and land-use planning, agriculture and forestry, environmental protection, geology and hydrology, coastal protection, climatology and meteorology, and oceanography are examined. Consideration is also given to the organization of remote sensing activities and the distribution of remote-sensing data to users. Diagrams, graphs, tables, and sample images are provided. T.K.

A88-15484#
ERS-1 - THE EUROPEAN REMOTE SENSING SATELLITE AND THE SPECIFICATION OF GROUND RECEPTION FACILITIES FOR AUSTRALIA
R. JEREMY (Hawker de Havilland Australia Pty., Ltd., Space Div., Bankstown) IN: National Space Engineering Symposium, 2nd, Sydney, Australia, Mar. 25-27, 1986, Preprints. Volume 1 . Barton, Australia/Brookfield, VT, Institution of Engineers, Australia/Brookfield Publishing Co., 1986, 11 p.

Satellite ERS-1 planned for launch by ESA in 1989 is an earth observation satellite of particular interest to Australia. It will include an active microwave instrument to provide SAR imagery of the earth's surface as well as wind and wave characteristics over oceans when operated in scatterometer mode. Oceanographic study data is also obtained from a radar altimeter and an along-track scanning radiometer plus microwave sounder. Technical characteristis of the ERS-1 instrumentation are described. For

reception by Australia of data from these sensors, a modification to the Australian Landsat station data acquisition facility at Alice Springs has been specified. An outline of these modifications is given. Author

A88-15505#
SMALL EARTH STATIONS FOR ENVIRONMENTAL SATELLITES
I. G. BIRD and C. G. WALLEY (CSIRO, Div. of Atmospheric Research, Aspendale, Australia) IN: National Space Engineering Symposium, 2nd, Sydney, Australia, Mar. 25-27, 1986, Preprints. Volume 2 . Barton, Australia/Brookfield, VT, Institution of Engineers, Australia/Brookfield Publishing Co., 1986, 10 p. refs

The CSIRO-sponsored development of small-station hardware to receive signals from the weather/environmental satellites NOAA (Advanced Tiros-N), GMS, and ERS-1 (to be launched in 1989) is reported. The satellite characteristics are reviewed; the signal parameters are listed in tables; and the RF system, low-noise preamplifier, and tracking mounts are briefly described. Consideration is also given to the commercial organization of station manufacturing of the stations and the potential Australian and world market for small earth stations. T.K.

A88-15643
OPTICAL AND RADIO RANGEFINDERS [SVETO- I RADIODAL'NOMERY]
IAROMIRA MIKHAILOVNA KOSTETSKAIA Lvov, Izdatel'stvo Vishcha Shkola, 1986, 264 p. In Russian. refs

This handbook expounds the theory of optical and radio rangefinders and radiogeodesic systems. Particular attention is given to instrument design, investigations using geodesic phase rangefinders, ranging errors, and the effect of meteorological factors in the atmospheric surface layer. Applications of optical and radio rangefinders are considered, including the establishment of geodetic networks and the assessment of the accuracy of triangulation networks. B.J.

A88-15683
METHODS FOR THE REMOTE SENSING OF EARTH RESOURCES [METODY DISTANTSIONNYKH ISSLEDOVANII DLIA RESHENIIA PRIRODOVEDCHESKIKH ZADACH]
V. N. SHARAPOV, ED. Novosibirsk, Izdatel'stvo Nauka, 1986, 200 p. In Russian.

Topics considered include remote-sensing techniques for geological studies, remote sensing in tectonics and seismicity studies, automated processing of remote-sensing images, and landscape studies. Particular papers are presented on regional structures of the Siberian platform, tectonic zoning using space photographs for the example of eastern Siberia, seismotectonic investigations in mountain and plain regions of Central Asia, the monitoring of a multiyear ecological trend, and the seaonal dynamics of landscapes. B.J.

A88-15878#
INTERNATIONAL COORDINATION OF OPERATIONAL INSTRUMENTS ON THE NASA AND ESA SPACE STATION POLAR ORBITING PLATFORMS
BRUCE H. NEEDHAM (NOAA, Washington, DC) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 8 p.
(IAF PAPER 87-112)

NOAA has undertaken the development of a suite of instruments aboard the NASA and ESA Polar Orbiting Platforms, in keeping with their 1995-launch schedule. The design, construction, integration, and operation of these instruments are being conducted in concert with several other organizations, notably the International Polar Orbiting Meteorological Satellite group and the International Forum for Earth Observation Using Space Station Elements. The instruments in question encompass a Global Ozone Monitoring Radiometer, an Earth Radiation Budget Instrument, and Advanced Microwave Sounding Units. O.C.

A88-15879#
FUTURE AUSTRALIAN PARTICIPATION IN METEOROLOGY FROM SPACE
IAN J. BARTON (CSIRO, Div. of Atmospheric Research, Aspendale, Australia) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 5 p. refs
(IAF PAPER 87-113)

In anticipation of a new generation of Australian communication satellites that will be launched in the early 1990s, collaborative programs have been undertaken by CSIRO with several international space agencies. The Along Track Scanning Radiometer will shortly fly aboard the Australia/UK ERS-1 satellite; an AVHRR-type instrument for polar orbit platform applications is under development. Design-definition studies are proceeding for a passive, surface pressure-measurement radiometer employing differential oxygen A-band absorption, and for a cloud size-analysis instrument. O.C.

A88-15885#
THE MONOCULAR ELECTRO-OPTICAL STEREO SCANNER (MEOSS) SATELLITE EXPERIMENT
F. LANZL (DFVLR, Institut fuer Optoelektronik, Oberpfaffenhofen, Federal Republic of Germany) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 6 p.
(IAF PAPER 87-122)

The Monocular Electrooptical Stereo Scanner (MEOSS), to be first flown in 1988 by the Indian Space Research Organization's SROSS satellite, is the first operational, along-track, threefold-stereoscopy CCD line scanner. The MEOSS will feature a single-objective imaging system with no moving parts and only passive cooling. Three long CCD lines of 3456 pixels will lie on a common focal plane that covers the 570-700 nanometer spectral band with 8-bit radiometric resolution. Image rectification procedures and correlation accuracy over land and cloud fields will be studied. O.C.

A88-15886#
THE NEW RADARSAT - AN ALL-WEATHER MULTI-PURPOSE EARTH OBSERVATION SPACECRAFT
S. AHMED, R. B. GRAY, H. R. WARREN (CDC, Communications Research Centre, Ottawa, Canada), and D. G. FEARN (Royal Aircraft Establishment, Space Dept., Farnborough, England) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 12 p. refs
(IAF PAPER 87-125)

The Canada/UK advanced remote sensing satellite, Radarsat, will be launched by NASA in 1994; its main instrument is a powerful and versatile SAR with many modes of operation and a 500 km-wide imaging swath from polar orbit. Spatial resolution is expected to be better than 10 m, and up to 20 min of SAR data can be obtained per orbit. The steerable antenna beam can sweep on command from 20 to 48 deg incidence angle. Complete global coverage can be achieved in 16 days. O.C.

A88-15887*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SPACEBORNE IMAGING RADAR PROGRAM: SIR-C - THE NEXT STEP TOWARD EOS
DIANE EVANS, CHARLES ELACHI, and JOBEA CIMINO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 4 p.
(Contract NAS7-100)
(IAF PAPER 87-126)

The NASA Shuttle Imaging Radar SIR-C experiments will investigate earth surface and environment phenomena to deepen understanding of terra firma, biosphere, hydrosphere, cryosphere, and atmosphere components of the earth system, capitalizing on the observational capabilities of orbiting multiparameter radar sensors alone or in combination with other sensors. The SIR-C sensor encompasses an antenna array, an exciter, receivers, a data-handling network, and the ground SAR processor. It will be

possible to steer the antenna beam electronically, so that the radar look angle can be varied. O.C.

A88-15888#
SYNTHETIC APERTURE RADAR IMAGING FROM GEOSYNCHRONOUS ORBIT - CONCEPT, FEASIBILITY AND APPLICATIONS
LESLEY M. MURPHY (Royal Aircraft Establishment, Farnborough, England) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 11 p. refs
(IAF PAPER 87-127)

This paper outlines the concept of Synthetic Aperture Radar (SAR) imaging from a geosynchronous orbit. A generalized set of equations which can be used for basic geosynchronous SAR system studies are presented. Also, the fundamental constraints which limit the potential performance of such systems are described. The feasibility of the concept is demonstrated by considering the design of a hypothetical geosynchronous SAR system for monitoring sea and polar ice. A brief review of other potential applications is also included. Author

A88-15904*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ADVANCES IN TERRESTRIAL PHYSICS RESEARCH AT NASA/GODDARD SPACE FLIGHT CENTER
VINCENT V. SALOMONSON (NASA, Goddard Space Flight Center, Greenbelt, MD) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 13 p. refs
(IAF PAPER 87-153)

Some past, current, and future terrestrial physics research activities at NASA/Goddard Space Flight Center are described. The uses of satellites and sensors, such as Tiros, Landsat, Nimbus, and SMMR, for terrestrial physics research are discussed. The spaceborne data are applicable for monitoring and studying vegetation, snow, and ice dynamics; geological features; soil moisture; water resources; the geoid of the earth; and the earth's magnetic field. Consideration is given to improvements in remote sensing systems and data records and the Earth Observing System sensor concepts. I.F.

