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Earth Resources
A Continuing
Bibliography
with Indexes

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STAR (N-10000 Series)	N88-20254 — N88-25430
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NASA SP-7041 (59)

EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY WITH INDEXES

Issue 59

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 July 1 and September 30 in

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

Scientific and Technical Information Division 1988
National Aeronautics and Space Administration
Washington, DC

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INTRODUCTION

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

This literature survey lists 518 reports, articles, and other documents announced between July 1 and September 30, 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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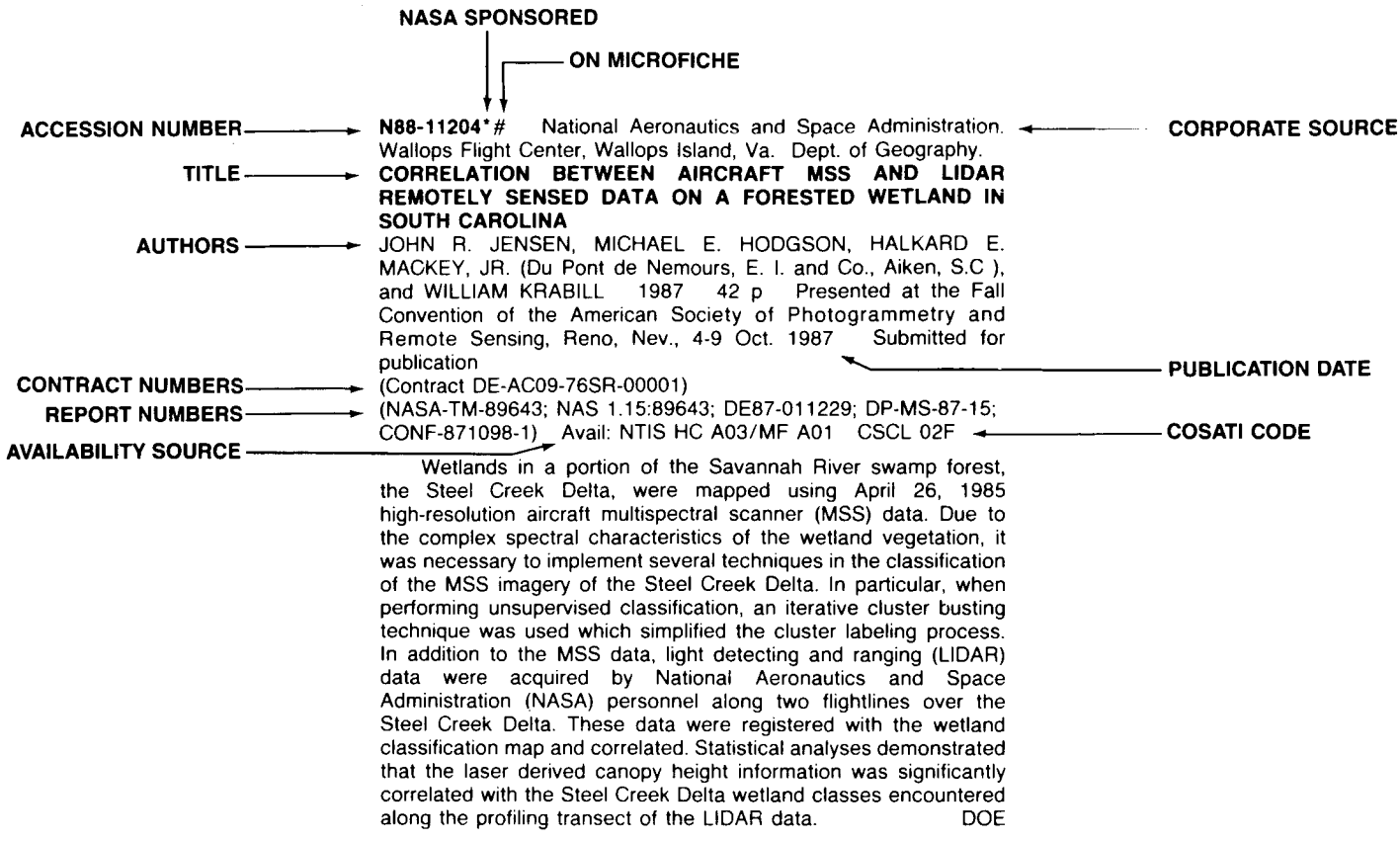
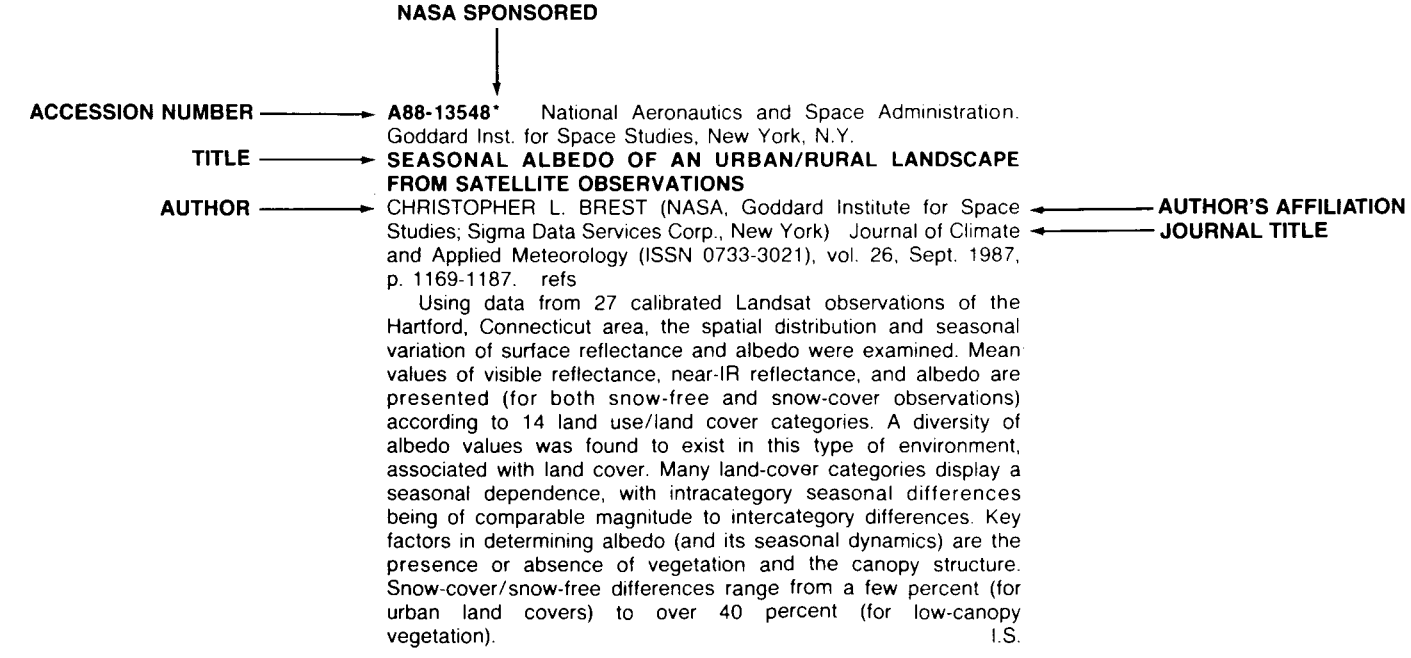
TYPICAL REPORT CITATION AND ABSTRACT



TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT



EARTH RESOURCES

A Continuing Bibliography (Issue 59)

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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.

A88-32909*# Geological Survey, Reston, Va.
PRELIMINARY MEASUREMENTS OF SPECTRAL SIGNATURES OF TROPICAL AND TEMPERATE PLANTS IN THE THERMAL INFRARED
JOHN W. SALISBURY and N. M. MILTON (USGS, Reston, VA) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 131-143. NASA-supported research. refs

Spectral reflectance measurements of seven tropical species and six deciduous species were carried out in thermal infrared to establish the species-dependent spectral characteristics and to investigate the effect on spectral signatures of environmental variables, such as leaf maturity, drought, and metal stress. Seasonal variations of spectral signatures occurred between spring and summer leaves, but such variations were minimal during summer and early fall. Overall reflectance of senescent leaves was higher than that of young leaves, as was the reflectance of leaves from trees growing in metal-enriched soils, as compared with leaves from the control area. However, the characteristic spectral features were not changed in either case. It was also found that water stress did not have any effect on the infrared signatures: trees grown during a drought season maintained their characteristic spectral signatures. I.S.

A88-32910*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
A NEAR INFRARED VEGETATION INDEX FORMED WITH AIRBORNE MULTISPECTRAL SCANNER DATA
CHRISTOPHER D. ELVIDGE and BARRETT N. ROCK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 147-159. refs

A near infrared vegetation index (NIVI) has been formed with the 1.24 and 1.65 micron bands on the NS001 Thematic Mapper Simulator. The NIVI was compared to the more traditional Perpendicular Vegetation Index (PVI) formed with the 0.66 and 0.83 micron bands. The PVI was found to be less susceptible to problems with rock and soil spectral variations than the VIVI. Author

A88-32911#
PRELIMINARY EVALUATION OF REMOTE SENSING DATA FOR DETECTION OF VEGETATION STRESS RELATED TO HYDROCARBON MICROSEEPAGE - MIST GAS FIELD, OREGON
MICHAEL F. CRAWFORD (ARCO Oil and Gas Co., Plano, TX) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 161-177. refs

A88-32921#
PROCESSING OF MULTIDATE LANDSAT TM DATA TO MAP SOIL COLOR VARIATIONS RELATED TO HYDROCARBON MICROSEEPAGE IN A CROPLAND SETTING - CEMENT, OKLAHOMA TEST SITE
JOHN B. MCKEON and MARK SETTLE (ARCO Oil and Gas Co., Plano, TX) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 347-361. refs

A88-32928#
SHIFT IN SPECTRAL RESPONSE OF NICKEL-LOADED AND CONTROL SHOOTS OF WHITE BIRCH
G. M. COURTIN, P. J. BECKETT, and G. O. TAPPER (Sudbury, Laurentian University, Canada) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 441-449. refs

A88-32930#
EFFECTS OF HEAVY METAL INDUCED CANOPY STRUCTURAL CHANGES ON FOREST CANOPY REFLECTANCE
C. BANNINGER (Graz, Technische Universitaet und Forschungszentrum, Austria) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 465-469. Research supported by the Scientific Research Office of Syria and BMFWF. refs

Relationships derived between canopy structure, soil metal content, and canopy reflectance of a spruce tree stand show a good correspondence between an increase in soil copper-lead-zinc content and a decrease in leaf density and Landsat Thematic Mapper (TM) canopy radiance values. The high correlation values obtained for TM bands 4 and 5 and the transformations employing these bands and the absence of visible stress symptoms in the canopy indicate a predominately morphological rather than a physiological basis of the changes in canopy spectral reflectance in response to heavy metal stress. Author

A88-32935#
SURROGATE SPECTRAL REFLECTANCES OF VEGETATION APPLIED TO GEOBOTANICAL REMOTE SENSING
G. O. TAPPER, G. M. COURTIN, and P. J. BECKETT (Sudbury, Laurentian University, Canada) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 545-554. refs

The paper reviews the methodology for measuring spectral reflectance of vegetation targets using handheld spectroradiometers. The objective was to measure the spectral reflectance of: (1) intact vegetation canopies; (2) the canopy of

felled trees; and (3) samples of clipped branches from within the canopy. This was done for samples of white birch, a species of extensive land cover throughout the boreal forest of northern Ontario. The spectral reflectances of samples were measured in situ and in the laboratory. The results indicate spectral response differences between different sample configurations of the birch samples. It is the aim of this work to improve the technique and field measurement of vegetation spectral response, and to allow increased accuracy to be obtained for the analysis and interpretation of remotely sensed data applied to geobotanical mineral exploration, as well as the ultimate detection of subsurface mineralization in the heavily forested Canadian Shield region of northern Ontario. Author

A88-35161
REGIONAL CROP-FORECASTING WITH LANDSAT - A FARMER'S EXPERIENCE
FRANK G. LAMB (Eastern Oregon Farming Co., Irrigon, OR) IN: Aerospace century XXI: Space sciences, applications, and commercial developments; Proceedings of the Thirty-third Annual AAS International Conference, Boulder, CO, Oct. 26-29, 1986. San Diego, CA, Univelt, Inc., 1987, p. 1713-1723.
(AAS PAPER 86-401)

This paper describes how a potato farmer uses Landsat data and a microprocessor-based image processing system as a management tool in his business, and how this techinque has been applied to larger-scale agricultural efforts. The use of Landsat data in an information system which could be used to expand the potato crop in the Columbia Basin is described. The application of these techniques to crops other than potatoes is discussed. C.D.

A88-35194* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THERMAL ANALYSIS OF WILDFIRES AND EFFECTS ON GLOBAL ECOSYSTEM CYCLING
VINCENT G. AMBROSIA and JAMES A. BRASS (NASA, Ames Research Center, Moffett Field, CA) Geocarto International (ISSN 1010-6049), vol. 3, March 1988, p. 29-39. refs

Biomass combustion plays an important role in the earth's biogeochemical cycling. The monitoring of wildfires and their associated variables at global scales is feasible and can lead to predictions of the influence of combustion on biogeochemical cycling and tropospheric chemistry. Remote sensing data collected during the 1985 California wildfire season indicate that the information content of key thermal and infrared/thermal wave band channels centered at 11.5 microns, 3.8 microns, and 2.25 microns are invaluable for discriminating and calculating fire related variables. These variables include fire intensity, rate-of-spread, soil cooling recovery behind the fire front, and plume structure. Coinciding Advanced Very High Resolution Radiometer (AVHRR) data provided information regarding temperature estimations and the movement of the smoke plume from one wildfire into the Los Angeles basin. Author

A88-35195
REMOTE SENSING FOR WILDLIFE MANAGEMENT - GIANT PANDA HABITAT MAPPING FROM LANDSAT MSS IMAGES
ROBERT R. DE WULF, ROLAND E. GOOSSENS (Gent, Rijksuniversiteit, Ghent, Belgium), JOHN R. MACKINNON (World Wide Fund for Nature, Gland, Switzerland), and WU SHEN CAI (Sichuan Forestry Bureau, Chengdu, People's Republic of China) Geocarto International (ISSN 1010-6049), vol. 3, March 1988, p. 41-50. refs

A88-35397
INFLUENCE OF TOPOGRAPHY ON FOREST REFLECTANCE USING LANDSAT THEMATIC MAPPER AND DIGITAL TERRAIN DATA
C. E. LEPRIEUR, J. M. DURAND (CNES, Laboratoire d'Etudes et de Recherches en Teledetection Spatiale, Toulouse, France), and J. L. PEYRON (Ecole Nationale du Genie Rural et des Eaux et Forets, Nancy, France) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, April 1988, p. 491-496. refs
(Contract CNES-85-1257; CNRS-508533)

The relationship between forestry variables and the response of Thematic Mapper bands is analyzed over selected mountainous forest sites with a view to improving current models. Forestry stand species and age information was collected for 250 sites in a region with slopes up to 35 degrees and a variety of aspects. Spring and summer Thematic Mapper imagery over the area were used; these data contain a wealth of information related to species and age, and topography. A digital elevation model was compiled with a resolution of 30 meters in order to study the relationship between reflectance, the variable of interest, and the local sun/surface/sensor geometry. Site radiance is dependent on illumination effects and directional effects. The distribution of apparent reflectances versus topographic parameters for each forestry class and each spectral band helped characterize species by their reflective properties. The influence of the age on the apparent reflectance distribution is analyzed: reflectance globally decreases with stand age, especially for TM4, TM5, and TM7. Author

A88-35398
CANOPY REFLECTANCE OF SOYBEAN AS AFFECTED BY CHRONIC DOSES OF OZONE IN OPEN-TOP FIELD CHAMBERS
WILLIAM W. CURE (North Carolina State University, Raleigh), SARAH M. NUSSER (Iowa State University, Ames), and ALLEN S. HEAGLE (USDA, Agriculture Research Service; North Carolina State University, Raleigh) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, April 1988, p. 499-504. refs

The relationship between canopy reflectance and ozone (O3) treatment was investigated in a field experiment with soybean growing in 3-m diameter, 2.4-m high open-top exposure chambers. The objectives were to develop an understanding of the pattern of reflectance changes induced by this air pollutant and to investigate how these changes might ultimately be related to yield. Correlations were obtained between the reflectance data and visual estimates of non-green leaf area, a widely-used technique for rating pollutant injury. Analysis of reflectance spectra taken in early September, early October, and mid October showed O3 treatments to be highly correlated with reflectances at visible wavelengths and at near-infrared wavelengths up to about 720 nm. Early leaf senescence caused by O3 was easily measured by reflectance changes. As this would reduce the time during which the plants could produce photosynthate needed for seed development, we hypothesize that multitemporal reflectance data could be used to estimate a rate of senescence that would relate to yield. Correlations between the reflectance data and visual estimates of non-green leaf area were high, indicating that rates of senescence could be estimated by either means. Author

A88-36164
REMOTE-SENSING METHODS FOR THE MONITORING AND FORECASTING OF THE ENTOMOLOGICAL CONDITION OF TAIGA FORESTS [DISTANTSIONNYE METODY KONTROLIA I PROGNOZA LESOENTOMOLOGICHESKOGO SOSTOIANIIA TAEZHNYKH TERRITORII]
A. S. ISAEV and V. IA. RIAPOLOV (AN SSSR, Institut Lesa i Drevesiny, Krasnoyarsk, USSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 48-55. In Russian. refs

A88-36165
INVESTIGATION AND MAPPING OF FORESTS USING SPACE SCANNER IMAGERY OBTAINED IN WINTER [IZUCHENIE I KARTOGRAFIROVANIE LESOV PO MATERIALAM ZIMNEI SKANERNOI S'EMKI IZ KOSMOSA]
V. I. KRAVTSOVA and E. P. SALAKHETDINOVA (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 56-65. In Russian. refs

Boundaries of forest regions and felled areas were identified

on Meteor-30 Fragment scanner imagery obtained over the Kostroma region in the winter of 1984. In terms of optical density, the forests in this area belong to four categories with different coniferous/deciduous ratios. The data obtained are compared with old maps in order to trace patterns of forest-land percentage, forest border lengths, and overall changes in forests over 40 years. B.J.

A88-36170
LINEAR COMBINATIONS OF SPECTAL REFLECTANCES IN CROP ANALYSES [LINEINYE KOMBINATSII KOEFFITSIENTOV SPEKTRAL'NOI IARKOSTI PRI ANALIZE SEL'SKOKHOZIAISTVENNOI RASTITEL'NOSTI]
T. A. NIL'SON (AN ESSR, Institut Astrofiziki i Fiziki Atmosfery, Tartu, Estonian SSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 95-103. In Russian. refs

A88-37370* Massachusetts Inst. of Tech., Cambridge.
IDENTIFICATION OF TERRAIN COVER USING THE OPTIMUM POLARIMETRIC CLASSIFIER
J. A. KONG, A. A. SWARTZ, H. A. YUEH (MIT, Cambridge, MA), L. M. NOVAK, and R. T. SHIN (MIT, Lexington, MA) Journal of Electromagnetic Waves and Applications (ISSN 0920-5071), vol. 2, no. 2, 1988, p. 171-194. DARPA-sponsored research. refs

A systematic approach for the identification of terrain media such as vegetation canopy, forest, and snow-covered fields is developed using the optimum polarimetric classifier. The covariance matrices for various terrain cover are computed from theoretical models of random medium by evaluating the scattering matrix elements. The optimal classification scheme makes use of a quadratic distance measure and is applied to classify a vegetation canopy consisting of both trees and grass. Experimentally measured data are used to validate the classification scheme. Analytical and Monte Carlo simulated classification errors using the fully polarimetric feature vector are compared with classification based on single features which include the phase difference between the VV and HH polarization returns. It is shown that the full polarimetric results are optimal and provide better classification performance than single feature measurements. Author

A88-37415* California Univ., Berkeley.
A METHODOLOGY FOR MAPPING FOREST LATENT HEAT FLUX DENSITIES USING REMOTE SENSING
LARS L. PIERCE and RUSSELL G. CONGALTON (California, University, Berkeley) Remote Sensing of Environment (ISSN 0034-4257), vol. 24, April 1988, p. 405-418. Research supported by the University of California. refs
(Contract NCA2-13B)

Surface temperatures and reflectances of an upper elevation Sierran mixed conifer forest were monitored using the Thematic Mapper Simulator sensor during the summer of 1985 in order to explore the possibility of using remote sensing to determine the distribution of solar energy on forested watersheds. The results show that the method is capable of quantifying the relative energy allocation relationships between the two cover types defined in the study. It is noted that the method also has the potential to map forest latent heat flux densities. R.R.

A88-37418* Kansas State Univ., Manhattan.
RADIATIVE SURFACE TEMPERATURES OF THE BURNED AND UNBURNED AREAS IN A TALLGRASS PRAIRIE
G. ASRAR, T. R. HARRIS, R. L. LAPITAN (Kansas State University, Manhattan), and D. I. COOPER (Arizona, University, Tucson) Remote Sensing of Environment (ISSN 0034-4257), vol. 24, April 1988, p. 447-457. refs
(Contract NAG5-389; NGT-17-002-801)

This study was conducted in a natural tallgrass prairie area in the Flint Hills of Kansas. The objective was to evaluate the surface radiative temperatures of burned and unburned treatments of the grassland as a means of delineating the areas covered by each treatment. Burning is used to remove the senescent vegetation resulting from the previous year's growth. Surface temperatures were obtained in situ and by an airborne scanner. Burned and unburned grass canopies had distinctly different diurnal surface radiative temperatures. Measurements of surface energy balance components revealed a difference in partitioning of the available energy between the two canopies, which resulted in the difference in their measured surface temperatures. The magnitude of this difference is dependent on the time of measurements and topographic conditions. Author

A88-38373#
VEGETATION INDICES AND OTHER VEGETATION PARAMETERS - EXAMPLES, INTERPRETATION AND PROBLEMS
K. BLUEMEL and W. TONN (Berlin, Freie Universitaet, Federal Republic of Germany) Rivista di Meteorologia Aeronautica (ISSN 0035-6328), vol. 47, Apr.-June 1987, p. 135-150. refs

NOAA-AVHRR multichannel data have been received since 1982 and are used for deriving vegetation indices. There exist several types of indices which depend on atmospheric influences, viewing geometry, surface topography and vegetation density in different ways. Here, results for the most significant indices are presented. Bidimensional frequency distributions of spectral channel are performed in different regions of Central Europe and North Africa for vegetation-type analysis. The interpretation of the normalized vegetation index (NVI) as a measure of leaf area index, biomass, canopy resistance, and biomass productivity is also discussed. Finally, vegetation index grain production, and weather conditions in the FRG in 1983-1984 are compared, and the correlation of NVI and radiation temperature of the ground is investigated. Author

A88-38805* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
PARTICULATE EMISSIONS FROM A MID-LATITUDE PRESCRIBED CHAPARRAL FIRE
WESLEY R. COFER, III, JOEL S. LEVINE, DANIEL I. SEBACHER (NASA, Langley Research Center, Hampton, VA), EDWARD L. WINSTEAD (ST Systems Corp., Hampton, VA), PHILIP J. RIGGIN (USDA, Forest Service, Riverside, CA), JAMES A. BRASS, and VINCENT G. AMBROSIA (NASA, Ames Research Center, Moffett Field, CA) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, May 20, 1988, p. 5207-5212. refs

Particulate emission from a 400-acre prescribed chaparral fire in the San Dimas Experimental Forest was investigated by collecting smoke aerosol on Teflon and glass-fiber filters from a helicopter, and using SEM and EDAX to study the features of the particles. Aerosol particles ranged in size from about 0.1 to 100 microns, with carbon, oxygen, magnesium, aluminum, silicon, calcium, and iron as the primary elements. The results of ion chromatographic analysis of aerosol-particle extracts (in water-methanol) revealed the presence of significant levels of NO2(-), NO3(-), SO4(2-), Cl(-), PO4(3-), C2O4(2-), Na(+), NH4(+), and K(+). The soluble ionic portion of the aerosol was estimated to be about 2 percent by weight. I.S.

A88-39082* Delaware Univ., Newark.
REMOTE SENSING OF BIOMASS OF SALT MARSH VEGETATION IN FRANCE
M. F. GROSS, V. KLEMAS (Delaware, University, Newark), and J. E. LEVASSEUR (Rennes I, Universite, France) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 397-408. Research supported by the University of Delaware; Centre National pour l'Exploitation des Oceans. refs
(Contract CNEXO-83/7202; NAGW-374)

Spectral data (gathered using a hand-held radiometer) and harvest data were collected from four salt marsh vegetation types in Brittany, France, to develop equations predicting live aerial biomass from spectral measurements. Remote sensing estimates of biomass of the general salt marsh community (GSM) and of Spartina alterniflora can be obtained throughout the growing season if separate biomass prediction equations are formulated for different species mixtures (for the GSM) and for different canopy types (for S. alterniflora). Results suggest that remote sensing will not

be useful for predicting Halimione portulacoides biomass, but can be used to estimate Puccinellia maritima biomass early in the growing season. Author

A88-39090
FLOOD DAMAGE ANALYSIS USING MULTITEMPORAL LANDSAT THEMATIC MAPPER DATA
YOSHIKI YAMAGATA and TSUYOSHI AKIYAMA (National Institute of Agro-Environmental Sciences, Tsukuba, Japan) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 503-514. refs

The paddy rice damage caused by a flood in the Kanto district in Japan has been analyzed using multitemporal Landsat-5 Thematic Mapper images. The image acquired immediately after the flood showed the spread of turbid water over the paddy fields and the image acquired 1 month after the flood showed the paddy rice damage in the inundated areas. The flood damage assessment was undertaken using several multivariate analyses: (1) the correlation analysis revealed that the turbidity level of flood water was related to the rice damage; (2) the decrease of the rice yield was estimated from both images by multiple regression models; and (3) the flood damage relationship was determined by a cluster analysis using the higher-order principal components of the multitemporal image. Based on the results of these analyses, distribution maps of the rice yield levels were estimated at each date and a classification of the flood damage pattern was obtained. Author

A88-40352#
SIR-B EXPERIMENTS IN JAPAN. II - RICE CROP EXPERIMENT
TAKESHI SUITZ, SHIN YOSHIKADO, MASARU ICHINOSE, YOSHIMATSU ECHIZENYA, MITSUHIRO KAMATA et al. Radio Research Laboratory, Journal (ISSN 0033-8001), vol. 35, March 1988, p. 29-37.

This paper discribes ground activities, including ground truth measurements made for a rice crop experiment as a part of SIR-B experiment proposal submitted by the Radio Research Laboratory to NASA. The main objective was to study the potential of remote sensing of rice crop conditions and of vegetation classification. The condition of the test site and rice crops and the results of field investigations for vegetation classification study are described. Descriptions are also made for an in-situ microwave backscatter measurement which was made as a part of the rice crop truth data collection. Author

A88-40355#
SIR-B EXPERIMENTS IN JAPAN. V.
SHIN YOSHIKADO, MASARU ICHINOSE, and MAKOTO SATAKE Radio Research Laboratory, Journal (ISSN 0033-8001), vol. 35, March 1988, p. 77-84. refs

Remote sensing of rice fields in Japan was executed using a microwave imaging radar in the SIR-B experiments. Imaging data taken over the Ohgata-mura test site were analyzed to study the microwave backscattering characteristics of rice plants and crop classification. There was a difference in image intensity between the rice fields and the surrounding area. However, no meaningful difference in the image intensity of the rice fields before and after harvest was found. Also, the correlation between the image intensity and the rice plant conditions was not clear. The investigation of crop classification also gave no significant results. The present results may be mainly attributed to the delay of the experimental term from August to October. Other possible explanations for the results are discussed. Author

A88-40784*# Oregon State Univ., Corvallis.
REMOTE SENSING OF LEAF WATER STATUS
WILLIAM J. RIPPLE and BARRY J. SCHRUMPF (Oregon State University, Corvallis) International Conference on Measurement of Soil and Plant Water Status, Utah State University, Logan, July 6-10, 1987, Paper. 8 p. refs
(Contract NAGW-924)

Relative water content (RWC) measurements were made concurrently with spectral reflectance measurements from individual snapbean leaves. The relationships between spectra and RWC were described using second order polynomial equations. The middle infrared bands most sensitive to changes in leaf RWC also had the highest water absorption coefficients, as published by Curcio Petty (1951). The relationship between reflectance at 2100nm and total water potential for a single leaf was found to be linear. Author

A88-41028*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A FOUR-LAYER MODEL FOR THE HEAT BUDGET OF HOMOGENEOUS LAND SURFACES
B. J. CHOUDHURY and J. L. MONTEITH (NASA, Goddard Space Flight Center, Greenbelt, MD) Royal Meteorological Society, Quarterly Journal (ISSN 0035-9009), vol. 114, Jan. 1988, p. 373-398. refs

The present model envisions the heat balance of a homogeneous land surface in terms of available energy, a set of driving potentials, and parameters for the physical state of the soil and vegetation. Two unique features of the model are: (1) the expression of the interaction of evaporation from the soil and from foliage by changes in the value of the saturation vapor pressure deficit of air in the canopy (the conclusions of this interaction being consistent with field observations); and (2) the treatment of sensible and latent heat exchange between the atmosphere and a soil consisting of two discrete layers. O.C.

A88-41055
MAPPING FROST-SENSITIVE AREAS WITH A THREE-DIMENSIONAL LOCAL-SCALE NUMERICAL MODEL. I - PHYSICAL AND NUMERICAL ASPECTS
R. AVISSAR (Colorado State University, Fort Collins) and Y. MAHRER (Jerusalem, Hebrew University, Rehovot, Israel) Journal of Applied Meteorology (ISSN 0894-8763), vol. 27, April 1988, p. 400-413. Research supported by the Israel Academy of Sciences and Humanities. refs
(Contract NSF ATM-84-14181; NSF ATM-86-16662)

A88-41947* National Aeronautics and Space Administration. John C. Stennis Space Center, Bay Saint Louis, Miss.
PRELIMINARY INVESTIGATION OF LARGE FORMAT CAMERA PHOTOGRAPHY UTILITY IN SOIL MAPPING AND RELATED AGRICULTURAL APPLICATIONS
R. E. PELLETIER (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) and W. H. HUDNALL (Louisiana State University, Baton Rouge) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 55-64. refs

The use of Space Shuttle Large Format Camera (LFC) color, IR/color, and B&W images in large-scale soil mapping is discussed and illustrated with sample photographs from STS 41-6 (October 1984). Consideration is given to the characteristics of the film types used; the photographic scales available; geometric and stereoscopic factors; and image interpretation and classification for soil-type mapping (detecting both sharp and gradual boundaries), soil parent material topographic and hydrologic assessment, natural-resources inventory, crop-type identification, and stress analysis. It is suggested that LFC photography can play an important role, filling the gap between aerial and satellite remote sensing. T.K.

A88-41948
ECONOMIC POTENTIAL OF LANDSAT THEMATIC MAPPER DATA FOR CROP CONDITION ASSESSMENT OF WINTER WHEAT
WARREN THETFORD and GEORGE MAY (Space Remote Sensing Center, Bay Saint Louis, MS) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church,

VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 65-72. refs

April, 1986 Landsat Thematic Mapper data were used in an attempt to estimate crop condition of winter wheat (Triticum aestivum L.) fields in Calloway County, Kentucky. It was hoped that information of some potential financial benefit to Hutson Company, Inc., a regional fertilizer distributor, might be extracted through analysis of the data. A total of 24,387 acres of wheat were classified and mapped. A method of estimating nitrogen deficiency was derived and implemented to provide Hutson with acreage and supplemental nitrogen need figures for the study area. The use of the Thematic Mapper data was found to have at best, marginal financial potential for Hutson in Calloway County alone. However, the prospect of applying similar techniques on a quarter scene or whole scene basis appears promising. Based on a quarter scene, profits from additional nitrogen sales ranged from $21,000 to $23,400 which could exceed imagery, processing, and analysis costs. Author

A88-41951* South Carolina Univ., Columbia.
CORRELATION BETWEEN AIRCRAFT MSS AND LIDAR REMOTELY SENSED DATA ON A FORESTED WETLAND IN SOUTH CAROLINA
JOHN R. JENSEN (South Carolina, University, Columbia), MICHAEL E. HODGSON (Colorado, University, Boulder), HALKARD E. MACKEY, JR. (Savannah River Laboratory, Aiken, SC), and WILLIAM KRABILL (NASA, Wallops Flight Facility, Wallops Island, VA) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 136-149. Previously announced in STAR as N88-11204. refs
(Contract DE-AC09-76SR-00001)

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. Author

A88-41952* Science Applications Research, Lanham, Md.
OBTAINING SPECTRAL REFLECTANCE FACTOR MEASUREMENTS OF STRESSED FOREST VEGETATION
DAVID W. CASE (Science Applications Research, Lanham, MD) and DARREL L. WILLIAMS (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 150-160. refs

Techniques and instruments used to collect spectral reflectance data on Vermont spruce and fir stands subjected to stress (due to acid rain and ozone) are described and illustrated. The healthy and stressed sites selected are characterized; the data-quality requirements are indicated; and particular attention is given to (1) a helicopter-mounted instrument package (radiometer, spectrometer, cameras, and video camera) for canopy-level remote sensing of reflectance and (2) a portable hemispherical light source for use in taking laboratory reflectance measurements from branches or needles. Typical data are presented in graphs and briefly discussed. T.K.

A88-41954
REMOTE SENSING AND THE ROLE OF TERRESTRIAL VEGETATION IN THE GLOBAL CARBON CYCLE
LAWRENCE FOX, III and JOHN D. STUART (Humboldt State University, Arcata, CA) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 191-196. refs

A88-41963
DIGITAL PROCESSING OF AIRBORNE MSS DATA FOR FOREST COVER TYPES CLASSIFICATION
KUO-MU CHIAO, YEONG-KUAN CHEN, and HANN-CHIN SHIEH (National Taiwan University, Taipei, Republic of China) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 15-18. Research supported by the Council of Agriculture of the Republic of China.

The purpose of this study is to find optimal band combinations of airborne MSS data for forest cover types classification. An eleven-channel airborne multispectral scanner was used to collect data. Processing of the MSS data was achieved through the use of the Interactive Digital Image Manipulation System (IDIMS). Forest cover types were interpreted with a hybrid supervised/unsupervised approach. Eight original bands of airborne MSS data and enhanced data such as principal component transformations, ratio images, spatial filtering data, resampling data and mixed bands were subjected to standard clustering and classification techniques. Among the numerous band combinations of MSS data, forty-seven best band combinations with highest values of average divergence and minimum divergence were selected, and classified on IDIMS by the maximum likelihood classifier. Findings of this study are summarized as follows: (1) the best band combination is the combination which contains more bands; (2) resampling and spatial filtering techniques increase 7-10 percent classification accuracy; and (3) because of the inherent property, the principal component transformations, ratio images and mixed bands are insufficient to improve the classification accuracy. Author

A88-41971
DIGITAL CLASSIFICATION OF FORESTED AREAS USING SIMULATED TM- AND SPOT- AND LANDSAT 5/TM-DATA
H.-J. STIBIG (Freiburg, Universitaet, Freiburg im Breisgau, Federal Republic of Germany) and M. SCHARDT (DFVLR, Cologne, Federal Republic of Germany) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 79-85.