A88-15907#
THE DEVELOPMENT OF LAND REMOTE SENSING APPLICATIONS FOR NOAA POLAR-ORBITING AND GEOSTATIONARY SATELLITES
DONALD R. WIESNET (Satellite Hydrology, Inc., Vienna, VA) and J. D. TARPLEY (NOAA, National Environmental Satellite, Data, and Information Service, Camp Springs, MD) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 5 p. refs
(IAF PAPER 87-157)

The NOAA research effort related to the study, application, and experimentation with satellite data from the environmental satellites is briefly reviewed with reference to the area of land sciences. The land applications of today's NOAA satellite system include global, hemispheric, and regional river basin snow mapping, river ice jams, lake ice buidup and breakup, monitoring ice sheets in Greenland and in Antarctica, measuring insolation, mapping geomorphology in the North Central Plains of the U.S., monitoring volcaninc eruptions, and mapping large-scale tectonic features. Other land applications mentioned are monitoring riverline and coastal flooding, measuring seasonal vegetation changes, detecting and monitoring fires, and studying land temperature effects. V.L.

A88-15918#
APPLICATIONS OF MICROWAVE RADIOMETRY
A. R. L. TATNALL (British Aerospace, PLC, Space and Communications Div., Bristol, England) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 6 p. refs
(IAF PAPER 87-173)

This paper describes the use of microwave radiometry in space for earth observation and the significant contributions to the field of meteorology, hydrology, oceanography and studies of the cryosphere that have already been made. In the next ten years a large number of interesting missions are planned particularly in the field of atmospheric sounding. Some of the key design drivers of these instruments and others that have already flown are discussed in this paper. Author

A88-16249#
OVERVIEW OF THE BRAZILIAN SATELLITE REMOTE SENSING PROGRAM AND SELECTED EXAMPLES OF RECENT APPLICATIONS
M. N. BARBOSA, R. P. CUNHA, and D. BASTOS NETTO (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 9 p.
(IAF PAPER 87-677)

A88-16711
A VERTICALLY POLARIZED RADAR ANTENNA FOR REMOTE SENSING APPLICATIONS
L. SHAFAI, E. BRIDGES, and R. SMEGAL (Manitoba, University, Winnipeg, Canada) IN: Electromagnetic compatibility 1986; Proceedings of the Eighth International Wroclaw Symposium, Wroclaw, Poland, June 24-26, 1986. Part 2 . Wroclaw, Poland, Wroclaw Technical University Press, 1986, p. 494-503. refs

A vertically polarized radar antenna is designed which consists of one hundred waveguide radiating elements. The radiating elements are located linearly, side by side, forming a line source of one hundred wavelengths in length and mounted inside a sectoral horn to shape its vertical radiation pattern. The unit was designed to provide low side lobes (less than 30 dB) in the horizontal plane and a beamwidth around one degree. In the vertical plane the antenna pattern was required to have sidelobe levels less than 2 dB and a beamwidth in excess of fifteen degrees. The unit was designed to be used as a remote sensing radar for investigation of ice formations in northern waters. Author

A88-17026* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING: EARTH'S SURFACE AND ATMOSPHERE; PROCEEDINGS OF WORKSHOP X AND THE TOPICAL MEETING OF THE 26TH COSPAR PLENARY MEETING, TOULOUSE, FRANCE, JUNE 30-JULY 11, 1986
W. D. CARTER, ED. (Globex, Inc., Reston, VA), A. ARKING, ED. (NASA, Goddard Space Flight Center, Greenbelt, MD), M. P. MCCORMICK, ED. (NASA, Langley Research Center, Hampton, VA), and E. RASCHKE, ED. (Koeln, Universitaet, Cologne, Federal Republic of Germany) Workshop and Meeting sponsored by COSPAR, International Union of Geological Sciences, UN, et al. Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, 259 p. In English and French. For individual items see A88-17027 to A88-17060.

The present conference on space-based remote sensing of the earth's surface and atmosphere addresses the two broad issues of remote sensing activities of interest to developing countries and the results obtained to date by the International Satellite Cloud Climatology Project, the Earth Radiation Budget Experiment, and the Stratospheric Aerosol and Gas Experiment (SAGE). Attention is given to the remote sensing of environmental factors affecting health, applications of satellite microwave radiometry, earth science missions for the NASA Space Station, and digitally produced Landsat map images. Also discussed are time-accumulated visible and IR histograms used as cloud cover descriptors, the estimation of the radiation budget's sensitivity to cloud variations, monitoring global surface temperature variations using cloud data sets, and an analysis of preliminary SAGE II data on ozone and NO2. O.C.

A88-17032
REMOTE SENSING APPLICATIONS IN THE METEOROLOGY AND OPERATIONAL HYDROLOGY PROGRAMMES OF WMO
JOHN A. LEESE (World Meteorological Organization, Geneva, Switzerland) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 49-57. refs

The World Meteorological Organization (WMO) of the UN employs polar-orbiting and GEO meteorological and communications satellites in support of (1) the World Weather Watch Program, (2) the Tropical Cyclone Program, and (3) the World Climate Program, as well as a general R&D program, an applications of meteorology program covering agricultural, aeronautical, and marine applications, a hydrology and water resources program, an educational and training program, and a technical cooperation program. The WMO has played a continuing role in the international coordination of meteorological satellite development for nearly 30 years. O.C.

A88-17035
APPLICATIONS OF SATELLITE MICROWAVE RADIOMETRY
M. HALLIKAINEN and P. JOLMA (Helsinki University of Technology, Espoo, Finland) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 73-76. refs

For the case of a Nimbus-7 satellite Scanning Multichannel Microwave Radiometer (SMMR) data set covering parts of the period 1978-1982, efforts are presently made to (1) retrieve the water equivalence figure of snow cover, (2) discriminate among forest types and land-cover categories, (3) determine the near-surface wind speed in the Baltic Sea, and (4) determine the sea-ice concentration in the Baltic Sea. For each of these investigations, SMMR data are compared against surface data to find a suitable frequency and polarization combination for the task. In some applications, a more complicated brightness temperature function involving two frequencies is required for best results. O.C.

A88-17506
A QUASI-OPTICAL SUBSYSTEM FOR A SATELLITE RADIOMETER
B. SCANNELL and D. L. FUDGE (Marconi Defence Systems, Ltd., Stanmore, England) IN: International Conference on Antennas and Propagation, 5th, York, England, Mar. 30-Apr. 2, 1987, Proceedings. Part 1 . London, Institution of Electrical Engineers, 1987, p. 19-23. Research supported by the Ministry of Defence Procurement Executive.

The Advanced Microwave Sounding Unit-B (AMSU-B) radiometer being developed for the TIROS-N satellite and the NOAA series of polar orbiting weather satellites scheduled for launch during the early 1990s is described. The AMSU is a 20-channel microwave radiometer providing temperature and humidity soundings. The channels, quasi-optic layout, and quasi-optic components are described. C.D.

A88-18291
AIRBORNE ELECTRO-OPTICAL SENSORS FOR RESOURCE MANAGEMENT
S. M. TILL (Canada Centre for Remote Sensing, Ottawa) Geocarto International (ISSN 1010-6049), vol. 2, Sept. 1987, p. 13-23. refs

Airborne electrooptical systems recently developed in Canada for ocean and land resource-related applications encompass a lidar for hydrographic surveys, a laser fluorosensor for marine pollution and hydrocarbon monitoring, the multielement linear array imaging system designated 'MEIS', and the Fluorescence Line Imager, which is an imaging spectrometer with two-dimensional detector arrays. The high performance spectral, spatial, and radiometric characteristics obtained by these airborne means furnish information unobtainable from satellites; pixel size and spectral band can, moreover, be optimized for the specific application. O.C.

A88-18977* Chicago Univ., Ill.
THE ULTRAVIOLET SPECTRAL ALBEDO OF PLANET EARTH
JOHN E. FREDERICK (Chicago, University, IL) and GEORGE N. SERAFINO (Applied Research Corp., Landover, MD) Tellus, Series B - Chemical and Physical Meteorology (ISSN 0280-6509), vol. 39B, July 1987, p. 261-270. refs
(Contract NAGW-873)

The solar backscattered ultraviolet spectral radiometer on the Nimbus 7 satellite provides a unique set of radiation measurements which allows an evaluation of the spectral albedo of the earth and its atmosphere in the wavelength range 300 to 340 nm. Near 340 nm, the derived spectral albedo expressed as a function of latitude and month exceeds that in the visible part of the spectrum, with values near 45 percent existing equatorward of 30 deg and an increase to 60-80 percent toward the poles. At middle to high latitudes, the monthly mean spectral albedo exceeds the contribution from Rayleigh scattering alone by factors of 1.4 to 2.2. At wavelengths from 300 to 310 nm, where absorption by stratospheric ozone is significant, the daylight averaged spectral albedos receive negligible contribution from scattering by tropospheric clouds, yet the derived values exceed those predicted for Rayleigh scattering from a clean stratosphere. These observations are consistent with the presence of an atmospheric scattering layer, distinct from cloudiness, located at an altitude above the tropopause. Author

A88-19810
AN IMPROVED CALIBRATION SCHEME FOR AVHRR-2
G. DALU and A. VIOLA (CNR, Istituto di Fisica dell'Atmosfera, Rome, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1501-1508. CNR-supported research. refs

The in-flight two-point calibration of the AVHRR-2 radiometer introduces an error in the brightness temperature derived from the 11 microns and 12 microns channels, due to the nonlinearity of the sensor response. The NOAA Users' Guide recommends assuming a negative value for the open space radiance to reduce this error for the range 225-310 K. This range, however, is too large for typical sea surface temperature variations, and differences as great as 0.4 deg K are still present in the derived 11 microns brightness temperature. This error is further amplified in the sea surface temperature, when estimated with the split window technique, as can be shown by radiative transfer model calculations. For this reason, a new practical calibration scheme is proposed to minimize the error due to the nonlinearity of the sensor response, over the range of radiances from the sea surface. Author

A88-19812
SOME USEFUL OBSERVATIONS IN THE ANALYSIS OF BRIGHTNESS TEMPERATURE DATA ACQUIRED BY THE BHASKARA-II SATELLITE MICROWAVE RADIOMETER (SAMIR) SYSTEM
K. S. RAO, B. K. MOHAN, P. V. NARASIMHA RAO (Indian Institute of Technology, Bombay, India), and R. L. KARALE (Indian Agricultural Research Institute, New Delhi, India) International Journal of Remote Sensing (ISSN 0143-1161), vol. 8, Oct. 1987, p. 1523-1530. Research supported by the Department of Science and Technology. refs

A88-20011
HIGH-SPEED SPECTRORADIOMETER FOR REMOTE SENSING
TADAKUNI MIYAZAKI, HIROSHI SHIMIZU, and YOSHIFUMI YASUOKA (National Institute for Environmental Studies, Tsukuba, Japan) Applied Optics (ISSN 0003-6935), vol. 26, Nov. 15, 1987, p. 4761-4766. refs

A high-speed spectroradiometer designed for spectral reflectance measurement in remote sensing is described. This

instrument uses a monochromatic grating and a photomultiplier system for light detection and sweeps over the 400-850-nm wavelength spectral range with the spectral resolution of 2 nm within 1 s. The instrument has the inherent advantage of portability and speed of operation which make it particularly suitable for field work in the area of fast moving surfaces, e.g., water with wave motion. Some applications of its use in laboratory and field experiments also have been presented. The instrument would seem to be an appropriate instrument for ground data collection in remote sensing. Author

A88-20053
RADAR ALTIMETRY RESPONSE FROM ROUGH SURFACES
SUNE R. J. AXELSSON (Linkoping, Universitet, Sweden) Photogrammetria (ISSN 0031-8663), vol. 42, Nov. 1987, p. 1-18. Research supported by the Swedish Board For Space Activities. refs

Radar altimetry from Skylab, GEOS 3, and Seasat has clearly shown the capability of the technique for measurements of wave-height, tidal action and the deviation from the perfect geoid. In order to further evaluate the performance over ice and land areas, a simulation model was developed which estimates the pulse response from an arbitrary ground surface. Simulation results for different surface conditions, e.g., sea, sea-ice, and land areas (including forests and lakes), display both possibilities and main limitations of the technique. For many land surface applications, the ground resolution of existing altimetry systems seems too poor. Possible improvements in the future by using more narrow-beam and scanning antennas are analyzed. Author

A88-20067
EARTH OBSERVATION FROM THE SPACE STATION
JOHN PLEVIN and DAVID LYNN (NERC, Swindon, England) (British Interplanetary Society, Space '86 , Brighton, England, Sept. 26-28, 1986) British Interplanetary Society, Journal (ISSN 0007-084X), vol. 40, Nov. 1987, p. 505-512.

The NASA Space Station's Polar Platform element will routinely furnish remotely-sensed data. Attention is presently given to the application priorities for the Polar Platform and their associated instrumentation requirements, stressing the importance of data handling and the features of proposals for user-based data centers in the Polar Platform's ground segment. Suggestions are made for the configuration of a British sensor development program whose instruments will complement those furnished by ESA. It is concluded that the Polar Platform's operational success will depend on effective institutional arrangements for both orbital and ground segment operations' management. O.C.

A88-20230#
SYNTHETIC-APERTURE ANTENNAS [LE ANTENNE SINTETICHE]
GIORGIO FRANCESCHETTI (CNR, Istituto di Ricerca per l'Elettromagnetismo e i Componenti Elettronici, Naples, Italy) Alta Frequenza (ISSN 0002-6557), vol. 56, July 1987, p. 109-117. In Italian. refs

The fundamental physical principles of synthetic-aperture antennas are reviewed, with a focus on their applicability to terrestrial remote sensing by satellite radars. Topics examined include the resolution parameters of antennas, apertures, and arrays; holographic analysis of SAR signals of terrain features; image-reconstruction methods; and inverse SARs. Diagrams and a table listing the satellite and instrument specifications for the Seasat, SIR-A, SIR-B, and SIR-C SARs are provided. T.K.

A88-20274* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MULTISPECTRAL REMOTE SENSING AS STRATIGRAPHIC AND STRUCTURAL TOOL, WIND RIVER BASIN AND BIG HORN BASIN AREAS, WYOMING
HAROLD R. LANG, STEVEN L. ADAMS, JAMES E. CONEL, BARBARA A. MCGUFFIE, EARNEST D. PAYLOR, and RICHARD E. WALKER (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) American Association of Petroleum Geologists, Bulletin (ISSN 0149-1423), vol. 71, April 1987, p. 389-402. refs

The use of Landsat TM, Airborne Imaging Spectrometer, and airborne Thermal IR Multispectral Scanner data in the geological evaluation of two sites in central Wyoming is described and illustrated with diagrams, maps, photographs, sample images, and tables of numerical data. The value of the remotely sensed information on the areal variation of attitude, sequence, thickness, and lithology of exposed strata is demonstrated; details of the data analysis are given; and the specialized software packages employed are briefly characterized. T.K.

A88-20280* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SURFACE EMITTANCE, TEMPERATURE, AND THERMAL INERTIA DERIVED FROM THERMAL INFRARED MULTISPECTRAL SCANNER (TIMS) DATA FOR DEATH VALLEY, CALIFORNIA
ANNE B. KAHLE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Geophysics (ISSN 0016-8033), vol. 52, July 1987, p. 858-874. refs

A88-20291
INGREDIENTS FOR A SHORT RANGE FORECASTING HEAVY PRECIPITATION INDEX
RODERICK A. SCOFIELD (NOAA, Satellite Applications Laboratory, Washington, DC) IN: Conference on Weather Modification, 11th, and Conference on Hydrometeorology, 7th, Edmonton, Canada, Oct. 6-8, 1987, Preprints. Boston, MA, American Meteorological Society, 1987, p. 130-136. refs

Mesoscale convective system (MCS) propagation is described with attention given to continuous and bounded propagation. The former is best detected by radar data and high resolution visible satellite imagery while the latter occurs when the periphery of the storm in the satellite picture is clearly bounded from any other convective system. Examples of forward and backward propagating MCSs are presented as well as stability patterns of MCSs and extratropical cyclone systems. The ingredients of a 3-12-h heavy precipitation index would include an instability burst factor, moisture, storm movement, and vertical motion. K.K.

A88-20320*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
DECONVOLUTION RESULTS FOR WIDE FIELD-OF-VIEW RADIOMETER MEASUREMENTS OF REFLECTED SOLAR RADIATION
G. LOUIS SMITH (NASA, Langley Research Center, Hampton, VA) and DAVID RUTAN (PRC Kentron, Inc., Hampton, VA) Conference on Satellite Meteorology and Oceanography, 3rd, Anaheim, CA, Jan. 31-Feb. 5, 1988, Paper. 7 p. refs

The measurement of reflected solar radiation by spacecraft wide-field-of-view radiometers is considered analytically, and the method proposed by Smith (1987) for the solution of the discretized governing equations is described and demonstrated. The theoretical basis of the singular-value decomposition method (partitioning the albedo field into observable and unobservable components) is outlined; its application to Nimbus 7 ERB data is explained in detail; and numerical results are presented in graphs and maps and briefly characterized. T.K.