In the following piece of research both SPOT- and TM-images, as well as true Landsat 5/TM data have been digitally classified. The results show information about the possibilities of recognizing different types and age classes of trees, together with a high resolution of the classified forest units. Using both TM- and SPOT-data it is possible to differentiate between at least three age classes in forest stands. As well as distinguishing between coniferous and deciduous trees, it is possible to recognize certain tree types in pure crop stands within these classes, depending on the time of year. The correctly classified forest unit is influenced by the form and size of the stands, but generally stands larger than an hectare can be recognized. The classification of the Landat 5/TM scenes was improved by taking into account topographical information and by using multitemporal data. Author

A88-41984
RELATING L-BAND SCATTEROMETER DATA WITH SOIL MOISTURE CONTENT AND ROUGHNESS
P. J. F. SWART (Delft, Technische Hogeschool, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium,

Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 183-186. refs

Preliminary results are reported of the analysis of L-band airborne radar backscatter data from large homogeneous agricultural fields. Examples are given of the calculated normalized radar cross section versus incidence angle. The main theme of discussion will be this angular dependency and its relation with measured soil moisture content and roughness. Author

A88-41986
RELATIONSHIP BETWEEN SOIL AND LEAF METAL CONTENT AND LANDSAT MSS AND TM ACQUIRED CANOPY REFLECTANCE DATA

C. BANNINGER (Graz, Forschungszentrum, Austria) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 195-200. Research supported by the Science Research Office of Styria and BMFWF. refs

The presence of high concentrations of copper, lead, and zinc in the soils underlying a spruce tree stand is not mirrored in the metal content of the spruce needles, except for zinc. A much stronger correlation exists between Landsat canopy reflectance data and soil metal content than with spruce needle metal content. This implies that the toxic effects of the heavy metals on the spruce trees are centered in the root systems rather than in the foliar parts of the trees. Author

A88-41987
THE DERIVATION OF A SIMPLIFIED REFLECTANCE MODEL FOR THE ESTIMATION OF LAI

J. G. P. W. CLEVERS (Landbouwhogeschool, Wageningen, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 215-220. refs

A simplified crop reflectance model for the estimation of leaf area index (LAI) which makes corrections for background caused by soil reflectance is presented. The model works by defining an apparent soil cover and then calculating a corrected infrared reflectance by subtracting the contribution of the soil from the measured reflectance. It is assumed that there is a constant ratio between the reflectances of bare soil in different spectral bands, independent of soil moisture content, enabling the corrected infrared reflectance to be calculated without knowing soil reflectance. Simulations with the SAIL model (Verhoef, 1984) are used to confirm this semi-empirical model's potential for estimating LAI. R.B.

A88-41988
THE APPLICATION OF A VEGETATION INDEX IN CORRECTING THE INFRARED REFLECTANCE FOR SOIL BACKGROUND

J. G. P. W. CLEVERS (Landbouwhogeschool, Wageningen, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 221-226. refs

A88-41989
MULTITEMPORAL ANALYSIS OF THEMATIC MAPPER DATA FOR SOIL SURVEY IN SOUTHERN TUNISIA

G. F. EPEMA (Landbouwhogeschool, Wageningen, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 245-249. refs

A88-41991
SPECTRAL SIGNATURE OF RICE FIELDS USING LANDSAT-5 TM IN THE MEDITERRANEAN COAST OF SPAIN

S. GANDIA, V. CASELLES, A. GILABERT, and J. MELIA (Valencia, Universidad, Spain) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 257-259. refs

This work gives the first results of a study carried out in an agricultural area of the Spanish Mediterranean coast using Thematic Mapper images. Three cover types, rice, critic - vegetable orchard and urban area are classified in the zone by using a vegetation index. Bands 4 and 5 seem to be more suitable for a possible classification of two varieties of rice. Author

A88-41993
DETERMINATION OF SPECTRAL SIGNATURES OF DIFFERENT FOREST DAMAGES FROM VARYING ALTITUDES OF MULTISPECTRAL SCANNER DATA

A. KADRO (Freiburg, Universitaet, Freiburg im Breisgau, Federal Republic of Germany) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 281-284. refs

Within the scope of the project 'forest damage inventory with multispectral scanner data' at the Department of Remote Sensing at the University of Freiburg, thematic mapper simulation data of different altitudes was acquired. Five test areas which differ in morphology, forest types and forest damage degree were sensed. For the investigation of the spectral signatures, reference panels were placed along the flying strip (size ca. 200 sqm) for the determination of the global radiation. The data were obtained from three altitudes (300, 1000, 3000 m) so that the spectral signatures could be determined in relation to the flight altitude. The scanner data of 300 m altitude enables the investigation of single trees. The data of higher altitudes only permit the investigation of trees or stands because of the larger pixel size. The same test areas have been used also for the investigation of spectral signatures of Landsat (TM) data. In this paper the results of the investigation are presented and discussed. Author

A88-41994
MULTITEMPORAL ANALYSIS OF LANDSAT MULTISPECTRAL SCANNER (MSS) AND THEMATIC MAPPER (TM) DATA TO MAP CROPS IN THE PO VALLEY (ITALY) AND IN MENDOZA (ARGENTINA)

M. MENENTI, S. AZZALI (Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen, Netherlands), D. A. COLLADO, and S. LEGUIZAMON (Instituto de Investigaciones Aplicadas en Ciencias Espaciales, Mendoza, Argentina) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 293-299. refs

A88-41997
SPECTRAL SIGNATURES OF SOILS AND TERRAIN CONDITIONS USING LASERS AND SPECTROMETERS

H. SCHREIER (British Columbia, University, Vancouver, Canada) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 311-315. refs

This paper presents the results of two studies. In the first, the results of airborne laser test flights were documented, demonstrating that high-resolution data on the terrain and vegetation heights and on the surface reflection can be obtained simultaneously. In the second study, conducted to explore the possibilities of ground-based multispectral laser measurements, ground-based reflection measurements (at 550, 630, and 1600 nm) done by a spectrometer were correlated with the contents of C, Fe, and sand, respectively, in different sets of soil samples. The relationships obtained were not universal, and were only applicable on a site-specific basis. For instance, organic carbon

could only be predicted with confidence in soils originating from a field where the organic C content was highly variable and greater than 2 percent, and the percent sand could be predicted accurately in samples with organic carbon below 2 percent. I.S.

A88-41998
RELATION BETWEEN SPECTRAL REFLECTANCE AND VEGETATION INDEX
S. M. SINGH (Reading, University, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 317-319. refs
(Contract NERC-F60/G6/12)

Atmospheric corrections are applied to the Advanced Very High Resolution Radiometer (AVHRR) channel-1 and channel-2 data. Both raw and atmospherically corrected Normalized Difference Vegetation Indices (NDVIs) are calculated. A comparison between them shows a contrast enhancement by a factor of at least two when atmospheric corrections are applied. Spectral reflectances and atmospherically corrected NDVI are partially correlated indicating a possibility of improving surface cover classification using NDVI and spectral reflectances instead of NDVI values alone. Raw NDVI and atmospherically corrected NDVI do not have a unique relationship but are highly correlated. This indicates that atmospheric corrections be applied to each scene of interest. Author

A88-41999
LANDSAT TEMPORAL-SPECTRAL PROFILES OF CROPS ON THE SOUTH AFRICAN HIGHVELD
B. TURNER (National Physical Research Laboratory, Pretoria, Republic of South Africa) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 325-330. refs

Landsat MSS data were standardized for variations in digital count coding between different receiving stations, satellite sensor response and solar illumination of the scene. The Kauth and Thomas approach has been used to obtain the independent variables of soil brightness, greenness and yellowness. The coefficients of the rotation matrix were modified to suit local conditions. Three vegetation indices, the vegetation ratio, the normalized vegetation index and the greenness index have been determined on a field-by-field basis using data recorded on sixteen overpasses within thirteen months. An intercomparison of the spectral-temporal profiles for a variety of crops is in progress. A correlation between the spectral profiles and a ground reference set consisting of detailed information on planting, growth and environmental conditions is to be undertaken. The spectral separability of the crops in terms of the vegetation indices and the field conditions is being evaluated. Author

A88-42002
OPTIMAL THEMATIC MAPPER BANDS AND TRANSFORMATIONS FOR DISCERNING METAL STRESS IN CONIFEROUS TREE CANOPIES
C. BANNINGER (Graz, Forschungszentrum, Austria) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 371-374. refs

A statistical analysis of multitemporal Landsat Thematic Mapper (TM) data acquired from a pine and a spruce tree stand growing in copper-lead-zinc enriched soils helped define the TM spectral bands and transformations best suited for detecting metal stress in coniferous tree canopies. Based on four Landsat TM scene dates, the first principal component (PC1) and the band difference (BD1) rank the highest of thirty-one single and transformed TM bands examined, followed by the TM brightness index (TMB) and Thematic Mapper bands 5 and 7. Author

A88-42003
THE USE OF MULTITEMPORAL LANDSAT DATA FOR IMPROVING CROP MAPPING ACCURACY
ALAN S. BELWARD and JOHN C. TAYLOR (Cranfield Institute of Technology, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 381-386. refs

The value of using multitemporal Landsat MSS data to improve classification accuracy in an area of diverse crop production was investigated using a 625-sq km area centered on Framingham, England, as a test site. Six scenes from between October 1979 and August 1980 were located, and the data were matched to 2000 hectares of ground information giving the crop type and field boundaries for the 1979-1980 growing season. Ten cover classes were identified: winter wheat, winter barley, spring barley, oilseed rape, grassland, sugar beet, peas, beans, and deciduous and coniferous woodland. It was found that multitemporal data gave better overall classification accuracies than the single date images. The best results were from a spring/early summer combination, with a mean classification accuracy of 70 percent. This is a 6-percent increase over the best single-date classification from May, and 46 percent better than the worst from February. I.S.

A88-42004
INVENTORY OF DECLINE AND MORTALITY IN SPRUCE-FIR FORESTS OF THE EASTERN U.S. WITH CIR PHOTOS
W. M. CIESLA, C. W. DULL, L. R. MCCREERY, and M. E. MIELKE (USDA, Forest Service, Fort Collins, CO) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 391-396. refs

An accelerated decline and mortality of several commercially important trees, including red spruce, Picea rubens, has recently been reported in the eastern United States. The causal agents responsible for this syndrome are not yet fully known. This has led to a concern that some form of anthropogenic pollution may be involved. Beginning in 1984, a series of special inventories were conducted by the Forest Pest Management organization of the USDA Forest Service to quantify the status of red spruce decline and mortality throughout its natural range. Color infrared aerial photography was used as an integral stage of these surveys. Photographic parameters and survey design approaches are described, and examples of survey results are presented. Resultant data are being stored in geographic information systems to facilitate integration with other resource information and research data. Survey designs currently used in the United States are compared to European approaches for assessment of similar types of damage. Author

A88-42005
A REMOTE SENSING AIDED INVENTORY OF FUELWOOD VOLUMES IN THE SAHEL REGION OF WEST AFRICA - A CASE STUDY OF FIVE URBAN ZONES IN THE REPUBLIC OF NIGER
STEVEN J. DAUS, MAMANE GUERO (Forestry and Land Use Planning, Niamey, Niger), and LAWALLY ADA (Niamey, Universite, Niger) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 403-408. Research supported by the U.S. Agency for International Development.

A88-42006
THE USE OF SPOT SIMULATION DATA IN FORESTRY MAPPING
S. J. DURY, W. G. COLLINS, and P. D. HEDGES (Aston, University, Birmingham, England) IN: Remote sensing for resources development and environmental management; Proceedings of the

Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 425-428. refs

The potential usefulness of the SPOT satellite for providing data for forestry management was investigated, comparing satellite data with the ground data on a test area located within the Forest of Dean, England. Several digital enhancement techniques were applied to SPOT simulation imagery and were visually assessed to give the best discrimination of the tree types; a maximum likelihood classification was then performed on suitably enhanced images. The results indicate that SPOT images can be used not only for distinguishing different tree species but also different age classes of certain species. A major source of error resulted from the high spectral variance of urban areas within the forest. Methods for overcoming this problem are proposed. I.S.

A88-42007
SPRUCE BUDWORM INFESTATION DETECTION USING AN AIRBORNE PUSHBROOM SCANNER AND THEMATIC MAPPER DATA

H. EPP (Canada Centre for Remote Sensing, Ottawa) and R. REED (Saskatchewan Parks and Renewable Resources, Prince Albert, Canada) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 429-434. refs

The potentials of high-resolution MEIS-II pushbroom scanner and Thematic Mapper data for detecting spruce budworm infestation were investigated. Data were acquired in the summer of 1985 on a test site in east-central Saskatchewan, Canada. The results showed that it is possible to identify areas of spruce budworm damage using areal photography and natural color images obtained from the pushbroom scanner data; one level of budworm infestation, with indications of a second level, was detected by the scanner. The lower-resolution Thematic Mapper data could only be used to identify the severely affected spruce budworm areas. I.S.

A88-42008
CONTRIBUTION OF REMOTE SENSING TO FOOD SECURITY AND EARLY WARNING SYSTEMS IN DROUGHT AFFECTED COUNTRIES IN AFRICA

ABDISHAKOUR A. GULAID (Berlin, Technische Universitaet, Federal Republic of Germany) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 457-460. refs

As a result of the disastrous drought that affected many countries in the Sahel Zone in 1973/74, the international community has been looking for means of obtaining immediate and reliable information on the potential causes of this terrible danger that threatens millions of human and animal lives. The Food and Agricultural Organizatiion of the United Nations (FAO), for example, has established an early warning system for predicting food shortages in many developing countries. The United Nations Environmental Program (UNEP) installed a global environmental monitoring program (GEMS). Many developing countries have set up their own food security and early warning systems with the help of multilateral or bilateral technical cooperation projects. The common aim of these programs is the collection, processing and analysis of relevant data with the help of one or several methods, and the subsequent presentation of the derived information to the planners and decision-makers in order to take appropriate measures in time. This paper assesses the role of remote sensing in the existing and the future food security programs and early warning systems in developing countries with particular emphasis on the drought affected countries in Africa. Author

A88-42009
DOUBLE SAMPLING FOR RICE IN BANGLADESH USING LANDSAT MSS DATA

BARRY N. HAACK (George Mason University, Fairfax, VA) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 461-464. refs

Landsat Multispectral Scanner (MSS) data were utilized to assess the location and area of the winter or boro rice crop for a study site in Bangladesh. Both digital classifications and visual interpretations of the Landsat data were conducted using a double sampling between the Landsat analyses and governmental reported acreages for ten administrative units. The digital data were classified using a table look-up of MSS Bands 5 and 7 and the visual analysis conducted with an enlarged false color composite subscene and a rearview projector. Both techniques located about one-half of the reported acreage but had correlations between the reported and Landsat data for the ten units of over 0.90. This study indicates that double sampling with Landsat data can be an effective technique for the inventory of renewable resources in rural areas. Author

A88-42010
EXPERIENCES IN APPLICATION OF MULTISPECTRAL SCANNER-DATA FOR FOREST DAMAGE INVENTORY

A. KADRO and S. KUNTZ (Freiburg, Universitaet, Freiburg im Breisgau, Federal Republic of Germany) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 469-472. refs

For testing the potential use of multispectral scanner data for the inventory of forest damages in large areas five test sites in southwest Germany were sensed at three flight altitudes with an 11-channel scanner. At the same time, ground truth information in these test sites were obtained and the actual state of the forest stands was documented with color infrared (CIR) aerial photographs. The test sites differ in morphology, forest types and degree of the actual forest damage. The acquired data were evaluated with a computer aided supervised classification using the maximum-likelihood method. For verification of the classification results for both single trees and stands, the terrestrial ground truth and the CIR-photographs were used. This paper presents the classification results and discusses the problems of a computer aided forest damage inventory. Author

A88-42011
APPLICATION OF MULTISPECTRAL SCANNING REMOTE SENSING IN AGRICULTURAL WATER MANAGEMENT PROBLEMS

G. J. A. NIEUWENHUIS (Instituut voor Cultuurtechniek en Waterhuishouding, Wageningen, Netherlands) and J. M. M. BOUWMANS (Landinrichtingsdienst, Utrecht, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 489-494. refs

A method has been developed for the automatical mapping of evapotranspiration from digitally taken reflection and thermal images. This method has been tested in combination with field measurements and agrohydrological model calculations. An important improvement of the hydrological description of an area can be achieved by combining the remote sensing approach with conventional methods. Especially the spatial variation in soil physical characteristics can be determined more accurately by applying remote sensing techniques. Satellite and airplane images acquired after a dry period supply information about the occurrence of drought damage. Because of the fast changing weather conditions in humid areas like the Netherlands remote sensing in water management will mainly depend on scanning techniques from airplanes. Author

A88-42012
GLOBAL VEGETATION MONITORING USING NOAA GAC DATA

H. SHIMODA, K. FUKUE, T. HOSOMURA, and T. SAKATA (Tokai University, Tokyo, Japan) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 505-508.