N88-10083# National Oceanic and Atmospheric Administration, Boulder, Colo. Space Environmental Lab.
TIROS-N/NOAA A-J SPACE ENVIRONMENT MONITOR SUBSYSTEM
R. A. SEALE and R. H. BUSHNELL Apr. 1987 117 p
(PB87-203998; NOAA-TM-ERL-SEL-75) Avail: NTIS HC A06/MF A01 CSCL 22B

The Space Environment Monitor (SEM), which is incorporated as a subsystem in the TIROS-N and NOAA A-J satellites, is described. The SEM consists of a Total Energy Detector (TED), a Medium Energy Proton and Electron Detector (MEPED), a High Energy Proton and Alpha Detector (HEPAD), and a Data Processing Unit (DPU). The detectors are intended to provide near real time particle data for use in the Space Environment Service Center of National Oceanic and Atmospheric Administration (NOAA), and to provide a long term scientific data base. Telemeter codes, data reduction, and test instructions are given. GRA

N88-10406# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Div.
STUDY ON THE SUITABILITY OF A EUROPEAN DATA RELAY SATELLITE TO SUPPORT A SYSTEM OF REMOTE SENSING SATELLITES Final Report
Paris, France ESA 1985 57 p
(Contract ESOC-5643/83-D-JS(SC))
(ESA-CR(P)-2400; MBB-URV/149; ETN-87-90535) Avail: NTIS HC A04/MF A01

The role of a data relay satellite (DRS) for advanced remote sensing satellite systems was compared with a network of conventional ground receiving stations. Orbital geometry and dynamics, target areas, and costs were considered. The ground network solution is found to be feasible for a limited scope of operations, but the DRS to be superior for a multisatellite global network. The economics of DRS operations are improved by increasing the number of customers. ESA

N88-10414*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTROMETRIC TEST OF A LINEAR ARRAY SENSOR
KENNETH S. BROWN and MOON S. KIM (Operations Research, Inc., Rockville, Md.) Jan. 1987 30 p
(NASA-TM-100676; REPT-87B0189; NAS 1.15:100676) Avail: NTIS HC A03/MF A01 CSCL 14B

A spectroradiometer which measures spectral reflectivities and irradiance in discrete spectral channels was tested to determine the accuracy of its wavelength calibration. This sensor is a primary tool in the remote sensing investigations conducted on biomass at NASA's Goddard Space Flight Center. Measurements have been collected on crop and forest plants both in the laboratory and field with this radiometer to develop crop identification and plant stress remote sensing techniques. Wavelength calibration is essential for use in referencing the study measurements with those of other investigations and satellite remote sensor data sets. This calibration determines a wavelength vs channel address conversion which was found to have an RMS deviation of approximately half a channel, or 1.5 nm in the range from 360 to 1050 nm. A comparison of these results with those of another test showed an average difference of approximately 4 nm, sufficiently accurate for most investigative work. Author

N88-10417# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
A METHOD RESOLVING AN AMIBIGUITY OF MEASURED DISTANCES BY MEANS OF NAVSTAR GPS SIGNALS
JIYU LIU *In its* Contributions to Geodesy, Photogrammetry and Cartography. Series 2, Number 45 p 5-7 1986
Avail: NTIS HC A03/MF A01

A means to resolve the ambiguity arising from the confidential nature of the PN coding used in the Global Positioning System (GPS) is suggested. The method can be used in constructing a portable GPS receiver. ESA

N88-11208# Mullard Space Science Lab., Dorking (England).
AN EXPLORATORY STUDY OF INLAND WATER AND LAND ALTIMETRY USING SEASAT DATA Final Report
C. G. RAPLEY, M. A. J. GUZKOWSKA, W. CUDLIP, and I. M. MASON Paris, France ESA Feb. 1987 377 p
(Contract ESTEC-6483/85-NL-BI)
(ESA-CR(P)-2433; ETN-87-90889) Avail: NTIS HC A17/MF A01

Ten million Seasat radar altimeter echo waveforms from inland water and land were analyzed. The results include a comparison of altimeter tracking continuity with the spatial variability of surface elevation, and the association of types of return echo with geographic classes of surface. Case studies of lakes, deserts, wetlands, and rivers are described. The effects of gravity on the surfaces of large lakes and their correlation with bathymetry are detected. Measurement of surface elevation for large lakes, lakes smaller than the altimeter footprint, and rivers, all to a precision of 1m or better, and an accuracy limited either by the satellite orbit ephemeris or by the knowledge of the elevation of a suitable reference surface are demonstrated. Data show that even small areas of exposed water can dominate terrain backscatter. The detection of ocean-like echo waveforms from desert areas, and the ability of the altimeter to provide a measure of dune height and to map desert zonation are noted. ESA

N88-11209*# National Aeronautics and Space Administration. Wallops Flight Center, Wallops Island, Va.
AIRBORNE LIDAR EXPERIMENTS AT THE SAVANNAH RIVER PLANT
WILLIAM B. KRABILL and ROBERT N. SWIFT (EG and G Washington Analytical Services Center, Inc., Wallops Island, Va.) Washington NASA Jun. 1985 97 p
(NASA-TM-4007; NAS 1.15:4007; DOE/SR/14075-1) Avail: NTIS HC A05/MF A01 CSCL 08B

The results of remote sensing experiments at the Department of Energy (DOE) Savannah River Nuclear Facility utilizing the NASA Airborne Oceanographic Lidar (AOL) are presented. The flights were conducted in support of the numerous environmental monitoring requirements associated with the operation of the facility and for the purpose of furthering research and development of airborne lidar technology. Areas of application include airborne laser topographic mapping, hydrologic studies using fluorescent tracer dye, timber volume estimation, baseline characterization of wetlands, and aquatic chlorophyll and photopigment measurements. Conclusions relative to the usability of airborne lidar technology for the DOE for each of these remote sensing applications are discussed. Author

N88-12138# Logica Ltd., Cobham (England).
COMMERCIAL PERSPECTIVE OF AN IMAGING SPECTROMETER DEVELOPMENT PROGRAM
D. C. FERNS *In* ESA, Commercial Opportunities for Remote Sensing with Polar Platforms p 49-54 Apr. 1987
Avail: NTIS HC A05/MF A01

The costs of commercial payload development programs are shown to be orders of magnitude greater than the revenue that might be expected from image and data product sales. The criteria by which an instrument is judged to have commercial potential are defined, and the reasons for the choice of an imaging spectrometer are given. ESA

N88-12140# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Space Systems Group.
MBB-ERNO VIEW OF REMOTE SENSING COMMERCIALIZATION
B. KUNKEL *In* ESA, Commercial Opportunities for Remote Sensing with Polar Platforms p 59-62 Apr. 1987
Avail: NTIS HC A05/MF A01

Commercial prospects for the Modular Optoelectronic Multispectral Scanner and Reflective Optics System Imaging Spectrometer derivatives are assessed. Prospects in terms of revenues are considered limited to pay off investments before the year 2000. ESA

N88-12141# Selenia S.p.A., Rome (Italy).
THE CNR/PSN ADVANCED MICROWAVE IMAGING RADIOMETER (AMIR)
E. ANTONUCCI, E. NISI, and R. SOMMA *In* ESA, Commercial Opportunities for Remote Sensing with Polar Platforms p 63-66 Apr. 1987
Avail: NTIS HC A05/MF A01

The feasibility of an advanced microwave imaging radiometer for oceanographic and atmospheric applications was studied. In order to measure sea surface wind speed, rain rate, sea surface temperature, soil moisture, atmospheric water content, snow cover, and sea ice extension and age, an instrument operating at 5, 10, 18, 22, and 37 GHz, all dual polarized, is needed. An open Cassegrain antenna, and a near total power receiver are selected. ESA

N88-12152# Centre d'Etudes et de Recherches, Toulouse (France).
ABSOLUTE AND INTERBAND CALIBRATION [ETALONNAGE ABSOLU ET INTERBANDE]
MAGDELEINE DINGUIRARD *In* CNES, SPOT 1: First In-Flight Results p 71-78 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, Toulouse, France

Calibration of SPOT imagers is described. The absolute calibration provides the proportionality coefficient between the scene radiance and the normalized numerical output. During the in-flight assessment period, atmospheric and reflectance measurements over the White Sands test site were used to calculate these absolute coefficients (one by spectral band). The site radiance collected by the HRV was estimated, using an atmospheric radiative transfer model. On board, the absolute calibration is performed by a fiber optics unit which projects exoatmospheric solar irradiance onto detectors in each band. White Sands measurements determine the in orbit characteristics of this fiber unit. The 10 percent specified accuracy in absolute calibration is met. The interband calibration is deduced from these measurements taking the green band (XS1) as a reference. The systematic uncertainties are thus eliminated and the specified interband calibration accuracy of 3 percent verified. ESA

N88-12178# Centre National d'Etudes Spatiales, Toulouse (France). Sous-Direction Applications.
THE NEW GENERATION OF SPOT SATELLITES [LA NOUVELLE GENERATION DES SATELLITES SPOT]
MICHEL COURTOIS *In its* SPOT 1: First In-Flight Results p 287-291 1987 In FRENCH
Avail: CEPADUES-Editions, Toulouse, France

The instrumentation, missions, observation program, and geometric image characteristics of the SPOT satellites 2 to 5 are described. The main differences compared to SPOT 1 concern an instrument for global vegetation monotoring and one for mid IR observation at 1.6 and 2.0 microns. ESA

N88-12185*# California Univ., Santa Barbara. Dept. of Geography.
THE CORRESPONDENCE OF SURFACE CLIMATE PARAMETERS WITH SATELLITE AND TERRAIN DATA Semiannual Report
JEFF DOZIER and FRANK DAVIS 14 Dec. 1987 14 p
(Contract NAG5-917)
(NASA-CR-181515; NAS 1.26:181515) Avail: NTIS HC A03/MF A01 CSCL 08B

One of the goals of the research was to develop a ground sampling stragegy for calibrating remotely sensed measurements of surface climate parameters. The initial sampling strategy involved the stratification of the terrain based on important ancillary surface variables such as slope, exposure, insolation, geology, drainage, fire history, etc. For a spatially heterogeneous population, sampling error is reduced and efficiency increased by stratification of the landscape into more homogeneous sub-areas and by employing periodic random spacing of samples. These concepts were applied in the initial stratification of the study site for the purpose of locating and allocating instrumentation. Author

N88-12865*# Arizona Univ., Tucson. Committee on Remote Sensing.
RADIOMETRIC CALIBRATION OF THE EARTH OBSERVING SYSTEM'S IMAGING SENSORS Semiannual Report, May - Nov. 1987
P. N. SLATER Dec. 1987 35 p
(Contract NAGW-896)
(NASA-CR-181542; NAS 1.26:181542) Avail: NTIS HC A03/MF A01 CSCL 14B

Philosophy, requirements, and methods of calibration of multispectral space sensor systems as applicable to the Earth Observing System (EOS) are discussed. Vicarious methods for calibration of low spatial resolution systems, with respect to the Advanced Very High Resolution Radiometer (AVHRR), are then summarized. Finally, a theoretical introduction is given to a new vicarious method of calibration using the ratio of diffuse-to-global irradiance at the Earth's surfaces as the key input. This may provide an additional independent method for in-flight calibration. Author

N88-13371*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A COMPUTER CODE TO PROCESS AND PLOT LASER ALTIMETRY DATA INTERACTIVELY ON A MICROCOMPUTER
H. G. SAFREN and J. L. BUFTON May 1987 48 p
(NASA-TM-100687; NAS 1.15:100687; 86B0419) Avail: NTIS HC A03/MF A01 CSCL 09F

A computer program, written in FORTRAN, is described which uses a microcomputer to interactively process and plot laser altimetry data taken with a laser altimeter currently under development at the Goddard Space Flight Center. The program uses a plot routine written for a particular microcomputer, so that the program could only be implemented on a different computer by replacing the plot routine. The altimetry data are taken from an aircraft flying over mountainous terrain. The program unpacks the raw data, processes it into along-track distance and ground height and creates plots of the terrain profile. A zoom capability is provided to expand the plot to show greater detail, along either axis, and provision is made to interactively edit out spurious data points. Author

N88-13755*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PROCEEDINGS OF THE THIRD AIRBORNE IMAGING SPECTROMETER DATA ANALYSIS WORKSHOP
GREGG VANE, ed. 15 Aug. 1987 190 p Workshop held in Pasadena, Calif., 2-4 Jun. 1987 Film slides as supplement
(Contract NAS7-918)
(NASA-CR-181552; JPL-PUB-87-30; NAS 1.26:181552) Avail: NTIS HC A09/MF A01 CSCL 08B

Summaries of 17 papers presented at the workshop are published. After an overview of the imaging spectrometer program, time was spent discussing AIS calibration, performance, information extraction techniques, and the application of high spectral resolution imagery to problems of geology and botany.

N88-13757*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AIS-2 RADIOMETRY AND A COMPARISON OF METHODS FOR THE RECOVERY OF GROUND REFLECTANCE
JAMES E. CONEL, ROBERT O. GREEN, GREGG VANE, CAROL J. BRUEGGE, RONALD E. ALLEY, and BRIAN J. CURTISS (Colorado Univ., Boulder.) *In its* Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 18-47 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 14B

A field experiment and its results involving Airborne Imaging Spectrometer-2 data are described. The radiometry and spectral calibration of the instrument are critically examined in light of laboratory and field measurements. Three methods of compensating for the atmosphere in the search for ground reflectance are compared. It was found that laboratory determined responsitivities are 30 to 50 percent less than expected for conditions of the flight for both short and long wavelength

observations. The combined system atmosphere surface signal to noise ratio, as indexed by the mean response divided by the standard deviation for selected areas, lies between 40 and 110, depending upon how scene averages are taken, and is 30 percent less for flight conditions than for laboratory. Atmospheric and surface variations may contribute to this difference. It is not possible to isolate instrument performance from the present data. As for methods of data reduction, the so-called scene average or log-residual method fails to recover any feature present in the surface reflectance, probably because of the extreme homogeneity of the scene. Author

N88-13760*# Washington Univ., Seattle.
CALIBRATING AIS IMAGES USING THE SURFACE AS A REFERENCE
M. O. SMITH, D. A. ROBERTS, H. M. SHIPMAN, J. B. ADAMS, S. C. WILLIS, and A. R. GILLESPIE *In* JPL Proceedings of the 3rd Airborne Imaging Spectrometer Data Analysis Workshop p 63-69 15 Aug. 1987
Avail: NTIS HC A09/MF A01 CSCL 08B

A method of evaluating the initial assumptions and uncertainties of the physical connection between Airborne Imaging Spectrometer (AIS) image data and laboratory/field spectrometer data was tested. The Tuscon AIS-2 image connects to lab reference spectra by an alignment to the image spectral endmembers through a system gain and offset for each band. Images were calibrated to reflectance so as to transform the image into a measure that is independent of the solar radiant flux. This transformation also makes the image spectra directly comparable to data from lab and field spectrometers. A method was tested for calibrating AIS images using the surface as a reference. The surface heterogeneity is defined by lab/field spectral measurements. It was found that the Tuscon AIS-2 image is consistent with each of the initial hypotheses: (1) that the AIS-2 instrument calibration is nearly linear; (2) the spectral variance is caused by sub-pixel mixtures of spectrally distinct materials and shade, and (3) that sub-pixel mixtures can be treated as linear mixtures of pure endmembers. It was also found that the image can be characterized by relatively few endmembers using the AIS-2 spectra. Author

N88-13775*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TOMS: THE ANTARCTIC OZONE HOLE AND OZONE TRENDS Abstract Only
RICHARD S. STOLARSKI *In its* Scientific and Operational Requirements for TOMS Data p 5-7 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 13B

The Total Ozone Mapping Spectrometer (TOMS) instrument aboard Nimbus 7 has proved invaluable for the investigation of the recent rapid decline in the springtime total ozone over the Antarctic. The principle problem discussed is that of observing the atmosphere over long periods of time to determine whether or not trends and/or slow oscillations are taking place. Total ozone is an excellent summary parameter for the state of the stratosphere. It responds to temperature changes, and in the long term, is expected to respond to chemical changes. Thus, when changes take place in total ozone, such as the springtime Antarctic decrease it is a clear indication of an important problem, both because of environmental potential and scientific importance. TOMS is actually an overkill for this problem. Significantly more data is taken than is necessary. Tests have shown that maps produced on a 2 by 4 degree grid are essentially equivalent to those produced from the entire gridded data set. Because the critical aspect of the search for changes in ozone is continuous data, reflight of a polar orbiting TOMS is important. Included in the flight should be a stratospheric temperature sensor and, if possible, a modification to obtain some ozone altitude information. A critical aspect of the problem is timeliness of the data. This is the only drawback of the existing TOMS. It is expected that in the very near future the processing will be done within two weeks of real time. This is critical to the process of discovery of phenomena such as the Antarctic ozone hole. Author

N88-13798*# SASC Technologies, Inc., Hyattsville, Md.
SELECTION OF OPTIMUM WAVELENGTHS FOR OZONE MAPPING FROM SATELLITES Abstract Only
P. K. BHARTIA *In* NASA. Goddard Space Flight Center, Scientific and Operational Requirements for TOMS Data p 83 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 08B

Faced with conflicting requirements for measuring total ozone with the Solar Backscatter Ultraviolet Spectrometer/Total Ozone Mapping Spectrometer (SBUV/TOMS), a recommended strategy is to select three wavelengths: one at the peak of the ozone absorption cross section spectrum, another at a nearby minimum and a third wavelength that lies just outside the absorption spectrum. A pair formed using the first two wavelengths are then used under most observing conditions; another pair formed using the last two wavelengths are used near the terminator. There is no evidence that the use of additional wavelengths provides any benefit for measuring total ozone. Additional wavelengths, however, are necessary if other atmospheric species, such as SO sub 2, need to be measured. Author

N88-13799*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF TOTAL OZONE FROM HIRS2/MSU SOUNDING DATA Abstract Only
JOEL SUSSKIND *In its* Scientific and Operational Requirements for TOMS Data p 84 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 08B

The total ozone fields computed from the High Resolution Infrared Sounder 2/Microwave Sounding Unit (HIRS2/MSU) are somewhat noisy compared to Total Ozone Mapping Spectrometer (TOMS) results and show latitude dependent systematic errors which vary slowly in time. Researchers used systematic errors from previous time periods to correct the HIRS2 soundings. Comparison of fields of HIRS2 and TOMS derived ozone are shown. Results are encouraging and indicate useful soundings of total O sub 3 burden can be done at night and in the polar winter. Ideally, joint infrared, microwave, and ultraviolet systems should be flown on low Earth orbiting and geostationary satellites to best utilize the complementary nature of the observations. Author

N88-13800*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPLEMENTARY INFORMATION BETWEEN UV AND IR FOR REMOTE SENSING OF TOTAL OZONE Abstract Only
PRABHAKARA CUDDAPAH *In its* Scientific and Operational Requirements for TOMS Data p 85 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 08B

When infrared and ultraviolet measurements are available simultaneously with the same field of view, it is possible to minimize some of the errors in measuring the total ozone. The addition of the infrared technique to Total Ozone Mapping Spectrometer (TOMS) operation can aid in getting measurements of ozone in the nighttime and during the polar night. A radiometer with a channel in the window region around 11 microns, a channel in the 9-6 micron O sub 3 band, and three channels in the 15 micron CO sub 2 band should be adequate to retrieve total ozone. Such a radiometer could be designed to do cross track scanning. This combination of ultraviolet and infrared instruments could be flown on a geostationary or polar orbiting satellite. Author