In the last decade, the necessity of global monitoring of vegetations or bio-mass has become a more urgent matter. In order to prevent the large disaster which may be caused by vegetation decrease, accurate conditions or stage of the world vegetation should be monitored. The only satellite system and observation data which can be used for the purpose is TIROS/NOAA system and Vegetation Index Data (VID) made of AVHRR, respectively. The purpose of this study is to establish the method to derive a global vegetation map from a VID set. One data set was used in this study. Large shading effects mainly caused by sun angle deviations were first eliminated. The classification was done using a maximum likelihood method with four channels of VID. Training data composed of 67 categories were chosen according to the World Vegetation Map made by Preston James et al. After the classification, these 67 categories were unified to 17 categories. Then the classified images were transformed to longitude and latitude coordinates. As a result of this study, NOAA Vegetation Index Data were proved to be a suitable data for worldwide vegetation monitorings. Author

A88-42013
CLASSIFICATION OF THE RIVERINA FORESTS OF SOUTH EAST AUSTRALIA USING CO-REGISTERED LANDSAT MSS AND SIR-B RADAR DATA
A. K. SKIDMORE, P. W. WOODGATE, and J. A. RICHARDS (New South Wales, University, Kensington, Australia) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 517-519. refs

A88-42014
COMPARISON OF SPOT-SIMULATED AND LANDSAT 5 TM IMAGERY IN VEGETATION MAPPING
H. TOMMERVIK (Tromso, Universitetet, Norway) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 525-529. refs

Results from work done on both SPOT-simulated imagery and Landsat 5 TM imagery are presented. The test area is situated in Central Troms, Northern Norway, and has a fairly wide variation in ecological niches and comprises both forest landscape and mountain areas (Artic alpine vegetation). The ground truth program did include both a traditional vegetation mapping program and a test-site program. Digital image processing was carried out both on the SPOT-simulated imagery and the Landsat imageries, but the scenes were taken too early in the spring or too late in the autumn to give a sufficient basis for a good classification. The investigation has shown that the Landsat scene from the springtime almost had the same accuracy by supervised classification as the SPOT-simulated imagery, due to the better radiometric resolution for the TM-sensor compared to the simulated HRV-sensor on the SPOT satellite. But classification on the SPOT-simulated imagery showed that the vegetation units within small areas, were better picked out due to the better spatial resolution, compared to the TM-sensor on the Landsat 5 satelite. Visual interpretation on the autumn-scene of Landsat 5 TM-sensor gave a successful detection of swamp forests at the riverbanks by using the channel combinations of CH 456 and CH 543. Author

A88-42015
MULTI-TEMPORAL LANDSAT FOR LAND UNIT MAPPING ON PROJECT SCALE OF THE SUDD-FLOODPLAIN, SOUTHERN SUDAN
Y. A. YATH (Jonglei Executive Organ, Karthoem, Sudan) and H. A. M. J. VAN GILS (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 531, 532.

The Sudd floodplain is extremely flat, covered mainly by grasslands, only locally interrupted by clusters of fields and seasonally flooded by rain and/or river water. Since photo-interpretation is based on relief, vegetation structure and field pattern, such technique is not satisfying for the Sudd floodplain. Moreover, the most important environmental component - the flooding - can be assessed only on sequential series of photographs. Studies of the Sudd-floodplain on regional scale have been carried out as environmental impact study for the Yonglei Canal project. However, such information proved of limited value on project scale. For the latter a combination of Landsat, aerial photography and field survey has been tried and proven successful. The methodology, results and limitations are outlined for application in similar floodplain areas as there are the Llanos in Southern America, Zambesi floodplain, Kafue flats and the Okavango swamps in Africa. Author

A88-42024
THEMATIC MAPPING FROM AERIAL PHOTOGRAPHS FOR KANDI WATERSHED AND AREA DEVELOPMENT PROJECT, PUNJAB (INDIA)
B. DIDAR SINGH and KANWARJIT SINGH (Planning and Design State Directorate, Chandigarh, India) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 595-598.

A88-42035
SMALL SCALE EROSION HAZARD MAPPING USING LANDSAT INFORMATION IN THE NORTHWEST OF ARGENTINA
JOSE MANUEL SAYAGO IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 669-674. refs

A88-42060
HOW FEW DATA DO WE NEED - SOME RADICAL THOUGHTS ON RENEWABLE NATURAL RESOURCES SURVEYS
J. A. ALLAN (London, University, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 901-906. refs

The use of remote sensing in renewable natural resources surveys is discussed, emphasizing the economics of monitoring and predicting agricultural change and production. It is argued that remote sensing specialists should identify economic activities which attract returns to institutions which will benefit by advance warning of agricultural performance at the regional level, and then determine the minimum level of sample coverage and frequency necessary to provide predictive information at a price which the economic activities will bear. It is concluded that any economically viable operational system will require economies in spatial cover through sampling. Principles according to which such economies might be decided are suggested, discussing the implications for sensor design and data processing. R.B.

A88-42061
THE POTENTIAL OF NUMERICAL AGRONOMIC SIMULATION MODELS IN REMOTE SENSING
J. A. A. BERKHOUT (Centre for World Food Studies, Wageningen, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29,

1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 907-911. refs

The possible use of remote sensing in a Geographic Information System (GIS) including crop growth models and the possible use of GIS as a partial substitute for ground truth in remote sensing analysis are discussed. Remote sensing can provide information required for successful implementation of an agricultural GIS early warning system, such as additional knowledge of the actual land use pattern, synoptic time series of the actual weather, and detailed knowledge on the physiography including soil characteristics and hydrology. Although it is felt that extensive field observations will continue to be required to quantify the combined effect of all land entities and farm practices on the cultivation of specific crops, the number of observations could be reduced with the introduction of numerical simulation models. R.B.

A88-42538
DETECTION OF ENVIRONMENTAL NOISES BETWEEN A VEGETATION CANOPY AND A RADIOMETRIC SENSOR
M. C. MUEKSCH (Saarland, Universitaet, Herrenberg, Federal Republic of Germany) IN: Optoelectronic technologies for remote sensing from space; Proceedings of the Meeting, Cannes, France, Nov. 19, 20, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1988, p. 81-85. refs

A method to determine environmental noises between a radiometric sensor and a vegetation canopy is described. The noises are the differences between the incoming radiation and a synthetic radiation, computed by a radiation model in which the local climatological data are introduced over the evapotranspiration component. Climatological data are simultaneously collected by sensors in the station and target area over a local area network (LAN), controlled by a master station in the radiometer standpoint. The LAN can quickly be rearranged in the observation area to get the actual amount of local environmental noises which then can be taken into consideration as corrections at the observed canopy reflectances. The method is primarily designed for remote sensing ground control. Author

A88-42545
IN FLIGHT CALIBRATION FOR THE IMAGING INSTRUMENT OF VEGETATION PAYLOAD (SPOT 4)
R. KRAWCZYK and G. CERUTTI-MAORI (Aerospatiale, Cannes, France) IN: Optoelectronic technologies for remote sensing from space; Proceedings of the Meeting, Cannes, France, Nov. 19, 20, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1988, p. 126-133. CNES-supported research.

'Vegetation' is a payload that will be carried by the earth-observation satellite SPOT 4 when it is launched in 1992; it is primarily aimed at conducting a global survey of vegetation cover in order to forecast agricultural yields and assist in environmental studies. The payload is secondarily concerned with the onservation of oceanic areas. Of the five spectral bands used, three are in the visible, one is in the near-IR, and the last is in the mid-IR. The pushbroom imaging used employs a CCD focal plane array, and capitalizes on the trajectory's perpendicularity to the CCD array to furnish 1.165-km sampling on the ground. O.C.

A88-42760
A VHF RADAR TO MAKE TERRAIN ELEVATION MODELS THROUGH TROPICAL JUNGLE
ROGER S. VICKERS (SRI International, Menlo Park, CA), RAYMOND T. LOWRY, and ARLEN D. SCHMIDT (Intera Technologies, Ltd., Calgary, Canada) IN: IEEE National Radar Conference, 3rd, Ann Arbor, MI, Apr. 20, 21, 1988, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1988, p. 44-49. refs

A radar system is described, operating at 200-400 MHz, which produces profiles of the ground in the presence of dense tropical forest cover. The profiles can be assembled to construct a contour map of the terrain at scales as large as 1:10,000. The radar uses a 5-ns pulsewidth, and has achieved a total system accuracy of 2.5 m (vertical). A brief description is given of each of the major features of the radar system, including antennas, processor, and radio frequency design. Examples are given of mapping products from a recent survey in Indonesia. Possible future improvements involving the use of the Global Positioning System are mentioned. I.E.

A88-43220
CROP CLASSIFICATION FROM AIRBORNE SYNTHETIC APERTURE RADAR DATA
G. M. FOODY (Kingston Polytechnic, Kingston upon Thames, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 655-668. refs

The ability of radar systems to record useful data independently of the prevailing weather conditions and the future increase in radar data availability is likely to result in their increased utilization for crop classification. However, a variety of factors relating to the quantity and quality of the data will influence the accuracy with which these data can be classified. This paper aims to illustrate the effect of some of these factors on crop classification accuracy from a multi-feature synthetic aperture radar data base. The results show that in addition to the number of data channels available for a classification, the method of radiometric correction applied to the data and the use of data from different look directions can have significant effects on the classification accuracy. The use of a multi-feature data base, however, was found to enable accurate discrimination of a variety of crop types. Author

A88-43221
USE OF DIGITAL TERRAIN DATA IN THE INTERPRETATION OF SPOT-1 HRV MULTISPECTRAL IMAGERY
A. R. JONES, B. K. WYATT (NERC, Institute of Terrestrial Ecology, Bangor, Wales), and J. J. SETTLE (NERC, Unit for Thematic Information Systems, Reading, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 669-682. refs

This paper describes the complementary use of digital terrain information and SPOT-1 HRV multispectral imagery for the study and mapping of semi-natural upland vegetation. A digital terrain model was derived for a 10 by 10 km study area in southern Snowdonia, Wales, and was used to generate slope and aspect images. A model was developed as a first-order approximation of changes in radiance with local topography, assuming Lambertian behavior of vegetation canopies. The model was implemented for the study area to assess its use in suppressing the effects of relief on scene radiance. Subsequently the model was refined to describe non-Lambertian reflectance. Author

A88-43222
POTATO CROP DISTRIBUTION AND SUBDIVISION ON SOIL TYPE AND POTENTIAL WATER DEFICIT - AN INTEGRATION OF SATELLITE IMAGERY AND ENVIRONMENTAL SPATIAL DATABASE
G. G. WRIGHT and J. G. MORRICE (The Macaulay Land Use Research Institute, Aberdeen, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 683-699. refs

A88-43670
TAKING THE EFFECT OF VEGETATION INTO ACCOUNT IN THE MICROWAVE-RADIOMETER REMOTE SENSING OF THE EARTH SURFACE ON THE RESULTS OF REMOTE SOUNDING OF THE EARTH SURFACE BY MICROWAVE RADIOMETRY [OB UCHETE VLIIANIIA RASTITEL'NOSTI PRI DISTANTSIONNOM SVCH-RADIOMETRICHESKOM ZONDIROVANII ZEMNYKH POKROVOV]
A. A. CHUKHLANTSEV and A. M. SHUTKO (AN SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1988, p. 67-72. In Russian. refs

This paper describes a method for estimating the effect of vegetation on the characteristics of soil moisture content obtained by remote microwave radiometry. The method, based on the procedure of Kurdiashev and Chukhlantsev (1979) developed originally for single-wave measurements and a priori knowledge of

the vegetation transfer coefficient, uses spectral measurements and makes it possible to determine the moisture content without a priori information. Using both methods, it was shown that the moisture content of soil under vegetative cover with a mass of 200-300 centners/hectare could be obtained with errors that are about 10-30 percent higher than errors for an open surface. The errors obtained with the spectral-measurement method do not exceed the errors obtained with single-wave measurements. I.S.

A88-43671
CONTRAST ENHANCEMENT OF AEROSPACE SCANNER IMAGERY OF CROP FIELDS [POVYSHENIE KONTRASTNOSTI SKANERNYKH AEROKOSMICHESKIKH IZOBRAZHENII SEL'SKOKHOZIAISTVENNYKH POLEI]
A. S. BARYKIN and V. P. POPOV (Vsesoiuznyi Nauchno-Issledovatel'skii Tsentr AIUS-Agroresursy; Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1988, p. 73-82. In Russian.

This paper presents a novel digital method that uses a moving contrast operator, which emphasizes intrafield brightness contrasts on aerospace scanner images of crop fields and makes it possible to restore smooth margins of the fields. The method increases crop classification distinctions and yields high-accuracy results on the phytopathological analysis of crops. Examples are presented using Landsat scanner images. I.S.

A88-43864
A SECOND GENERATION LUNAR AGRICULTURAL SYSTEM
JUDITH FIELDER and NICKOLAUS LEGGETT British Interplanetary Society, Journal (ISSN 0007-084X), vol. 41, June 1988, p. 263-268. refs

This paper presents a soil-based system of agriculture for use at a second generation lunar base. Enriched lunar regolith is used to grow food crops in pressurized agricultural modules. Estimated physical requirements and agricultural practices for a self-sustaining system are discussed. This agricultural system is designed to supplement and perhaps supplant hydroponic agricultural systems used for first generation applications. Author

A88-44116* Texas Univ., Arlington.
AN EMPIRICAL MODEL FOR POLARIZED AND CROSS-POLARIZED SCATTERING FROM A VEGETATION LAYER
H. L. LIU and A. K. FUNG (Texas, University, Arlington) Remote Sensing of Environment (ISSN 0034-4257), vol. 25, June 1988, p. 23-36. refs
(Contract NAG9-115)

An empirical model for scattering from a vegetation layer above an irregular ground surface is developed in terms of the first-order solution for like-polarized scattering and the second-order solution for cross-polarized scattering. The effects of multiple scattering within the layer and at the surface-volume boundary are compensated by using a correction factor based on the matrix doubling method. The major feature of this model is that all parameters in the model are physical parameters of the vegetation medium. There are no regression parameters. Comparisons of this empirical model with theoretical matrix-doubling method and radar measurements indicate good agreements in polarization, angular trends, and k sub a up to 4, where k is the wave number and a is the disk radius. The computational time is shortened by a factor of 8, relative to the theoretical model calculation. Author

A88-44117
THE EFFECT OF ATMOSPHERIC CORRECTION ON THE INTERPRETATION OF MULTITEMPORAL AVHRR-DERIVED VEGETATION INDEX DYNAMICS
S. M. SINGH (NERC, Unit for Thematic Information Systems, Reading, England) and R. J. SAULL (Reading, University, England) Remote Sensing of Environment (ISSN 0034-4257), vol. 25, June 1988, p. 37-51. refs
(Contract NERC-F60/G6/12)

The actual evapotranspiration and potential evapotranspiration data for the 1984 vegetation season over the United Kingdom supplied by the UK Meteorological Office Rainfall and Evapotranspiration Calculation System are used to indicate moisture stress variation on the vegetation canopy. Raw and atmospherically corrected normalized difference vegetation indices (NDVIs) for the same period are calculated from 10 images obtained from the AVHRR in order to test the effect of the atmosphere on the NDVI dynamics interpretation. Comparison of the NDVI seasonal cycle (for various surface-cover types) with the moisture stress variation shows that: (1) there is a marked improvement in the understanding of the vegetation dynamics if remotely sensed data are corrected for atmospheric effects and (2) the relationship between the NDVI and moisture stress seems to depend on the type of vegetation present in the area in question. Author

A88-44119
SOIL AND ATMOSPHERE INFLUENCES ON THE SPECTRA OF PARTIAL CANOPIES
A. R. HUETE (Arizona, University, Tucson) and R. D. JACKSON (USDA, Water Conservation Laboratory, Phoenix, AZ) Remote Sensing of Environment (ISSN 0034-4257), vol. 25, June 1988, p. 89-105. refs

Ground-measured radiances over partially vegetated canopies with their simulated responses at the top of a clear 100 km meteorological range and a turbid 10 km atmosphere are compared using an atmospheric radiant transfer model. Atmospheric influences on the spectra of partial canopies were found to be dependent on the brightness of the underlying soil. Both increasing soil brightness and atmospheric turbidity lower the ratio vegetation index (RVI) and normalized difference vegetation index (NDVI) values. Atmospheric-induced RVI and NDVI degradation were greatest over canopies with darker soils and were not detectable over canopies with light-colored soils, whereas soil and atmospheric effects on the perpendicular vegetation index were independent with atmosphere degradation being similar across all soil backgrounds. R.B.

A88-44307
RADAR BACKSCATTER CHARACTERISTICS OF TREES AT 215 GHZ
RAM MOHAN NARAYANAN, CHRISTOPH C. BOREL, and ROBERT E. MCINTOSH (Massachusetts, University, Amherst) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. 26, May 1988, p. 217-228. refs
(Contract DAAG29-85-K-0227)

Millimeter-wave backscatter measurements are presented for various tree types taken during the 1987 growing season at Amherst, Massachusetts. These measurements were taken with a 215-GHz radar system that is capable of measuring backscatter for the VV (vertical transmit, vertical received), HH (horizontal transmit, horizontal received), VH, and HV polarizations. Geometrical optics modeling was used for the normalized radar cross section (RCS) of deciduous trees and the backscatter is shown to be characterized in terms of gravimetric leaf water content, the leaf area, and the foliage crown cover. Data are also provided for coniferous trees, although the geometrical optics model is not applicable in those cases. I.E.

A88-44308
MILLIMETER-WAVE BISTATIC SCATTERING FROM GROUND AND VEGETATION TARGETS
FAWWAZ T. ULABY, TAHERA E. VAN DEVENTER, JACK R. EAST, THOMAS F. HADDOCK, and MICHAEL EUGENE COLUZZI (Michigan, University, Ann Arbor) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. 26, May 1988, p. 229-243. refs

A 35-GHz bistatic radar system was used to measure the attenuation through trees and the bistatic scattering pattern of tree foliage. The data were found to be in good agreement with a first-order multiple scattering model. Measurements were also made to study the angular vibration of the bistatic scattering coefficient of a smooth sand surface, a rough sand surface, and a gravel surface. The measurements, which were made for HH, HV (horizontal transmit, verticle receive), and VV polarization

configurations over a wide range of the azimuth angle and the scattering angle, provide a quantitative reference for the design and use of millimeter-wave bistatic radar systems. I.E.

A88-44319#
MILLIMETER-WAVE PROPAGATION IN VEGETATION: EXPERIMENTS AND THEORY
FELIX K. SCHWERING (U.S. Army, Communications Electronics Command, Fort Monmouth, NJ), EDMOND J. VIOLETTE, and RICHARD H. ESPELAND (National Telecommunications and Information Administration, Institute for Telecommunication Sciences, Boulder, CO) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. 26, May 1988, p. 355-367. refs

Microwave/millimeter-wave propagation in woods and forests was investigated at 9.6, 28.8, and 57.6 GHz. The experiments were repeated over the same transmission paths, under both summer and winter conditions, i.e., with tree in leaf and without leaves. Of particular interest were the range dependence, beam broadening, and depolarization of millimeter-wave beams in vegetation and frequency dependence of these effects. The experiments have shown, in particular, that the range dependence is characterized by a high attenuation rate at short vegetation depths and a reduced attenuation rate at large depth. For trees fully in leaf, the transition between the two regimes can be abrupt and the change in attenuation rate substantial. Just after the transition significant beam broadening (and depolarization) occurs. A theory of millimeter-wave propagation in vegetation was derived using transport theory. Theoretical and experimental results are in good qualitative agreement; both show the same trends. The theory explains these trends in terms of the interplay between the coherent (direct path) field component and the incoherent (multiscattered) field component. Good quantitative agreement will require further refinement of the theory. I.E.