N88-13801*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OBSERVATION GUIDELINES FOR A TOTAL OZONE MAPPING SPECTROMETER (TOMS) IN GEOSYNCHRONOUS ORBIT
WILLIAM E. SHENK *In its* Scientific and Operational Requirements for TOMS Data p 86-87 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 08B

The successful utilization of Total Ozone Mapping Spectrometer (TOMS) measurements in low Earth orbit for the analysis of rapidly changing events has led to the consideration of a TOMS in geosynchronous orbit. This orbit should allow for the selection of temporal and spatial resolutions that are specifically designed for these events, plus the flexibility of selecting different sized areas

and pointing the sensor to focus on the most interesting events. Separate temporal and spatial resolution guidelines plus recommended areal coverage have been developed for tropical cyclones, jet streams, the interaction between strong convection and the environment, and the surveillance of volcanoes. It is also suggested that the most effective use of TOMS would be simultaneous flights with microwave and high spatial resolution infrared temperature profiles. Author

N88-13802*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A GEOSTATIONARY IMAGING SPECTROMETER TOMS INSTRUMENT
ARLIN J. KRUEGER, J. OWEN MALOY, and H. B. ROEDER (Perkin-Elmer Corp., Garden Grove, Calif.) *In its* Scientific and Operational Requirements for TOMS Data p 88-89 Dec. 1987
Avail: NTIS HC A06/MF A01 CSCL 08B

One design for a geostationary Total Ozone Mapping Spectrometer (TOMS) with many desirable features is an imaging spectrometer. A preliminary study makes use of a 0.25 m Czerny-Turner spectrometer with which the Earth is imaged on a charge-coupled device (CCD) in dispersed light. The wavelength is determined by a movable grating which can be set arbitrarily by ground control. The signal integration time depends on wavelength but this system allows arbitrary timing by command. Special circumstances such as a requirement to track a low-lying sulfur dioxide cloud or a need to discriminate high level ozone from total ozone at midlatitudes could be obtained by adding a particular wavelength to the normally pre-programmed time sequence. The incident solar irradiance is measured by deploying a diffuser plate in the field of view. Individual detector elements correspond to scene elements in which the several wavelengths are serially sampled and the Earth radiance is compared to the incident sunlight. Thus the problem of uncorrelated drift of multiple detectors is removed. Author

N88-14059# California Univ., Berkeley.
SATELLITE OBSERVATIONS OF EXTREME ULTRAVIOLET RADIATION Final Report, 22 Apr. - 31 May 1976
STUART BOWYER 11 May 1987 8 p
(Contract DAAG29-77-C-0031)
(AD-A185043; ARO-13706.5-GS) Avail: NTIS HC A02/MF A01 CSCL 20E

The first Extreme UltraViolet (EUV) spectrometer (ECOM-721) was flown on the DOD satellite P78-1. The instrument collected a large amount of high quality data on the Earth's atmosphere, ionosphere and magnetosphere. It is still the only such experiment performed from a satellite. Because the instrument was on a spinning satellite, in a noon-midnight polar orbit at 600km altitude, it obtained a huge amount of unique data of geophysical interest. A substantial number of important geophysical observations were made, including the first spectrum of the polar cusp under sunlight, the first spectrum of the EUV nightglow emissions, the first spectrum of the tropical airglow in the EUV, the first spectrum of the nightside aurora below 800A, the detection of dielectronic recombination emissions in the atmosphere, and the first spectrum of the polar cap emissions in the EUV. GRA

N88-14325*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS). A DESCRIPTION OF THE SENSOR, GROUND DATA PROCESSING FACILITY, LABORATORY CALIBRATION, AND FIRST RESULTS
GREGG VANE, ed. 15 Nov. 1987 102 p Presented at the Imaging Spectroscopy 2 Conference of the 31st Annual International Symposium on Optical and Optoelectronic Applied Science and Engineering, San Diego, Calif., 20-21 Aug. 1987
(Contract NAS7-918)
(NASA-CR-182365; JPL-PUB-87-38; NAS 1.26:182365) Avail: NTIS HC A06/MF A01 CSCL 14B

The papers in this document were presented at the Imaging Spectroscopy 2 Conference of the 31st International Symposium on Optical and Optoelectronic Applied Science and Engineering, in San Diego, California, on 20 and 21 August 1987. They describe the design and performance of the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) sensor and its subsystems, the ground data processing facility, laboratory calibration, and first results.

N88-14326*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A SYSTEM OVERVIEW OF THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS)
WALLACE M. PORTER and HARRY T. ENMARK *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 3-12 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

The AVIRIS instrument has been designed to do high spectral resolution remote sensing of the Earth. Utilizing both silicon and indium antimonide line array detectors, AVIRIS covers the spectral region from 0.41 to 2.45 microns in 10-nm bands. It was designed to fly aboard NASA's U-2 and ER-2 aircraft, where it will simulate the performance of future spacecraft instrumentation. Flying at an altitude of 20 km, it has an instantaneous field of view of 20 m and views a swath over 10 km wide. With an ability to record 40 minutes of data, it can, during a single flight, capture 500 km of flight line. Author

N88-14327*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS) SPECTROMETER DESIGN AND PERFORMANCE
STEVEN A. MACENKA and MICHAEL P. CHRISP *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 13-24 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

The development of the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) has been completed at JPL. This paper outlines the functional requirements of the spectrometer optics subsystem, and describes the spectrometer optical design. The optical subsystem performance is shown in terms of spectral modulation transfer functions, radial energy distributions, and system transmission at selected wavelengths for the four spectrometers. An outline of the spectrometer alignment is included. Author

N88-14328*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AVIRIS FOREOPTICS, FIBER OPTICS AND ON-BOARD CALIBRATOR
MICHAEL P. CHRISP, THOMAS G. CHRIEN, and L. STEIMLE *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 25-30 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

The foreoptics, fiber optic system and calibration source of the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) are described. The foreoptics, based on a modified Kennedy scanner, is coupled by optical fibers to the four spectrometers. The optical fibers allow convenient positioning of the spectrometers in the limited space and enable simple compensation of the scanner's thermal defocus (at the -23 C operating temp) by active control of the fiber focal plane position. A challenging requirement for the fiber optic system was the transmission to the spectral range 1.85 to 2.45 microns at .45 numerical aperture. This was solved with custom fluoride glass fibers from Verre Fluore. The onboard calibration source is also coupled to the spectrometers by the fibers and provides two radiometric levels and a reference spectrum to check the spectrometers' alignment. Results of the performance of the assembled subsystems are presented. Author

N88-14329*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
VISIBLE AND INFRARED LINEAR DETECTOR ARRAYS FOR THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS)
GARY C. BAILEY *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 31-35 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) instrument uses four separate focal plane assemblies consisting of line array detectors that are multiplexed to a common J-FET preamp using a FET switch multiplexing (MUX) technique. A 32-element silicon line array covers the spectral range from 0.41 to 0.70 microns. Three additional 64-element indium antimonide (InSb) line arrays cover the spectral range from 0.68 to 2.45 microns. The spectral sampling interval per detector element is nominally 9.8 nm, giving a total of 224 spectral channels. All focal planes operate at liquid nitrogen temperature and are housed in separate dewars. Electrical performance characteristics include a read noise of less than 1000 e(-) in all channels, response and dark nonuniformity of 5 percent peak to peak, and quantum efficiency of greater than 60 percent. Author

N88-14330*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AVIRIS SCAN DRIVE DESIGN AND PERFORMANCE
D. C. MILLER *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 37-44 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

The Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) images the ground with an instantaneous field of view (IFOV) of 1 mrad. The IFOV is scanned 30 deg from left to right to provide the cross-track dimension of the image, while the aircraft's motion provides the along-track dimension. The scanning frequency is 12 Hz, with a scan efficiency of 70 percent. The scan mirror has an effective diameter of 5.7 in, and its positional accuracy is a small fraction of a milliradian of the nominal position-time profile. Described are the design and performance of the scan drive mechanism. Tradeoffs among various approaches are discussed, and the reasons given for the selection of the cam drive. Author

N88-14331*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SIGNAL CHAIN FOR THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS)
JAMES S. BUNN, JR. *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 45-50 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

The AVIRIS instrument has a separate dedicated analog signal processing chain for each of its four spectrometers. The signal chains amplify low-level focal-plane line array signals (5 to 10 mV full-scale span) in the presence of larger multiplexing signals (approx 150 mV) providing the data handling system a ten-bit digital word (for each spectrometer) each 1.3 microns. This signal chain provides automatic correction for the line array dark signal nonuniformity (which can approach the full-scale signal span). Author

N88-14332*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AVIRIS ONBOARD DATA HANDLING AND CONTROL
RONALD E. STEINKRAUS and ROGER W. HICKOK *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 51-60 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

The timing and flow of detector and ancillary data for the Airborne Visible/Infrared imaging spectrometer (AVIRIS) are controlled within the instrument by its digital electronics assembly. In addition to providing detector and signal chain timing, the digital electronics receives, formats, and rate-buffers digitized science data; collects and formats ancillary (calibration and engineering) data; and merges both into a single tape record. Overall AVIRIS data handling is effected by a combination of dedicated digital electronics to control instrument timing, image data flow, and data rate buffering and a microcomputer programmed to handle real-time control of instrument mechanisms and the coordinated preparation of ancillary data. Author