A88-44521 Thessaloniki Univ. (Greece).
MANUAL INTERPRETATION OF SMALL FORESTLANDS ON LANDSAT MSS DATA
MICHAEL A. KARTERIS (Salonika, University, Greece) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, June 1988, p. 751-755. Research supported by the Michigan Department of Natural Resources and NASA. refs

The use and potential of Landsat MSS images for interpretation and mapping small scattered forestlands were evaluated in this study. Four images - two from late winter (a black-and-white band 5 and a color composite) - and two from early fall (a color composite and a diazo-enhanced color composite) - were tested. Forestlands were interpreted and mapped from each Landsat image and the resulting maps were compared with various other sources. The detected interpretation errors were categorized as commission and omission, and were further classified into errors of boundary placement (over 85 percent of the cases) and errors of identification. Over 55 percent of all errors were less than 2.0 hectares in size. The most frequently misclassified areas were agricultural lands, treed-bogs, brushlands, lowland hardwoods, and mixed hardwoods. Oak-hickory was the most accurately interpreted forest type category. The overall interpretation performance, which was expressed by two types of accuracy (identification and mapping), ranged between 74 and 95 percent. The best results were obtained from the interpretation of the winter color composite with snow on the ground. Author

A88-44643* California Univ., Santa Barbara.
SIMULATION OF L-BAND AND HH MICROWAVE BACKSCATTERING FROM CONIFEROUS FOREST STANDS - A COMPARISON WITH SIR-B DATA
GUO-QING SUN and DAVID S. SIMONETT (California, University, Santa Barbara) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, May 1988, p. 907-925. refs
(Contract JPL-956887)

SIR-B images of the Mt. Shasta region of northern California are used to evaluate a composite L-band HH backscattering model of coniferous forest stands. It is found that both SIR-B and simulated backscattering coefficients for eight stands studied have similar trends and relations to average tree height and average number of trees per pixel. Also, the dispersion and distribution of simulated backscattering coefficients from each stand broadly match SIR-B data from the same stand. Although the limited quality and quantity of experimental data makes it difficult to draw any strong conclusions, the comparisons indicate that a stand-based L-band HH composite model seems promising for explaining backscattering features. R.B.

A88-44644* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SHUTTLE RADAR MAPPING WITH DIVERSE INCIDENCE ANGLES IN THE RAINFOREST OF BORNEO
J. P. FORD and D. J. CASEY (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, May 1988, p. 927-943. refs

N88-20711*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
REMOTE SENSING OF EARTH TERRAIN Semiannual Report, 1 Sep. 1987 - 29 Feb. 1988
J. A. KONG 28 Apr. 1988 17 p
(Contract NAG5-270)
(NASA-CR-182677; NAS 1.26:182677) Avail: NTIS HC A03/MF A01 CSCL 08B

A systematic approach for the identification of terrain media such as vegetation canopy, forest, and snow covered fields is developed using the optimum polarimetric classifier. The covariance matrices for the various terrain covers are computed from the theoretical models of random medium by evaluating the full polarimetric scattering matrix elements. The optimal classification scheme makes use of a quadratic distance measure and is applied to classify a vegetation canopy consisting of both trees and grass. Experimentally measured data are used to validate the classification scheme. Theoretical probability of classification error using the full polarimetric matrix are compared with classification based on single features including the phase difference between the VV and HH polarization returns. It is shown that the full polarimetric results are optimal and provide better classification performance than single feature measurements. A systematic approach is presented for obtaining the optimal polarimetric matched filter which produces maximum contrast between two scattering classes, each represented by its respective covariance matrix. Author

N88-21553 Institut National de la Recherche Agronomique, Paris (France).
MODELING SURFACE EXCHANGES: THE SOIL-VEGETATION-ATMOSPHERE CONTINUUM [MODELISATION DES ECHANGES DE SURFACE: CONTINUUM SOL-PLANTE-ATMOSPHERE]
A. D. PERRIER *In* CNES, Climatology and Space Observations p 423-456 Sep. 1987 In FRENCH
Avail: CEPADUES-Editions, 111 rue Nicolas-Vauquelin, 31100 Toulouse, France

The basic processes regulating the exchange of climatic factors are described in order to calculate climatic balances. The application of notions such as flow resistance and surface potential is suggested. It is shown that the soil-vegetation-atmosphere complex may be treated in space diversity as a single entity. The adopted method is based on the linearization of the temperature gradients. The applications discussed include a model of soil surface, a vegetation model, and equilibrium temperature determination. ESA

N88-22448# Environmental Protection Agency, Research Triangle Park, N.C. Atmospheric Sciences Research Lab.
ASSESSMENT OF CROP LOSS FROM AIR POLLUTANTS: METEOROLOGY-ATMOSPHERIC CHEMISTRY AND LONG RANGE TRANSPORT

A. P. ALTSHULLER Dec. 1987 49 p
(PB88-146857; EPA-600/D-87-366) Avail: NTIS HC A03/MF A01 CSCL 02C

The scales of intermediate and longer range transport influencing the atmospheric distribution of O3 are discussed. Atmospheric concentrations of O3 can vary substantially during each day, from day to day, and with the season of the year as well as with geographical location. In contrast to ozone, sulfur dioxide is a primary pollutant. Both the sources of SO2 and its mechanisms of removal can be much different than for ozone. Sulfur dioxide exposures tend to be of concern on a local rather than a regional scale. Author

N88-22452*# Alabama A & M Univ., Huntsville. Center for Application of Remote Sensing.
DEVELOPMENT OF REMOTE SENSING TECHNIQUES CAPABLE OF DELINEATING SOILS AS AN AID TO SOIL SURVEY Final Report, 1 Oct. 1984 - 1 Mar. 1986
T. L. COLEMAN and O. L. MONTGOMERY 12 Apr. 1988 28 p (Contract NAG13-3)
(NASA-CR-182610; NAS 1.26:182610; ACARS-123187) Avail: NTIS HC A03/MF A01 CSCL 08M

Eighty-one benchmark soils from Alabama, Georgia, Florida, Tennessee, and Mississippi were evaluated to determine the feasibility of spectrally differentiating among soil categories. Relationships among spectral properties that occur between soils and within soils were examined, using discriminant analysis. Soil spectral data were obtained from air-dried samples using an Exotech Model 20C field spectroradiometer (0.37 to 2.36 microns). Differentiating among the orders, suborders, great groups, and subgroups using reflectance spectra achieved varying percentages of accuracy. Six distinct reflectance curve forms were developed from the air-dried samples based on the shape and presence or absence of adsorption bands. Iron oxide and organic matter content were the dominant soil parameters affecting the spectral characteristics for differentiating among and between these soils. Author

N88-23315# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF ENERGY EMISSION FOR DETECTING THE NECESSITY OF IRRIGATION IN WHEAT IN FIELD CONDITIONS M.S. Thesis [USO DE ENERGIA EMITIDA, PARA DETECTAR NE CESSIDADE DE IRRIGACAO EM TRIGO, EM CONDICOES DE CERRADO]
RUBENS AUGUSTO CAMARGOLAMPARELLI Apr. 1988 99 p In PORTUGUESE; ENGLISH summary
(INPE-4461-TDL/318) Avail: NTIS HC A05/MF A01

Through the utilization of plant parameters (radiometric canopy temperature, T sub d, aerodynamic and canopy resistances) and meteorological data (air temperature, T sub A, global net radiation, R sub n, vapor pressure deficit in air, delta e), which are components of the Index (CWSI), the utility of this methodology is demonstrated to identify the plant water status and detect irrigation necessity. The objectives of this methodology were to: observe the T sub d behavior with irrigation levels; verify cloud and wind influences in the T sub d; and to observe the index (CWSI) behavior, as an indicative irrigation necessity. That experiment was performed in the Centro de Pesquisas Agropecuarias dos Cerrados (CPAC) and consists of three parcels with the following treatments: daily irrigation; irrigation (day 50 after the seedling growth); two irrigations (days 50 and 60 after seedling growth), in the booting period. At thirty-day intervals, T sub A, T sub d, R sub n, wind velocity, soil water potential data and plant parameters were collected daily. The results showed that the radiometric canopy temperature and the index (CWSI) had a relationship according to the treatments verified through the data. The wind influence was only observed in radiometric canopy temperature and cloud appearance provoked changes in the radiometric canopy temperature as well as in the index (CWSI). The qualitative analysis was possible only because of the small sensibility of some systems of measurement. Author

N88-23322# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETECTION, MONITORING AND ANALYSIS OF SOME ENVIRONMENTAL EFFECTS OF FIRES IN THE AMAZON REGION THROUGH UTILIZATION OF NOAA AND LANDSAT SATELLITE IMAGERY AND AIRCRAFT DATA M.S. Thesis [DETECCAO, MONITORAMENTO E ANALISE DE ALGUNS EFEITOS AMBIENTAIS DE QUEIMADAS NA AMAZONIA ATRAVES DA UTILIZACAO DE IMAGENS DOS SATELITES NOAA E LANDSAT, E DADOS DE AERONAVE]
MARCOS DACOSTAPEREIRA 1987 258 p In PORTUGUESE; ENGLISH summary
(INPE-4503-TDL/326) Avail: NTIS HC A12/MF A01

The purpose is to analyze, using orbital remote sensing as a main tool, some of the environment effects caused by combustion of large amounts of biomass in the Amazon forest. During the GTE/ABLE-2A, an experiment to measure trace gases and aerosols in the Amazon troposphere from July 19 to August 8, 1985, twenty-five images of the NOAA-8 and 9 satellites were recorded, in which many smoke plumes and fires of large dimensions were detected. After locating the areas most affected by the fires, LANDSAT/TM images of the same place were processed and the spectral characteristics of the fires and burned sites were studied with both satellites. With radiosounding data a trajectory analysis of the emissions were performed in order to study the long-range transport of pollutants. Based on aircraft sampling data from GTE/ABLE-2A an estimate was performed of the amounts of gases and aerosols produced by regional and global effects. Author

N88-24015*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR PENETRATION IN THE AMAZONIAN RAIN FOREST Abstract Only
ROBERTO PEREIRADACUNHA (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) and JOHN FORD *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 58 1986
Avail: NTIS HC A99/MF E03

Radar return from vegetation covered terrains is due to three components: the scattering resulting from the top surface of the vegetation canopy (surface scattering); the scattering which occurs within the vegetation layer (volume scattering); and the scattering which takes place at the surface below the vegetation canopy (ground scattering). Through the studies of selected areas in the Amazon Region a case is presented where most of the radar returns observed in radar imagery results from the scattering at the surface below vegetation layer (ground scattering). Thus, radar penetration occurred. Author

N88-24016# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
A PROPOSAL FOR A PROJECT ENTITLED ASSESSMENT OF FOREST RESOURCES IN URUGUAY SUBMITTED TO THE UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO) Abstract Only
RENE ANTONIO NOVAES, DAVID CHUNG LIANG LEE, PEDRO HERNANDEZ FILHO, ARMANDO PACHECODOSSANTOS, and FLAVIO JORGE PONZONI *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 59 1986
Avail: NTIS HC A99/MF E03

The main objective of this project is to collect basic forest information for the development, promotion, and utilization of alternative sources of energy through the use of national resources, and to determine the value of LANDSAT-TM data as an aid in efficient management of Uruguay's plantations. An additional objective is to train a Uruguayan technical team. Indications are given as to how each task will be accomplished and what techniques will be employed in performing main tasks such as: forest mapping and development of the map legends; map accuracy assessment and forest area correction; stand timber volume

evaluation; and field sampling and mensuration procedures. In addition, information was included concerning: project flow diagram; activity bar diagrams; and equipment required for task accomplishment. The required specific results of maps and timber volumes were mentioned. Author

N88-24023# Silsoe Coll., Bedford (England).
MAPPING SOIL AND ROCK VARIATION FROM SATELLITE IMAGES IN THE SAHEL Abstract Only
JOHN TAYLOR, ALAN BELWARD, DAVID HEWITT, and BARRY WYATT *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 131 1986
Avail: NTIS HC A99/MF E03

The use of the Soil Brightness Index (SBI) for mapping soil and rock variation in arid and semi-arid conditions with partial vegetation cover was investigated. The test site was near Kao in the Sahelian pasturelands of the Republic of Niger. Field visits were undertaken to characterize the range of cover types in the study area and to establish training areas which could be located on LANDSAT 5 MSS imagery. The main rock types were laterites in easily identifiable outcrops. Soils consisted of fractured laterite close to the outcrops progressing through various mixtures of clay outwash with laterite gravel to clay outwash furtherest from the outcrop. Spectral reflectance measurements of surface soils, rocks, and vegetation were made in the field using a portable seven-band radiometer. The relationship between relfectances of the bare soil and rock categories in the red and infrared wavebands was determined by linear regression. The equation of the soil line for the MSS image was used to calculate a transform equation to calculate the value of the SBI for each pixel of the Kao test area. Author

N88-24030# Paraiba Univ., Joao Pessoa (Brazil).
INDENTIFICATION OF SHALLOW GROUNDWATER REGIONS IN SEMI-ARID BRAZIL BY REMOTE SENSING METHODS Abstract Only
S. V. KAMESWARA SARMA *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p257 1986
Avail: NTIS HC A99/MF E03

Employing remote sensing techniques for identifying regions with shallow groundwater depths is a recent advance reported by Menenti (1984). In semi-arid and arid regions, the evaporation can be reliably determined by soil balance methods. A rugged crust overlying a 20 cm deep groundwater table or a smooth hard, very dry soil surface overlying a 1 m deep water table are examples that can be cited to establish the efficacy of this method. However, initial calibration by a thermal infrared radiometer or a neutron probe of ground reference points would be necessary to establish the required relationships for the interpretation of the data. The field data from observed piezometric heads would help in finding the detailed groundwater flow pattern. The large daily amplitudes of surface temperatures observed in soft friable surfaces where groundwater discharge occurs is taken advantage of in predicting the shallow groundwater regions. Using the soil water flow simulation model SWATR, relationships between shallow groundwater depth and ratio of actual to potential evaporation could be obtained. The potentially useful role of remotely sensed data to study the soil layering, surface energy balance, and evaporation of semi-arid and arid regions of north-east Brazil is stressed. Author

N88-24036# Sociedad Colombiana de Fotogrametria y Percepcion Remota, Bogota.
THE USE OF SLAR AND SIRA IMAGENES FOR THE CLASSIFICATION OF FOREST TYPEN IN TROPICAL RAIN FORESTS Abstract Only
LUIS CARLOS MOLINAMARINO *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 323 1986
Avail: NTIS HC A99/MF E03

The use of the three radar systems, two airborne (Westinghouse and Goodyear) and one spaceborne (SIR-A) for delineation and classification of biomass, ecosystem, and forest types in different ecological conditions of tropical rain forest in Columbia are described. The results are shown in a comparative form with respect to its use. The reflection of vegetation is analyzed in a comparative form with its advantages and limitations. Furthermore, this work presents the classification systems for tropical rain forests utilizing remote sensing imagery. Author

N88-24041# Universidad Nacional de Lujan (Argentina).
ESTIMATION OF AN AREA CULTIVATED WITH WHEAT FROM LANDSAT DATA THROUGH A TWO-PHASE SAMPLING METHOD Abstract Only [ESTIMACION DEL AREA CULTIVADA CON TRIGO A PARTIR DE DATOS LANDSAT MEDIANTE EL METODO DE MUESTREO EN DOS FASES]
CARLOS A. CAPPELLETTI and MARIA C. SERAFINI *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 357-360 1986 In SPANISH; ENGLISH summary
Avail: NTIS HC A99/MF E03

The objective is to estimate the cultivated area of wheat using combined ground and LANDSAT data through a two-phase sampling system with estimation of regression, fixed error rate, and minimum cost. The result obtained was 92.217 ha with a coefficient of variation of 8.93 percent. The results compared with the simulated system by a Monte Carlo technique presented an error (relative difference) of 1.73 percent. Author

N88-24042# Sao Paulo Univ. (Brazil). Escola Superior de Agricultura.
UTILIZATION OF TM/LANDSAT IMAGES IN THE IMPLANTED FORESTS MAPPING IN THE MOGI-GUACU REGION (SP-BRAZIL) [UTILIZACAO DE IMAGENS TM/LANDSAT NO MAPEAMENTO DE FLORESTAS IMPLANTADAS NA REGIAO DE MOGI-GUACU (SP-BRAZIL)]
CARLOS A. VETTORAZZI and HILTON T. Z. DOCOUTO *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 361-365 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

Through the visual interpretation of TM/LANDSAT images and field checking, the forest cover mapping was made of the Horto Mogi-Guacu (Mogi-Guacu-SP). The analysis of the obtained results led to the conculsion that the utilization of images from the spectral bands 3, 4, and 5 were efficient for the forest cover mapping, allowing the discrimination of seven different classes of occupation of the stands: stands being reformed; various native species; angico (Piptadenia spp); tropical pine; eucalypts up to one year old; eucalypts between one and two years old; and eucalypts over two years old. Author

N88-24043# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANOMALIES IN THE VEGETATION IN THE ALTO XINGU - MT [ANOMALIAS DE VEGETACAO NO ALTO XINGU - MT]
MARIA DELOURDESBUENOTRINDADE, ROBERTO PEREIRADACUNHA, and PEDRO HERNANDEZ FILHO *In its* Latin American Symposium on Remote Sensing 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 366-372 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The MSS and TM LANDSAT data showed anomalies in the vegetal cover in the transition between Amazonian rain forests and cerrado, Brazilian tropical savannah. The study was carried out in the Alto Xingu region (Mato Grosso state, Brazil). Through visual interpretation a map was made showing the spatial distribution of the anomalies in the study area. In order to do the multitemporal monitoring of the anomalies, a test area was selected and MSS images of two different dates were visually interpreted. Within the tests area, for these two dates, a thematic classification

through digital analysis was also carried out on the I-100 Image Analyzer. The auxiliary data used were color infrared photographs (scale 1:15,000) and field information. Author

N88-24044*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
RADAR PENETRATION IN THE AMAZONIAN RAIN FOREST
ROBERTO PEREIRADACUNHA (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) and JOHN P. FORD *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 373-374 1986
Avail: NTIS HC A99/MF E03

Radar return from vegetation covered terrains is due to three components: the scattering resulting from the top surface of the vegetation canopy (surface scattering); the scattering which occurs within the vegetation layer (volume scattering); and the scattering which takes place at the surface below the vegetation canopy (ground scattering). Through the studies of selected areas a case is presented where most of the radar return observed in radar imageries results from the scattering at the surface below the vegetation layer (ground scattering). Author

N88-24045# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REMOTE SENSING TECHNIQUES IN THE ESTIMATION OF THE AREA CULTIVATED WITH BEANS, CORN, AND CASTOR BEANS IN THE IRECE COUNTY (BAHIA STATE) [SENSORIAMENTO REMOTO NA ESTIMATIVA DA AREA PLANTADA COM FEIJAO, MILHO E MAMONA NO MUNICIPIO DE IRECE]
BERNARDO F. T. RUDORFF and THELMA KRUG *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 380-384 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The objective was to obtain an estimation of the areas cultivated with beans, corn, and castor beans in the Irece county (Bahia State) using statistical and remote sensing techniques. Using a topographic chart at a scale of 1:100,000 the county area was divided into approximately 2000 segments of 2 x 1 km. A random sample of 97 segments (corresponding to 5 percent of the target area) was considered. Over these segments aerial vertical photographs were obtained in the approximate scale of 1:40,000 by means of a 35 mm camera with a wide-angle of 28 mm focal length lens aboard a Cherokee-six aircraft. The projection of the aerial color photographs over 1:5000 cadastrial maps available in the region made it possible to extract the thematic information of the planted areas of interest. Subsequently an evaluation of the area cultivated with beans, corn, and castor beans was made. From the results the estimates (punctual and by interval) were obtained and the following results encountered: 87,759 ha with beans, 76,519 ha with castor beans, and 10,550 ha with corn. Author

N88-24046# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CANASATE: SUGAR CANE MAPPING BY SATELLITE [CANASATE - MAPEAMENTO DA CANA-DE-ACUCAR POR SATELITE]
FRANCISCO JOSE MENDONCA *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 385-393 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The CANASATE Project, sugarcane mapping by satellite, has the objective of obtaining the spatial distribution and area estimation of sugarcane plantations, at national level, using remote sensing techniques. To achieve this objective, Brazil was divided into three areas: Area 1, which includes Rio de Janeiro, Sao Paulo, and Parana states; Area 2, which includes Alagoas, Pernambuco, Paraiba, and Rio Grande do Norte states; and Area 3, which includes Minas Gerais, Espirito Santo, Goias, and Mato Grosso do Sul states. The results show that Area 1 represents approximately 60 percent of the national sugarcane plantations. Twenty-three thematic maps on the scale of 1:250,000 were obtained using LANDSAT MSS or TM images of 1983 and 1984. The results were: 236,635 ha in Rio de Janeiro state; 2,158,000 ha in Sao Paulo state; and 135,859 ha in Parana state. The overal average accuracy on the estimation was 91 percent. Author

N88-24047# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SPECTRAL BEHAVIOR OF CROPS THROUGH ANALYSIS OF LANDSAT-TM DATA [COMPORTAMENTO ESPECTRAL DE CULTURAS A PARTIR DA ANALISE DE DADOS DO LANDSAT TM]
SHERRY CHOU CHEN, JEAN FRANCOIS DALLEMAND, and DANIEL ALFREDO ROSENTHAL *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 394-401 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The LANDSAT-TM digital data of January 19, 1985, were requested for a 15 x 15 km area near Maringa, Parana State to study spectral response of agricultural crops of soybeans, corn, and sugarcane. Study results show that correlations were found between spectral data of visible bands (band 1, 2, and 3) and infrared bands (band 4 vs 5 and band 5 vs 7). Among the six TM bands analyzed, bands 4 and 5 contained more information than the others. For crop discrimination using single TM bands, band 4 was the best even though differentiations of soybeans from non-soybeans was possible in bands 5 and 7. These preliminary results indicate not only the potential of LANDSAT-TM data for crop discrimination, but also differentiations of sugarcane varieties and the soybean biomass. Author

N88-24048# Empresa Brasileiro de Pesquisa Agropecuaria, Planaltina.
IDENTIFICATION OF AREAS CULTIVATED WITH SOYBEANS IN THE CERRADOS REGIONS, THROUGH DIGITAL PROCESSINGOF SATELLITE IMAGES: A METHODOLOGICAL APPROACH [IDENTIFICACAO DE AREAS CULTIVADAS COM SOJA NOS CERRADOS, ATRAVES DO PROCESSAMENTO DIGITAL DE IMAGENS DE SATELITE: UM APORTE METODOLOGICO]
PAULO JORGE ROSACARNEIRO *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 402-417 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

Soybean growing recently introduced in the cerrado region, has shown exceptional growth in areal extent every year. Digital processing of LANDSAT images makes it possible to accompany this evolution with efficiency, providing precise data such as area planted and expected yield, of great use in planning actions necessary for strengthening this sector. Author

N88-24049# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STRUCTURE AND DYNAMICS OF VEGETATION IN THE MIDDLE SEMI-ARID TROPICS. QUIXABA'S CAATINGA (PE): TERRAIN ANALYSIS OF MSS/LANDSAT DATA [ESTRUTURA E DINAMICA DA VEGETACAO EM MEIO TROPICAL SEMI-ARIDO. A CAATINGA DE QUIXABA (PE): DO TERRENO A ANALISE DE DADOS MSS/LANDSAT]
VITOR CELSODECARVALHO *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 418-426 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

Estimation of practibility and limits of MSS/LANDSAT data for monitoring and the control of the tropical semi-arid ecosystems from a test region of Brazilian Nordeste, north of Petroline-PE (Quixaba) and their vegetal cover are presented. A structural classification of the vegetation is developed and applied. Then, a

1:100,000 scale structural mapping, drawn from the 1955, 1965, and 1983 aerial photographs, allows structural characterization and dynamic evaluation of the Quixabas Caatinga. The power discrimination of the images from four MSS/LANDSAT scenes (1973, 1974, and 1983-2) numerical processing, are estimated, by comparison to vegetation structure maps: while in these maps, 15 thematic classes are distinguished, only 7 are available on the classified picture (maximum). Author

N88-24072# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INTERPRETATION OF MSS/LANDSAT DATA FOR EVALUATION OF PHYSICAL DISTRIBUTION OF MANGROVES IN CANANEIA-IGUAPE (SP) [INTERPRETACAO DE DADOS MSS/LANDSAT PARA AVALIAR A DISTRIBUICAO FISICA DOS MANGUEZAIS DE CANANEIA-IGUAPE (SP)]
CARMEN REGINA SILVEIRAESPINDOLA *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 604-614 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

Mangrove is considered responsible for the high productivity of biological and ecological coastal systems. However, it is unknown and strongly destroyed, requiring appropriate research techniques to provide fast and cheap procedures for its identification. Remote sensing techniques using digitally processed satellite data, were found to be valuable not only for its low cost, but also for its overall view. The objective is to evaluate the physical distribution of Cananeia-Iguape mangroves using MSS-LANDSAT image processing and correlate it with radar images and aerial photographs. A statistical classification performed by algorithms used by the Multispectral Interactive Image Analyzing System (IMAGE-100) provided a thematic map with 13 mangrove units from which areas were calculated and correlated with areas obtained from panchromatic aerial photographs and from radar images. The results indicate very high linear correlation coefficients ($r = 0.99$) which showed that the use of MSS-LANDSAT products are good enough to spectrally separate mangroves from other soil cover types. Author

N88-24075# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF AN ESTIMATION SYSTEM FOR AN IRRIGATED AREA IN A TROPICAL REGION THROUGH TM-LANDSAT IMAGERY [AVALIACAO DE UM SISTEMA DE ESTIMATIVA DE AREA IRRIGADA EM REGIAO TROPICAL ATRAVES DE IMAGENS TM-LANDSAT]
SHERRY C. CHEN, EVLYN M. LEAO NOVO, SERGIO DOSANJOS F. PINTO, MARIO VALERIO FILHO, and ROBERTO ROSA (Universidade Federal de Uberlandia, Brazil) *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 630-637 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

A joint project of the Sao Paulo State Department of Water and Energy (DAEE) and INPE was performed to evaluate the possibility of using LANDSAT-TM imagery for irrigated area estimation in the water basin of Piracicaba. Successful studies were reported in the semi-arid region where the identification of irrigated areas using remotely sensed data obtained during the dry season is relatively trivial due to the presence of green biomass. However, in the tropical environment, there is no well defined dry period and the cropping and irrigation systems are diversified, these factors make the task of estimating irrigated areas difficult. Two methods were proposed to estimate irrigated areas: direct expansion of field information collected in sampled segments when LANDSAT data are not available and regression estimation using ground-gathered data of sampled segments and multidate LANDSAT false color images. Study results show that when the LANDSAT data were used and incorporated to ground information of the randomly selected segments, a reduction of 94.02 percent in variance of the estimated acreage was achieved compared to that obtained using the approach of direct expansion. The advantages and limitations of using LANDSAT data to estimate irrigated areas in tropical climates are also presented. Author

N88-24086# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF THE MANGROVE AREA AT THE PIAUI RIVER (SE) THROUGH REMOTE SENSING [AVALIACAO DAS AREAS DE MANGUEZAL DO RIO PIAUI (SE) ATRAVES DE SENSORIAMENTO REMOTO]
MYRIAN DEMOURAABDON, CARMEN REGINA S. ESPINDOLA, DALTON DEM. VALERIANO, ERNESTO GETULIOMVIEIRA, ALBERTO W. SETZER, AUXILIADORA MARIA SANTOS, and YARA SCHAEFFER NOVELLI (Sao Paulo Univ., Brazil) *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 710-713 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The purpose is to estimate the areas of mangroves at the estuary of the River Piaui (SE) with remote sensing techniques, and also to evaluate any degradation of these areas associated with the growing industrialization in the region. Aerial panchromatic photos in the 1:25,000 scale from December 20, 1984, were used to produce a ground truth map where mangrove areas were identified from other ground cover features. Digital multispectral and multitemporal analysis of MSS/LANDSAT (March 26, 1979) and TM/LANDSAT (July 19, 1984) imagery produced thematic maps of the region, which showed that no significant clearing occurred in the mangrove areas for the 1979 and 1984 period. Author

N88-24087# Universidade Federal de Parana, Curitiba (Brazil).
THE 35 MM VERTICAL AERIAL PHOTOGRAPHS FOR MAPPING STANDS OF BRACATINGA IN DIFFERENT AGE CLASSES [FOTOGRAFIAS AERAS VERTICAIS 35 MM PARA MAPEAR POVOAMENTOS DE BRACATINGA EM DIFERENTES IDADES]
ATTILIO ANTONIO DISPERATI, NELSON CARLOS ROSOT, and JOAO ROBERTODOSSANTOS *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing symposium and 6th SELPER Plenary Meeting, Volume 1 p 716-723 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The value of 35 mm vertical aerial photographs used to identify and map Mimosa scabrella Benth (bracatinga) in different age classes is shown. It was possible to differentiate three age classes of bracatinga using the elements of image interpretation. Complemented by field work and dendrometric measurements on the stands, it was possible to discriminate on the photographs of all seven of the different ages of stands in the area. From the resulting photointerpretation map, the area of bracatinga stands in the study area was found. For comparison, the number of bracatinga crowns in plots on 1:3,000 aerial photographs were counted and compared with the data collected in the field. The best results were found for the stands between four to six years of age. Author

N88-24089# Universidad Nacional de San Juan (Argentina).
THE BREAKED ANTICLINES, CUESTA AND CREST HOMOCLINES, ORTOCLINAL VALLEYS, AND OTHER FORMS OF RELIEF OUTCROPS DELINEATED WITH THE HELP OF REMOTE SENSING IMAGERY [ANTICLINALES APORTILLADOS, CUESTAS Y CRESIAS HOMOCLINALES, VALLES ORIOCLINALES Y OTRAS FORMAS DE RELIEVES PLEGADOS DELIMITADOS CON AYUDA DE IMAGENS DE SENSORES REMOTES]
GRACIELA M. SUVIRES *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 733-738 1986 In SPANISH; ENGLISH summary
Avail: NTIS HC A99/MF E03

A regional geomorphological map was obtained, in the scale

of 1:250,000 from analysis and interpretation of satellite imagery. This map shows many landscapes of relief elaborated over folded outcrops. The Breaked anticlines of Guayaguas-Catantal and Las Quijadas, cuesta and crest homoclinal, orthoclinal, and transversal valley are the main landforms. Author

N88-24091# Universidade Federal de Parana, Curitiba (Brazil). Departamento de Silvicultura e Manejo.
STEREOSCOPIC PHOTOGRAPHS, GROUND AND AERIAL, OF TREES USED IN THE ARBORIZATION OF CURITIBA (PR) [FOTOGRAFIAS ESTEROSCOPICAS, TERRESTRES E AEREAS, DE ARVORES UTILIZADAD NA ARBORIZACAO DE CURITIBI - PR]
ATTILIO ANTONIO DISPERATI and CARLOS VELLOZO RODERJAN *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 757-763 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

This paper deals with the acquisition of 35 mm ground stereo photographs using one camera. The usual trees in the arborization of Curitiba were photographed in two different seasons of the year. Technical and practical aspects related with the acquisition and stereo observation are discussed. The ground stereo-pairs and aerial stereo-pairs, recently acquired from a photogrammetry survey, were introduced in the practical classes of Forest Photointerpretation and Dendrology and the reactions of the students were extremely favorable. Author

N88-24092# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MAPPING OF PLANT ASSOCIATIONS AND THE VARIATION OF SURFACE WATER IN THE PANTANAL MATO-GROSSENSE NATIONAL PARK, THROUGH REMOTE SENSING TECHNIQUES [MAPEAMENTO DAS FORMACOES VEGETAIS E DA VARIACAO DA LAMINA DAGUA NO PARQUE NACIONAL DO PANTANAL MATO GROSSENSE, ATRAVES DE TECNICAS DE SENSORIAMENTO REMOTO]
DAGOBERTO SILVA and HERMANN J. H. KUX *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 764-771 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The objective was to map the plant associations and the variation of the water surface in the Pantanal Mato-grossense National Park, using remote sensng techniques. Color infrared aerial photographs and MSS-LANDSAT digital data were used. Using aerial photographic interpretation techniques, the following vegetation units were identified: semideciduous seasonal alluvial forest, vegetation of transition, and seasonally flooded grasslands. During the digital processing (supervised classification) of the MSS-LANDSAT data, the seasonally flooded grasslands unit was considered as two under classes, due to the relationship between spectral response and soil moisture. The utilization of a SLICER algorithm at the MSS-LANDSAT 7 band allowed mapping of the area covered with water in flooded and dry seasons. Author

N88-24093# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PRELIMINARY STUDY ON THE APPLICATION OF DIGITAL PROCESSING OF TM-LANDSAT DATA IN THE MAPPING OF APPLE ORCHARDS IN FRAIBURGO (SC) [ESTUDO PRELIMINAR SOBRE A APLICACAO DE PROCESSAMENTO DIGITAL DE DADOS TM-LANDSAT NO MAPEAMENTO DE POMARES DE MACA EM FRAIBURGO, SC]
JOSE ROBERTO PROVESI, DALTON DEMORISSON VALERIANO, and THELMA KRUG *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 772-784 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

An evaluation of the discriminability of apple orchards from other land uses in the county of Fraiburgo, SC, was attempted through digital analysis of TM-LANDSAT data. The ground truth was a panchromatic aerial survey acquired in September, 1979 (1:20,000) and a ground verification realized in January, 1986; the TM-LANDSAT data (221/79A, December, 1984, bands TM: 2, 3, 4, and 7) were analyzed in the Image-100 System (1:25,000). A hybrid digital classification was employed in the study area. Eight spectral classes were obtained through the K-Means algorithm (non-supervised). These were further divided into eighteen supervised classes by the MAXVER algorithm, comprising eight informative classes: pinus, forest, apple, prepared soil, pasture, water, wetlands, and urban areas. The analysis of the classes localized in the space of attributes TM-3 x TM-4 indicated that the three supervisoned classes for apple overlaped with the forest, pasture, and wetlands classes. These confusions were attributed to differences in the management of the orchards and the age of the apple parcels (from 5 to 20 years). A multitemporal approach, which better explores the phenological characteristics of apple is suggested so as to better discriminate this class from other land uses. Author

N88-24095# Sao Paulo Univ. (Brazil). Escola Superior de Agricultura.
CHARACTERISTICS OF DRAINAGE DETERMINATIONS IN AERIAL PHOTOGRAPHS AND RELIEF DETERMINATION ON DIFFERENT SCALES PLANIALTIMETRIC CHARTS FOR THREE SOILS IN THE STATE OF SAO PAULO [CARACTERISTICAS DA DRENAGEM DETERMINADAS EM FOTOGRAFIAS AEREASE DO RELEVO DETERMINADAS EM CARTAS PLANIALTIMETRICAS DE ESCALAS DIFERENTES PARA TRES SOLOS DO ESTADO DE SAO PAULO]
R. ANGULOFILHO, V. A. DEMETRIO, and G. V. DEFRANCA *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 792-798 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