N88-14334*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SPECTRAL AND RADIOMETRIC CALIBRATION OF THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER
GREGG VANE, THOMAS G. CHRIEN, EDWARD A. MILLER, and JOHN H. REIMER *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 73-87 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

The laboratory spectral and radiometric calibration of the AVIRIS science data collected since 1987 is described. The instrumentation and procedures used in the calibration are discussed and the accuracy achieved in the laboratory as determined by measurement and calculation is compared with the requirements. Instrument performance factors affecting radiometry are described. The paper concludes with a discussion of future plans. Author

N88-14335*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
FIRST RESULTS FROM THE AIRBORNE VISIBLE/INFRARED IMAGING SPECTROMETER (AVIRIS)
GREGG VANE *In its* Airborne Visible/Infrared Imaging Spectrometer (AVIRIS). A Description of the Sensor, Ground Data Processing Facility, Laboratory Calibration, and First Results p 89-97 15 Nov. 1987
Avail: NTIS HC A06/MF A01 CSCL 14B

After engineering flights aboard the NASA U-2 research aircraft in the winter of 1986 to 1987 and spring of 1987, extensive data collection across the United States was begun with the Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) in the summer of 1987 in support of a NASA data evaluation and technology assessment program. This paper presents some of the first results obtained from AVIRIS. Examples of spectral imagery acquired over Mountain View and Mono Lake, California, and the Cuprite Mining District in western Nevada are presented. Sensor performance and data quality are described, and in the final section of this paper, plans for the future are discussed. Author

N88-14461# Joint Publications Research Service, Arlington, Va.
USES OF AIRBORNE LASER CHAYKA-1 FOR PROBING WATER, LAND SURFACES Abstract Only
V. LAGOVSKIY *In its* USSR Report: Earth Sciences p 24-25 22 May 1987 Transl. into ENGLISH from Sotsialisticheskaya Industriya (Moscow, USSR), 11 Dec. 1986 p 4
Avail: NTIS HC A06/MF A01

Applications of the first airborne laser unit, Chayka-1 are discussed. The unit is reportedly installed on an AN-30 airplane marked with the number 30060. Tests of the laser to reveal an infection of cotton plants in the Fergana Valley were undertaken. An infection was revealed in its early stages, and the height of the plants was determined. It is claimed that the laser unit can be

used not only to determine the composition of impurities in water, but also their composition. With oil, it is claimed that the laser unit can tell the type of oil and also whether it was spilled by a passing tanker or seeped from a nearby offshore well. R.J.F.

09

GENERAL

Includes economic analysis.

A88-14055
EOSAT - A NEW DIRECTION FOR LANDSAT
EARL J. TULLOS (Earth Observation Satellite Co., Lanham, MD) IN: American Society for Photogrammetry and Remote Sensing and American Congress on Surveying and Mapping, Fall Convention, Anchorage, AK, Sept. 28-Oct. 3, 1986, Technical Papers . Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1986, p. 29-37.

Eosat (Earth Observation Satellite Company), whose goal is to transform the Landsat program into an economocally viable industry, is described. The design of the two new Landsat spacecraft (Landsat 6 and 7) is based on a concept called Omnistar which emphasizes long life and flexibility. Both spacecraft will have enough power and room to accomodate the Land Remote Sensing mission. The new ground processing system is described as well as customer services and marketing. K.K.

A88-14454* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE ALASKA SYNTHETIC APERTURE RADAR (SAR) FACILITY PROJECT
F. CARSEY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena), K. JEZEK (NASA, Washington, DC), J. MILLER, W. WEEKS, and G. WELLER (Alaska, University, Fairbanks) EOS (ISSN 0096-3941), vol. 68, June 23, 1987, p. 593, 596. refs

A receiving station for the acquisition and processing of spaceborne synthetic aperture radar (SAR) data is being established by the National Aeronautics and Space Administration (NASA) at the University of Alaska, Fairbanks. The data that will be received from a number of SAR satellites that are to be launched starting in 1990 will allow U.S. researchers to study sea ice, oceanographic and geological features, hydrological processes, glaciers, and vegetation cover in Alaska and its surrounding seas. Author

A88-15877#
INDIAN REMOTE SENSING PROGRAMME
Y. S. RAJAN, P. P. N. RAO, and G. BEHERA (Indian Space Research Organization, Bangalore, India) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 10 p. refs
(IAF PAPER 87-111)

The paper discusses the ongoing remote sensing application activities and planned efforts of India. The foundations and infrastructure development of the National Natural Resources Management System (NNRMS) are described. Important components of the Indian Remote Sensing Satellite Series (IRS) and the Regional Remote Sensing Service Centres are highlighted. Low cost photointerpretation equipments developed in India and the status of infrastructure development by the State and Central Governments for using remote sensing techniques are briefly discussed. A number of international cooperative efforts in which India is a partner are narrated. Author

A88-15880#
EUMETSAT - OBJECTIVES, PROGRAMMES AND FUTURE PLANS
J. MORGAN (EUMETSAT, Darmstadt, Federal Republic of Germany) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 3 p.
(IAF PAPER 87-114)

The Eumetsat intergovernmental organization is charged with maintaining and exploiting West European meteorological satellite systems. The first such undertaking concerns the Meteosat geostationary satellite system developed by ESA. Three new Meteosats and old prototype are currently being readied for launch; their operational objective is the provision of earth imagery, at half-hourly intervals, that can be used for weather forecasting. The first Meteosat was launched in 1977; the second, launched in 1981, was still in operation six years later. O.C.

A88-15881#
EARTH OBSERVATION PROGRAM IN JAPAN AND ITS INTERNATIONAL COOPERATIVE ACTIVITIES
YASUSHI HORIKAWA, TASUKU TANAKA, MASAHIRO KOJIMA, and KOHEI CHO (National Space Development Agency of Japan, Tokyo) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 10 p.
(IAF PAPER 87-115)

The primary development objectives of the NASDA next-generation earth observation satellite program designated ADEOS, whose prospective launch date is in 1993, encompass a more advanced sensor suite, a modular satellite configuration that will serve as the future platform's prototype, and the use of satellite relaying of observational data in order to form a global network. An effort is also to be made in the direction of cooperative development and ADEOS integration of sensors originating in both domestic and foreign organizations. The two core sensors are the Ocean Color and Temperature Scanner and the Advanced Visible and Near-IR Radiometer. O.C.

A88-15883#
APPLIED REMOTE SENSING INFORMATION - THE GEOSAT COMMITTEE EXPERIENCE
FREDERICK B. HENDERSON, III (Geosat Committee, Inc., Norman, OK) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 20 p. refs
(IAF PAPER 87-117)

Geosat Committee, Inc., is a forum for the coordination of satellite remote sensing services among over 150 international companies and organizations. A primary goal of the Committee is the generation of 'management-friendly' information; it is accordingly conducting a study of standardization among techniques and methodologies in remote sensing technology, with a view to the improvement of such data's integration with data bases and other information and decision-making systems. O.C.

A88-15884#
SPOT - REMOTE SENSING WITH A COMMERCIAL FUTURE
PIERRE BESCOND (SPOT Image Corp., Reston, VA) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 5 p.
(IAF PAPER 87-121)

An account is given of the advanced capabilities of the SPOT program and of the innovative features of its product-marketing approach. SPOT imagery applications are progressing in the agricultural, urban planning, and news-gathering fields. The 'raw data' of SPOT imagery are being furnished to various 'value-added' enterprises that furnish image-interpretation services to the final users of this information by using advanced analytical hardware and software. These enterprises are affiliated with the SPOT organization under its 'SPOT Recommends' program. O.C.

A88-15892#
COST-EFFECTIVE SYSTEM OF REMOTE SENSING OF THE EARTH
A. S. SELIVANOV and IU. M. TUCHIN (Glavkosmos, USSR) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 8 p. refs
(IAF PAPER 87-134)

It has been demonstrated by experience gained in acquiring and processing sensor data from such satellites as the Kosmos-1689 that space photography and specialized ocean surveillance have reached a level of high cost effectiveness as well as accuracy. High resolution scanners are currently under development in the USSR for operation in concert with available medium-resolution scanners; a line-of-sight change capability allows the scanner to be used as a 'magnifying glass' for the observation of distant areas by broad-coverage sensors. O.C.

A88-15908#
LAND APPLICATIONS OF DIFFERENT SATELLITE REMOTE SENSING DATA - EXPERIENCE IN NATIONAL REMOTE SENSING AGENCY, HYDERABAD, INDIA
L. R. A. NARAYAN (National Remote Sensing Agency, Hyderabad, India) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 6 p.
(IAF PAPER 87-158)

This paper briefly describes the Indian experience in the development and progress of Remote Sensing Applications in India, particularly through the establishment of National Remote Sensing Agency (NRSA), under the Department of Space, Government of India. Some brief descriptions in the use of remotely sensed data, since 1975, of some of the survey projects have been given. Some of them are of problem solving types, while a few others are of inventory type. It could be seen that India has progressed considerably in the use of various types of satellite Remote Sensing data, and has its own reception, processing and analysis facilities. The awareness has also been considerable during the period between 1975 and 1987. A brief outline of the Indian Remote Sensing Program and the ultimate evolution of the National Natural Resources Management System, training opportunities in this field and the National Missions now being executed, have also been given. Author

A88-15912*# National Aeronautics and Space Administration. Earth Resources Lab., Bay St. Louis, Miss.
NASA'S EARTH RESOURCES LABORATORY - SEVENTEEN YEARS OF USING REMOTELY SENSED SATELLITE DATA IN LAND APPLICATIONS
KENNETH D. CASHION and CHARLES A. WHITEHURST (NASA, Earth Resources Laboratory, Bay Saint Louis, MS) IAF, International Astronautical Congress, 38th, Brighton, England, Oct. 10-17, 1987. 8 p.
(IAF PAPER 87-164)

The activities of the Earth Resources Laboratoy (ERL) for the past seventeen years are reviewed with particular reference to four typical applications demonstrating the use of remotely sensed data in a geobased information system context. The applications discussed are: a fire control model for the Olympic National Park; wildlife habitat modeling; a resource inventory system including a potential soil erosion model; and a corridor analysis model for locating routes between geographical locations. Some future applications are also discussed. V.L.

A88-17042
PRESENT AND FUTURE DEVELOPMENT OF REMOTE SENSING IN CHINA
H. R. PAN, J. S. JIANG, D. Y. HU, and C. Y. WANG (Chinese Academy of Sciences, Beijing, People's Republic of China) (COSPAR, International Union of Geological Sciences, UN, et al., Plenary Meeting, 26th, Workshop X and Topical Meeting on Remote Sensing: Earth's Surface and Atmosphere, Toulouse, France, June 30-July 11, 1986) Advances in Space Research (ISSN 0273-1177), vol. 7, no. 3, 1987, p. 129-131.

A development history and current status report are given for remote sensing techniques and applications in China; the applications encompass simultaneous aerial photography and satellite imagery surveys of grasslands in Xinjiang province and realtime flood monitoring in the Tong-Ting Lake drainage basin in 1985. A large, indoor remote sensing-simulating laboratory was established in 1984; more recently, a Landsat receiving station was imported from the U.S., and it has already successfully obtained MSS and TM images. An expansion of this receiving station to obtain SPOT imagery is contemplated. O.C.

A88-19750
REMOTE FUTURE FOR THIRD WORLD SATELLITE DATA
DAVID BAKER New Scientist (ISSN 0028-6664), vol. 116, Oct. 22, 1987, p. 48, 49-51.

Problems encountered by the Landsat program are presented with attention given to the US government's decision to abandon formal control of this remote sensing program. The rising cost of Landsat data is discussed as well as the monitoring of deforestation. The effect of private operation of remote-sensing satellites on Third World countries is considered. K.K.

A88-19833
THE FUTURE OF EARTH OBSERVATIONS IN THE USA
JOHN H. MCELROY (Texas, University, Arlington) Space Policy (ISSN 0265-9646), vol. 3, Nov. 1987, p. 313-325. refs

Economic and political aspects of satellite remote sensing (SRS) are reviewed from a U.S. perspective. Topics discussed include the need to take economic benefits into account in defining objectives for the U.S. space program, current NASA and NOAA SRS activities, opportunities for economies of scale in the U.S. SRS effort (with increased private-sector participation), technological advances in SRS, the economic feasibility of private SRS, opportunities for international economies of scale, and the need for international cooperation. It is recommended that the private Landsat operator Eosat be given government encouragement and support to act as the U.S. designee in establishing an international commercial SRS organization. T.K.

N88-10055# Joint Publications Research Service, Arlington, Va.
STUDY OF EARTH FROM SPACE AND STRENGTHENING OF ECONOMY
YU. P. KIYENKO *In its* USSR Report: Space p 115-126 22 Apr. 1987 Transl. into ENGLISH from Zemlya i Vselennaya (Moscow, USSR), no. 4, Jul. - Aug. 1986 p 16-25
Avail: NTIS HC A08/MF A01

Under modern conditions of development of the economy appropriate attention must be directed to mobilization of natural production forces. For this reason there was an increase, in particular, of the role of remote sensing of the Earth from space. What the advantages are of space information over the data obtained by traditional methods are discussed. Today the elements of the space system for the study of natural resources and the environment are being used in the interests of the development of the national economy, but also within the framework of international cooperation. Certification and realization of a comprehensive inventory of the natural potential of the entire country should become an important contribution of the study of the Earth from space to the development of the economy. By such an inventory and regularly repeated space surveys in the immediate future it may be possible, first of all, to organize monitoring of the dynamics of natural processes, and second, to

ensure the setting up of an automated system for control of the use of natural resources. B.G.

N88-12137# ERSAC Ltd., Livingston (England).
MARKET POTENTIAL FOR COMMERCIAL REMOTE SENSING
G. C. STOVE *In* ESA, Commercial Opportunities for Remote Sensing with Polar Platforms p 39-45 Apr. 1987
Avail: NTIS HC A05/MF A01

Remote sensing applications, market areas, payloads, sensor concepts, and data handling are reported on, together with the results of a commercial questionnaire which perceived a market growth varying from 10% to 20% in the near term. Really significant growth and a demand for future data and services depend on a bold preparatory and market development program. Pilot project fields are listed and a business development strategy for such preparatory programs is suggested. ESA

N88-13807# National Aerospace Lab., Amsterdam (Netherlands). Afdeling Ruimtevaart.
NATIONAL POINT OF CONTACT (NPOC)-SPOT INQUIRY 1986
O. H. M. DEVRIES 1986 24 p In DUTCH; ENGLISH summary
(NLR-MP-86055-U; B8707399; ETN-88-90830) Avail: NTIS HC A02/MF A01

The Dutch market for remote sensing satellite data was surveyed. Results show that the application is not on a large enough scale to maintain a completely commercial market. A reasonable market expansion is expected due to the interest in SPOT; an extra stimulus could be the development of a National Data Archive. ESA

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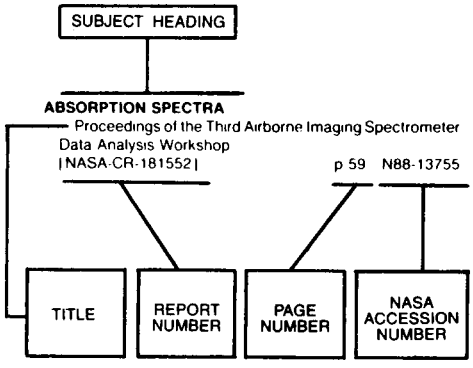

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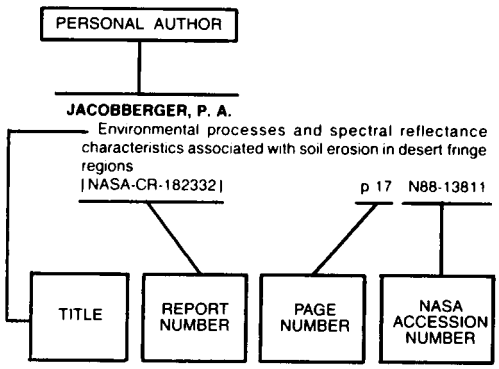

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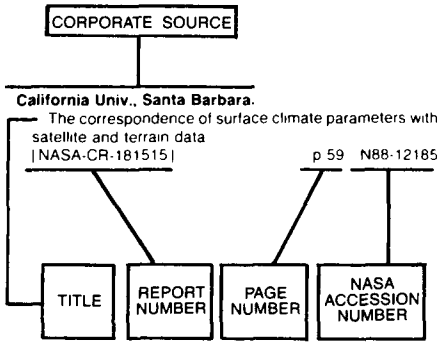

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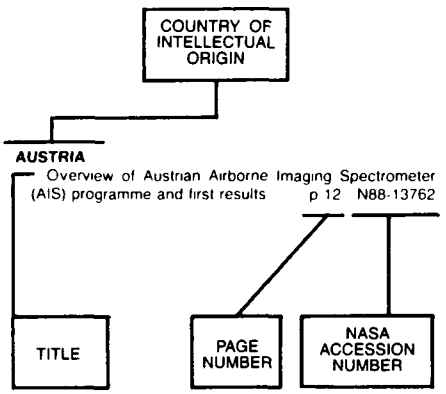

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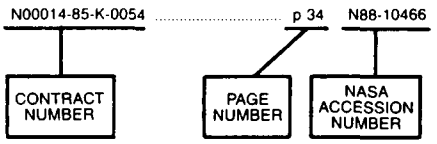

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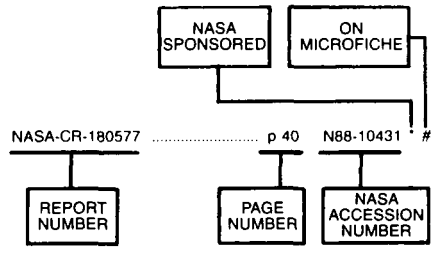

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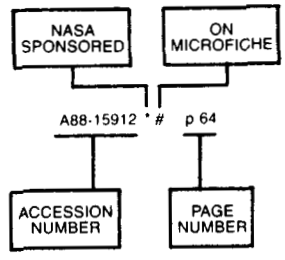

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