Based on the interpretation of vertical aerial photographs on a 1:35,000 scale, the characterization was made of the drainage standards from three different soils of the State of Sao Paulo (red-yellow latosol, red-yellow podzol, and litosol) and the variation was determined for the relief indices obtained from planialtimetric charts on different scales. Each soil unit was represented by three circular samples of 10 sq km. From tracing the drainage networks on the vertical aerial photographs, quantitative indices for the drainage standards were determined for the circular samples. The relief indices were obtained from the circular samples traced on the different scales planialtimetric charts (1:10,000 and 1:50,000). Subsequently, the values for the relief indices obtained from the two charts were compared to determine their variation. Author

N88-24096# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF TM FALSE COLOR COMPOSITES FOR CROP DISCRIMINATION [AVALIACAO DE COMPOSICOES COLIDAS TM FALSA COR PARA A DISCRIMINACAO DE CULTURAS]
CHOU CHEN SHERRY and ANGELA MARIA DELIMA *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 799-804 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

Visual interpretation of LANDSAT imagery is frequently used in natural resources studies instead of the sophisticated digital analysis which is more expensive and requires expertise. To form false color composites, three LANDSAT bands are needed, generally bands 4, 5, and 7 are used for the 4 band LANDSAT-MSS data. However, the selection of three bands from the available 7 TM bands is not an easy task; because there are 210 possible combinations of the selected three bands with the three prime colors. In this study three different criteria for band selection: entropy, the optimum index factor, and the principal component were used. After band selection, color composites were compared

visually to verify discrimination of soybeans, corn, and sugar cane. Study results show that there was no apparent superiorities of visual differentiation among crop types for the color composites selected by any of the studied criteria over the conventional composites using bands 2, 3, and 4. It is concluded that the conventional false color composite should be used for crop discrimination, because no additional training of photointerpreter on the color-surface target relationship is needed. Author

N88-24109*# Pennsylvania State Univ., University Park. Dept. of Meteorology.
AN UPDATE ON REMOTE MEASUREMENT OF SOIL MOISTURE OVER VEGETATION USING INFRARED TEMPERATURE MEASUREMENTS: A FIFE PERSPECTIVE
Semiannual Status Report, Mar. 1987 - Mar. 1988
TOBY N. CARLSON Jun. 1988 29 p
(Contract NAG5-919)
(NASA-CR-182926; NAS 1.26:182926) Avail: NTIS HC A03/MF A01 CSCL 08B

Using model development, image analysis and micro-meteorological measurements, the object is to push beyond the present limitations of using the infrared temperature method for remotely determining surface energy fluxes and soil moisture over vegetation. Model development consists of three aspects: (1) a more complex vegetation formulation which is more flexible and realistic; (2) a method for modeling the fluxes over patchy vegetation cover; and (3) a method for inferring a two-layer soil vertical moisture gradient from analyses of horizontal variations in surface temperatures. HAPEX and FIFE satellite data will be used along with aircraft thermal infrared and solar images as input for the models. To test the models, moisture availability and bulk canopy resistances will be calculated from data collected locally at the Rock Springs experimental field site and, eventually, from the FIFE project. Author

N88-25134*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
HISTORY OF WILDLAND FIRES ON VANDENBERG AIR FORCE BASE, CALIFORNIA
DIANA E. HICKSON (Bionetics Corp., Cocoa Beach, Fla.) Mar. 1988 39 p
(Contract NAS10-10285)
(NASA-TM-100983; BIO-1; NAS 1.15:100983) Avail: NTIS HC A03/MF A01 CSCL 06C

The fire history of the past 50 years for Vandenberg AFB, California was determined using aerial photography, field investigation, and historical and current written records. This constitutes a record of the vegetation age classes for the entire base. The location, cause, and fuel type for sixty fires from this time period were determined. The fires were mapped and entered into a geographic infomation system (GIS) for Vandenberg. Fire history maps derived from this GIS were printed at 1:9600 scale and are on deposit at the Vandenberg Environmental Task Force Office. Although some ecologically significant plant communities on Vandenberg are adapted to fire, no natural fire frequency could be determined, since only one fire possibly caused by lightning occurred in the area now within the base since 1937. Observations made during this study suggest that burning may encourage the invasion of exotic species into chaparral, in particular Burton Mesa or sandhill chaparral, an unusual and geographically limited form of chaparral found on the base. Author

02

ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

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

A88-33770* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
MONITORING THE ENVIRONMENT BY REMOTE SENSING
WALTER E. WESTMAN (NASA, Ames Research Center, Moffett Field; California, University, Berkeley) Trends in Ecology and Evolution (ISSN 0169-5347), vol. 2, Nov. 1987, p. 333-337. refs

Structural features of ecosystems, such as leaf area index, phytomass and canopy chemical contents, are beginning to be estimated from remotely sensed data. This development, in combination with ecological modeling, is permitting the estimation of functional features of ecosystems including primary productivity and nutrient cycling. Such techniques are also being applied to the problem of monitoring the effects of air or water pollutants on biota. Sensors that obtain data at a coarse spatial scale (1 km2 or more) are also permitting the observation of biospheric patterns at a large regional or global scale for the first time. When coupled with atmospheric measurements, field data and simulation models, such data may serve to address ecological processes, including pollution effects, at large regional or global scales. Author

A88-36243#
LONG-TERM AIR QUALITY MONITORING AT THE SOUTH POLE BY THE NOAA PROGRAM GEOPHYSICAL MONITORING FOR CLIMATIC CHANGE
E. ROBINSON (Mauna Loa Observatory, Hilo, HI), B. A. RODHAINE, W. D. KOMHYR, S. J. OLTMANS (NOAA, Air Resources Laboratory, Boulder, CO), L. P. STEELE (Cooperative Institute for Research in Environmental Sciences, Boulder, CO) et al. Reviews of Geophysics (ISSN 8755-1209), vol. 26, Feb. 1988, p. 63-80. refs

The objectives of the NOAA program of Geophysical Monitoring for Climatic Change (GMCC) for the South Pole include measurements of atmospheric changes which can potentially impact climate. This paper discusses the long-term GMCC South Pole air chemistry data for carbon dioxide, total ozone, surface ozone, methane, halocarbons, nitrous oxide, and aerosol concentrations, comparing the findings with GMCC data for other regions. Special consideration is given to the results of recent GMCC ozonesonde operations and to an asessment of Dobson ozone spectrophotometer data taken at South Pole by NOAA since 1964. Data are discussed in the framework of Antarctic 'ozone hole' phenomenon. I.S.

A88-39094
URBANIZATION AND LANDSAT MSS ALBEDO CHANGE IN THE WINDSOR-QUEBEC CORRIDOR SINCE 1972
ALAIN ROYER, LISE CHARBONNEAU, and FERDINAND BONN (Sherbrooke, Universite, Canada) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 555-566. Research supported by the Ministere de l'Education du Quebec. refs
(Contract NSERC-A-8643; NSERC-A-5252)

A88-41961
REMOTE SENSING FOR RESOURCES DEVELOPMENT AND ENVIRONMENTAL MANAGEMENT; PROCEEDINGS OF THE SEVENTH INTERNATIONAL SYMPOSIUM, ENSCHEDE, NETHERLANDS, AUG. 25-29, 1986. VOLUMES 1, 2, & 3
M. C. J. DAMEN, ED., G. SICCO SMIT, ED., and H. TH. VERSTAPPEN, ED. (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) Symposium sponsored by the International Society of Photogrammetry and

Remote Sensing (Commission VII) and Netherlands Remote Sensing Board. Rotterdam, A. A. Balkema, 1986, p. Vol. 1, 562 p.; vol. 2, 414 p.; vol. 3, 115 p. For individual items see A88-41962 to A88-42070.

Papers and working group conclusions and recommendations are presented concerning the use of remote sensing for resources development and environmental management in the fields of visible and infrared data, microwave data, spectral signatures of objects, renewable resources in rural areas, nonrenewable resources, hydrology, human settlements, and geoinformation systems. Topics covered include methods of image and data processing and classification, the use of remote sensing for geological analysis, satellite mapping of vegetation, forestry, agriculture, soil survey, and land and water use. The use of remote sensing in geomorphology, oceanography and engineering projects, satellite observation of surface water, coastal zones, ice and snow, and remote sensing for urban surveys, human settlement analysis, and archeology, and the analysis of data obtained by Landsat, SIR-A, SIR-B, SLAR, and SPOT systems are also discussed. R.B.

A88-41972
CLASSIFICATION OF LAND FEATURES, USING LANDSAT MSS DATA IN A MOUNTAINOUS TERRAIN

H. TAHERKIA and W. G. COLLINS (Aston, University, Birmingham, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 87-91.

This paper evaluates Landsat MSS data in a hostile terrain located in central Alborz, north of Iran. Correlation of the Three bands of the image were evaluated, and separation of different ground features was examined. Training areas of different categories were located on the image using field work. Data from the training areas then were manipulated to eliminate unwanted pixels. Mean and standard deviation of the categories were calculated and data which fell in the range of three standard deviations was selected. For the execution of the training areas a selected subscene was chosen and then classified. Author

A88-42000
MONITORING OF RENEWABLE RESOURCES IN EQUATORIAL COUNTRIES

R. VAN KONIJNENBURG (Nederlands Instituut voor Vliegtuigontwikkeling en Ruimtevaart, Delft, Netherlands) and MAHSUM IRSYAM (Indonesian National Institute of Aeronautics and Space, Jakarta, Indonesia) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 335-340. refs

Studies have been conducted on the feasibility of a joint Indonesian-Netherlands project for the development and operation of a dedicated Tropical Earth Resources Satellite (TERS) system. The studies confirm the need for an earth-observation system with a high temporal and geometric resolution to provide the capability of monitoring the renewable resources in equatorial countries. The result of cloud studies indicates that the requirement for a high temporal resolution cannot be met by a satellite in polar orbit. An equatorial orbit, however, can meet this requirement. In the course of the studies the user requirements for such a tropical earth-observation satellite were elaborated. Based on these requirements a baseline design was conceived. 'Key applications' have been identified, which would typically need a TERS system and which are of sufficient importance from a benefits point of view. The two most important fields of application are agriculture and forestry. Analysis of these key applications indicate profits in excess of yearly cost. It has been recognized that it will be necessary to ascertain that by the time TERS becomes operational an adequate infrastructure for the utilization of such a system will be available. For that purpose the preliminary outlines of a rice production monitoring system and of a TERS utilization preparation plan have been established. Author

A88-42018
OPERATIONAL SATELLITE DATA ASSESSMENT FOR DROUGHT/DISASTER EARLY WARNING IN AFRICA - COMMENTS ON GIS REQUIREMENTS

HUBERTUS L. BLOEMER, SCOTT E. NEEDHAM (Ohio University, Athens), and LOUIS T. STEYAERT (NOAA, National Environmental Satellite Data and Information Service, Columbia, MO) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 561-568. refs

An operational climate impact assessment system for improved drought/disaster early warning in semi-arid regions of Africa using daily NOAA polar orbiting AVHRR satellite data in combination with ten-day rainfall reports from ground stations throughout the region has been developed. Assessments are prepared using a 'light table' Geographic Information System (GIS) approach for map/image overlay and statistical time series analysis. The assessment process and hardware and software considerations to meet the needs of the spatial analyst are discussed. Remote sensing data processing and GIS capabilities are assessed according to various data handling proficiency and applicability of data, including available computer systems. R.B.

A88-42020
GLOBAL DISTRIBUTIVE COMPUTER PROCESSING SYSTEMS FOR ENVIRONMENTAL MONITORING, ANALYSIS AND TREND MODELING IN EARLY WARNING AND NATURAL DISASTER MITIGATION

J. O. BRUMFIELD (Marshall University, Huntington, WV) and H. H. L. BLOEMER (Ohio University, Athens) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 573-577. refs

Hierarchical levels of environmental data availability and processing capabilities are discussed and illustrated for the following global configuration of components based on experimental design results: (1) national analysis and early warning workstations, (2) international regional processing nodes, (3) international data and processing facilities, and (4) global telecommunication networking for computers and early warning systems. Inasmuch as the components of computer hardware/software systems and source data are spatially distributed on a global scale, workstations and nodes must be able to communicate effectively (analog and/or digital) to maximize information exchange and decision making potential on a national or regional basis. Further information/data from global data bases are often necessary to supplement or augment locally or regionally derived information (e.g., climate data from NOAA and NASA and WMO and AVHRR and/or GOES data from NOAA. Author

A88-42031
REMOTE SENSING ASSESSMENT OF ENVIRONMENTAL IMPACTS CAUSED BY PHOSPHAT INDUSTRY DESTRUCTIVE INFLUENCE

S. C. MULARZ (Akademia Gorniczo-Hutnicza, Krakow, Poland) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 639-644. refs

A number of remote sensing techniques, such as color aerial photography, black and white aerial photography and thermal imaging have been used to detect adverse environmental impacts associated with the location of the phosphogypsum dump area. As an effect of processing and interpreting remotely sensed data, assessments of water pollution, solid waste disposal impacts on toe-failure deformation zones and the degree of vegetation cover damages, have been specified. Results of experiments indicate that remote sensing methods are an irreplaceable tool to solve environmental monitoring, as well as planning problems. Wide-area repetitive coverage by remote sensors provides information which

is not readily available by conventional measuring techniques. Author

A88-42032
REMOTE SENSING FOR SURVEY OF MATERIAL RESOURCES OF HIGHWAY ENGINEERING PROJECTS IN DEVELOPING COUNTRIES
R. L. NANDA (Nigerian Building and Road Research Institute, Lagos) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 645-650. refs

The use of remote sensing techniques for highway engineering projects in developing countries for determining route location and highway pavement performance and for survey of material resources, especially sub-surface calcrete, is discussed. In India and Nigeria, remote sensing techniques have been limited to black and white aerial photographs, SLAR imagery, and Landsat imagery. It is found that air photo interpretation provides an accurate and expeditious means of conducting survey of highway material resources, even if the region is inaccessible, although both SLAR and Landsat imageries lack the three-dimensional view of terrain essential for the interpretation of sub-surface calcrete. R.B.

A88-42056
AN ANALYSIS OF REMOTE SENSING FOR MONITORING URBAN DERELICT LAND
E. C. HYATT, J. L. GRAY, and W. G. COLLINS (Aston, University, Birmingham, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 817-822. refs

The use of aerial photography and the potential of Thematic Mapper satellite imagery for monitoring urban derelict land areas are considered. Aerial photography is revealed to be an accurate assessor of derelict and waste land sites at a mapping scale of 1: 10,000, comparing favorably, and being compatible with trends determined by local authorities. The role of satellite data and their problems and prospects are reviewed in the context of urban area studies. Author

A88-42057
HUMAN SETTLEMENT ANALYSIS USING SHUTTLE IMAGING RADAR-A DATA - AN EVALUATION
C. P. LO (Georgia, University, Athens) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 841-845. refs

The detectability of human settlements from Shuttle Imaging Radar-A images was determined with reference to the radar system geometry and physical and cultural characteristics of the environment in four specific geographic regions of the United States represented in five strips of images. The usefulness of the settlement area data directly measured from the images for population estimation was also evaluated. It was concluded that Shuttle Imaging Radar-A data could produce accurate population estimates of individual settlements and complement other forms of high-resolution space data in human settlement analysis. Author

A88-42058* Lockheed Missiles and Space Co., Sunnyvale, Calif.
SPATIAL RESOLUTION REQUIREMENTS FOR URBAN LAND COVER MAPPING FROM SPACE
WILLIAM J. TODD (Lockheed Missiles and Space Co., Inc., Sunnyvale, CA) and ROBERT C. WRIGLEY (NASA, Ames Research Center, Moffett Field, CA) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 881-886. refs

Very low resolution (VLR) satellite data (Advanced Very High Resolution Radiometer, DMSP Operational Linescan System), low resolution (LR) data (Landsat MSS), medium resolution (MR) data (Landsat TM), and high resolution (HR) satellite data (Spot HRV, Large Format Camera) were evaluated and compared for interpretability at differing spatial resolutions. VLR data (500 m - 1.0 km) is useful for Level 1 (urban/rural distinction) mapping at 1:1,000,000 scale. Feature tone/color is utilized to distinguish generalized urban land cover using LR data (80 m) for 1:250,000 scale mapping. Advancing to MR data (30 m) and 1:100,000 scale mapping, confidence in land cover mapping is greatly increased, owing to the element of texture/pattern which is now evident in the imagery. Shape and shadow contribute to detailed Level II/III urban land use mapping possible if the interpreter can use HR (10-15 m) satellite data; mapping scales can be 1:25,000 - 1:50,000. Author

A88-42059
SPECTRAL CHARACTERIZATION OF URBAN LAND COVERS FROM THEMATIC MAPPER DATA
DOUGLAS J. WHEELER (Utah State University, Logan) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 893-898. refs

Using Salt Lake City, Utah, as a test case, this study evaluates the capabilities of Landsat 5 Thematic Mapper (TM) digital data for distinguishing urban land cover materials. This was accomplished by using a newly developed hierarchical clustering algorithm which statistically derived spectral classes from TM channels 2, 3, 4, and 5 (visible, near infrared and middle infrared). The relationships between spectral groups were further analyzed using three statistical evaluations: principal components analysis, cluster analysis, and discriminant analysis. Through the use of component scores, cluster linkage diagrams, and canonical discriminant function scatter plots; as well as TM spectral curves, aerial photography, and ground investigation; the spectral classes were grouped into twelve predetermined land cover categories. The accuracy of classification was assessed at approximately 80 percent (0.05 significance level). A significant improvement in classification accuracy (91.5 percent) was achieved by stratifying the multispectral classification with thresholds from the TM thermal channel introduced as ancillary data. Author

A88-42062
RECORDING RESOURCES IN RURAL AREAS
RICHARD K. BULLARD (National Remote Sensing Centre, Chelmsford, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 913-916.

The use of high resolution satellite imagery in conjunction with conventional imagery to record resources in rural areas for use in multipurpose cadastre (MPC) is discussed. The use of the DTM allows the resources of a land parcel to be considered in three-dimensions. Satellite imagery can be used to detect resources both above and below ground. The MPC can serve as a data base for storing rural resources, aiding in reapportionment and development of rural areas. R.B.

A88-42063
EVALUATION OF REGIONAL LAND RESOURCES USING GEOGRAPHIC INFORMATION SYSTEMS BASED ON LINEAR QUADTREES
JAMES HOGG, MARK GAHEGAN, and NEIL STUART (Leeds University, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 917-925. Research supported by the University of Leeds. refs

Evaluation of regional land resources involves the integration and analysis of geographic data which comes from a variety of different sources and in many different forms. This paper describes results of a pilot study using a computerized geographic informations system (GIS) based on linear quadtrees to integrate and analyze geographic data for evaluation of regional land resources near Matlock in the Peak District Derbyshire, England. Results are presented which show the reponse to queries involving set logic operations on binary raster images and are discussed in relation to methods of regional land resources evaluation. The paper concludes that GIS based on linear quadtrees provide a flexible, powerful analytical tool for geographical research involving integration of geographic data from various sources, including remote sensing. Author

A88-42064
A COMPREHENSIVE LRIS OF THE KANANASKIS VALLEY USING LANDSAT DATA
G. D. LODWICK, S. H. PAINE, M. P. MEPHAM, and A. W. COLIJN (Calgary, University, Canada) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 927-932. refs

This paper describes the design and development of a general land-related information system (LRIS) covering the upper Kananaskis Valley of south western Alberta. Landsat data provide information on surface cover, principally vegetation, as well as on land use. In addition, a range of overlays of thematic data obtained from conventional sources, such as geology, topography, snow-cover, hydrology and pedology, is being added to the LRIS. The land information is stored on a VAX 11/750 computer system using VAX/DBMS a CODASYL compliant network data base system. The primary key is the position-based data defined by the geographic coordinates of the various data types. Information retrieval by various secondary keys is possible. As well, topological relationships have been incorporated into the LRIS design allowing data retrieval in both graphical and tabular form. Author

A88-42065
LAND RESOURCE USE MONITORING IN ROMANIA, USING AERIAL AND SPACE DATA
N. ZEGHERU (Institute of Geodesy, Photogrammetry, Cartography and Land Management, Bucharest, Rumania) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 953-956. refs

A88-42069
THE INTEGRATION OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEMS
DAVID G. GOODENOUGH (Canada Centre for Remote Sensing, Ottawa) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 3. Rotterdam, A. A. Balkema, 1986, p. 1015-1028. refs

The integration of remote sensing and geographic information systems is essential for effective resource management. The volume of remote sensing imagery for managing a provincial resource, such as forestry, is such that one must use digital image analysis systems. By combining remote sensing image analysis and geographic information systems, resource managers can have timely and accurate knowledge of a renewable resource. There are, however, several scientific and technical problems that reduce the success of this integration. This paper describes several integration problems and the LANDSAT Digital Image Analysis System (LDIAS) used at the Canada Center for Remote Sensing (CCRS). Experiments have been conducted integrating a forestry geographic information system for the province of British Columbia with LDIAS. Some of the difficulties encountered require the use of non-algorithmic solutions which use symbolic reasoning. A brief description of expert systems for this integration is given. Several key issues for the future are raised for consideration. Author

A88-42070
MONITORING ENVIRONMENTAL RESOURCES THROUGH NOAA'S POLAR ORBITING SATELLITES
JOAN C. HOCK (NOAA, Assessment and Information Services Center, Washington, DC) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 3. Rotterdam, A. A. Balkema, 1986, p. 1029-1032.

Satellite imagery in combination with surface weather observations can provide a potential tool for evaluating ground and water conditions throughout the world. In order to monitor the economic impacts of anomalous weather, the Assessment and Information Services Center (AISC), of the National Environmental Satellite, Data, and Information Service (NESDIS), National Oceanic and Atmospheric Administration (NOAA) integrates satellite data, geographic information, agronomic, and economic models to monitor both land and marine resources. Such assessments can provide government officials with an early warning of crop failure in order to mitigate potential climate impacts and reduce climate vulnerability. Author

A88-44446
THE USE OF METRIC MULTISPECTRAL PHOTOGRAPHY IN ENVIRONMENTAL AND RESOURCE EXPLORATION
KARL-HEINZ MAREK, KARL-HEINZ JOHN (Akademie der Wissenschaften der DDR, Zentralinstitut fuer Physik der Erde, Potsdam, German Democratic Republic), and SIGMUND JAEHN Jena Review (ISSN 0448-9497), vol. 32, no. 4, 1987, p. 160-163. refs

The application of high-resolution metric multispectral photography (MMP) to perform thematic, topographic, geologic, and land use maps, detect and localize depression zones, and perform shallow water bathymetry is examined. MMP can produce topographic maps with scales between 1:50,00 and 1:100,000. Advantages of the MMP system include recording earth surface images and extracting information from them more easily and economically efficiently than digital recording systems and producing images suitable for topographic and thematic mapping at low cost. R.B.

N88-22453# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UPDATING OF THE MUNICIPAL OFFICIAL REGISTER OF REAL ESTATE THROUGH A GEOGRAPHICAL INFORMATION SYSTEM [ATUALIZACAO DO CADASTRO IMOBILIARIO MUNICIPAL ATRAVES DE UM SISTEMA DE INFORMACOES GEOGRAFICAS]
ADRIANA ABRAHAO and MOACIR GODOYJUNIOR Dec. 1987 18 p In PORTUGUESE; ENGLISH summary Presented at the 1st National Meeting on Applied Remote Sensing for Municipal Planning, 22-23 Oct. 1987
(INPE-4459-PRE/1238) Avail: NTIS HC A03/MF A01

The objective of this work is to demonstrate the feasibility of automating the municipal land register by using the geographical information system now being developed at INPE. The test area was Jambeiro city located in the Vale do Paraiba region, Sao Paulo state. The pilot program to update maps and taxes were devoloped with the municipal land register in mind. Author

N88-22456# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPARATIVE UTILIZATION OF ANALOG AND DIGITAL PROCESSES IN THE TREATMENT OF MSS-LANDSAT DATA FOR STUDYING THE NATIONAL PARKS OF BRAZIL M.S. Thesis
JOAQUIM HENRIQUE DURANPINTO Oct. 1986 184 p In PORTUGUESE; ENGLISH summary Original contains color

illustrations
(INPE-4011-TDL/240) Avail: NTIS HC A09/MF A01

Three MSS-LANDSAT data interpretation methods are presented in a comparative form: visual interpretation using multispectral images of channel 5 and 7 at the 1:250,000 scale; visual interpretation using positive transparencies of the four channels at the 1:3,704,000 scale through a Color Additive Viewer; and digital analysis of compatible computer tapes (CCT) by means of the Image-100 System. The study areas comprise three modules of 400 sq km in the regions of Araguaia, Emas, and Iguacu National Parks. Qualitative, quantitative, and cost evaluations were made in the comparison of the three methods. This work also presents an analysis of land use in the regions around the parks. The results of this comparative study led to the following conclusions: the utilization of the color composite obtained by the Color Additive Viewer presented the best visualization of the classes, with clearly defined limits; visual interpretation through a Color Additive Viewer presented the lowest cost per square kilometer mapped, but it was the most-time consuming; on the other hand, the sophisticated digital analysis was the fastest with the highest cost, and generally, the resulted maps of the three interpretative methods showed that there was no significant differences in terms of area, form, and classes spatial distribution, when compared to ground information. Author

N88-22833# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ORBITAL REMOTE SENSING: AN INSTRUMENT FOR MONITORING URBAN GROWTH
MARIA DELOURDESN.O.KURKDJIAN Apr. 1988 7 p In PORTUGUESE; ENGLISH summary Presented at the National Meeting of the Study on Urban Growth, 5-9 Oct. 1987, Recife, Brazil
(INPE-4456-PRE/1287) Avail: NTIS HC A02/MF A01

The principal advantages in using orbital remote sensing data as an auxiliary instrument for urban growth monitoring are examined. Author

N88-23692# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
APPLICATIONS OF MULTITEMPORAL COMPOSITIONS OBTAINED FROM LANDSAT DATA IN THE STUDY OF URBAN GROWTH [APLICACOES DE COMPOSICOES MULTITEMPORAIS OBTIDAS A PARTIR DE DADOS LANDSAT NO ESTUDO DE CRESCIMENTO URBANO]
MADALENA NIEROPEREIRA, MARIA DELOURDESNEVES-DEO.KURKDJIAN, CELINA FORESTI, and UBIRAJARA MAURICIO BARSOTTIDELIMA Mar. 1988 19 p In PORTUGUESE; ENGLISH summary Presented at the 3rd Brazilian Symposium on Remote Sensing, Rio de Janeiro, Brazil, 1984
1984
(INPE-4480-PRE/1246) Avail: NTIS HC A03/MF A01

Urban growth has developed in an accelerated and disorganized manner in most Brazilian cities. One of the factors influencing the monitoring and control of urban growth is the lack of precise and updated information. Through the use of satellite remote sensing it is possible to obtain a repetitive covering of the target area showing the different tendencies of urban growth. Thus, the objective of this study is to analyze urban growth in the city of Sao Jose dos Campos during the past six years, using automatic digital processing of LANDSAT data. The algorithm Image Registration was used as implemented on the Image-100 System, which correlates image registration of LANDSAT data for different dates. Multitemporal color compositions using colored filters (blue, green, and red) were obtained. The analysis of the composites permitted the evaluation of the urban growth of Sao Jose dos Campos and showed the intense process of construction in isolated residential areas resulting from the redistribution of rural land into parcels or lots. Author

N88-23693# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UPDATING LAND-USE OF THE SAO JOSE DOS CAMPOS MUNICIPALITY THROUGH REMOTE SENSING DATA [ATUALIZACAO DO USO DA TERRA DO MUNICIPIO DE SAO JOSE DOS CAMPOS ATRAVES DE DADOS DE SENSORIAMENTO REMOTO]
MADALENA NIEROPEREIRA, EVLYN MARCIA LEAODEMOR-AESNOVO, MARIA DELOURDESN.DEO.KURKDJIAN, JULIO CESAR LIMADALGE, and TERESA GALLOTTIFLORENZANO Mar. 1988 66 p In PORTUGUESE; ENGLISH summary
(INPE-4479-RPE/562) Avail: NTIS HC A04/MF A01

The land-use survey of Sao Jose dos Campos municipality using black and white aerial photographs is related to LANDSAT TM imagery. This work was carried out in a joint-cooperation with the local municipal administration according to the agreement that INPE provides the technical support to the local agency. The project included: (1) the developing of data interpretation methodology for LANDSAT-TM data and aerial photographs; (2) the evaluation of TM imagery for land-use mapping and monitoring; (3) the technology transfer of the developed methodology to the local agency through training courses; and (4) technical advice on the process of mapping the whole municipality using aerial photographs on the scale of 1:25,000. Land use maps on the scales of 1:25,000 and 1:100,000 based on aerial photographs and LANDSAT-TM imagery were produced. The mapping accuracy of the land use map obtained by using the LANDSAT-TM imagery is 85 percent at the 95 percent confidence level. The results demonstrate the adequacy of TM data for land-use mapping. Author

N88-24034# Gregory Geoscience Ltd., Ottawa (Ontario).
REMOTE SENSING AND DATA INTEGRATION: PRACTICAL SOLUTIONS FOR RESOURCE MANAGERS Abstract Only
JACQUES GUERETTE and BILL BRUCE (Canada Centre for Remote Sensing, Ottawa, Ontario) *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 1986
Avail: NTIS HC A99/MF E03

Augmenting data bases, even in data scarce areas, is only one requirement for improved resource management decision making. Equally important is the ability to compile and integrate the particular data sets most appropriate for the resolution of an individual resource problem. This integration must furthermore be accomplished in a fashion which yields effective results within a specific set of time, cost and performance constraints. For many applications computer-based geographical information systems can provide a desirable solution. For many operational resource management agencies, the cost prevents development and support. Attention is being focused on finding practical solutions to the common data integration and update problems faced by such agencies. In Canada, practical needs have contributed to the development of data integration methodologies which are a blend of digital and analog technologies. A system now in use in Canada is described. Applications of this system are presented under the constraints of operational mapping programs in agriculture, forestry, geology, and in map revision. Author

N88-24063# Toulouse Univ. (France).
THE SAGE GEOGRAPHIC ANALYSIS SYSTEM
R. CAUBET and A. HAMEURLAIN *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 541-547 1986
Avail: NTIS HC A99/MF E03

The design and implementation of a geographic analysis system, SAGE, is described. A classification of geographic analysis database queries and two geographic data manipulation modes are presented. Then, after establishing a database model for geographic charts, integrity contraints are specified for the time and space elements of the geographic database and a means of ensuring the structural coherence of geographic objects is discussed. Author

N88-24071# BP Mineracao Ltda., Rio de Janeiro (Brazil).
TORNADO TRACKS IN SOUTHWESTERN BRAZIL, EASTERN PARAGUAY, AND NORTHWESTERN ARGENTINA [RASTROS DE TORNADOS NO SUDOESTE DO BRASIL, LESTE DO PARAGUAI E NORDESTE DA ARGENTINA]
ROBERT C. DYER *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 589-603 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

A series of tornado tracks which were identified in a region that encompasses part of eastern Paraguay, southwestern Brazil, and northeastern Argentina is described. The tracks are clearly observable on 1965 black-and-white photographs (1:60,000) and on some of the early 1970 LANDSAR imagery. The multitemporal assessment of different photocoverages and LANDSAT imagery pertaining to the depicted region, showed that most of those tornadoes struck the region sometime between June 1964 and July 1965; a few tracks were determined to belong to tornadoes that hit the region in earlier years and one, in later years. The most extensive trajectories are 70 km long, and the widest, around 2 km. The severe deforestation that took place in the region in the late 1960s obliterated almost completely the tornado scars on more recent remote sensing products. A scan of the literature pertaining to the region under investigation resulted in the gathering of some interesting information on damages caused by the effect of such tornadoes. Author

N88-24074# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LOW ALTITUDE REMOTE SENSING DATA IN THE IMPLEMENTATION OF A MATHEMATICAL MODEL FOR THE PLANNING OF URBAN EQUIPMENT NETWORKS [DADOS DE SENSORIAMENTO REMOTO A BAIXA ALTITUDE NA IMPLEMENTACAO DE UM MODELO MATEMATICO PARA O PLANEJAMENTO DE REDES DE EQUIPAMENTOS URBANOS]
MARIA DELOUDESNEVESDEOLIVEIRAKURKDJIAN, MARIA SUELENA SANTIADOBARROS, HORACIO HIDEKIYANASSE, ACIOLI ANTONIODEOLIVO, and NANDAMUDI LANKALAPAL VIJAYKUMAR *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 622-629 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

This work is mainly directed to urban planners involved in solving local social use equipment location problems. Such equipment is generated as an extension of the residential function and, therefore, their location in the urban structure must follow the distribution of the different population segments in the city. Photointerpretation data is used to supply the lack of urban information, a common fact observed in the municipal administration in Brazil. The aerial photographic data are used to locate, quantify, and give priority to the equipment demand, being the last aspect function of the socio-economic conditions of the several groups of households. The data from the photointerpretation are used to model the system as a network in order to rationalize the urban equipment location. This methodology was applied using as a test area Sao Jose dos Campos, SP, where the best location for a network of urban health equipment for local use was indicated. Author

N88-24085# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
DETECTION OF BIOMASS BURNING AND SMOKE PLUMES IN THE AMAZON REGION THROUGH NOAA SATELLITE IMAGERY [DETECCAO DE QUEIMADAS E PLUMAS DE FUMACA NA AMAZONIA ATRAVES DE IMAGENS DOS SATELLITES NOAA]
M. C. PEREIRA and A. W. SETZER *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 701-709 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

Twenty-five NOAA-8 and 9 satellite images covering the Amazon region were recorded from July 19th to August 9th, 1985 and analyzed along with the GTE/ABLE-2A field measurements. The objective was the detection of biomass burnings and smoke plumes to assess the environmental impact caused by their emissions in the atmosphere. The area covered by the smoke varied from 2,800 to 90,000 sq km as the dry season progressed. Maps and slides show the areas affected by the burnings. The methodology proved to be adequate to the detection of large biomass burnings. Author

N88-24101*# Kansas Univ., Lawrence. Space Technology Center.
RESEARCH ON ENHANCING THE UTILIZATION OF DIGITAL MULTISPECTRAL DATA AND GEOGRAPHIC INFORMATION SYSTEMS IN GLOBAL HABITABILITY STUDIES Final Report, 1986-1987
EDWARD A. MARTINKO and JAMES W. MERCHANT Apr. 1988 138 p
(Contract NGL-17-004-024)
(NASA-CR-182799; NAS 1.26:182799) Avail: NTIS HC A07/MF A01 CSCL 08B

During 1986 to 1987, the Kansas Applied Remote Sensing (KARS) Program continued to build upon long-term research efforts oriented towards enhancement and development of technologies for using remote sensing in the inventory and evaluation of land use and renewable resources (both natural and agricultural). These research efforts directly addressed needs and objectives of NASA's Land-Related Global Habitability Program as well as needs of and interests of public agencies and private firms. The KARS Program placed particular emphasis on two major areas: development of intelligent algorithms to improve automated classification of digital multispectral data; and integrating and merging digital multispectral data with ancillary data in spatial modes. B.G.

N88-24104# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
COUPLING OF SATELLITE REMOTE SENSING TO DIGITIZED TOPOGRAPHIC MAP TO DETECT CHANGES IN LAND USE Thesis [HET KOPPELEN VAN SATELLIET REMOTE SENSING GEGEVENS AAN EEN GEDIGITALISEERDE TOPOGRAFISCHE KAART OM VERANDERINGEN IN GRONDGEBRUIK TE DETEKTEREN]
L. F. VERHEIJ Nov. 1987 65 p In DUTCH; ENGLISH summary
(B8735129; ETN-88-92418) Avail: NTIS HC A04/MF A01

Images from LANDSAT Thematic Mapper were coupled to a 1:25,000 map to aid planning and environment management. By digitizing the analog map, a vector-file is created which consists of closed polygons. The lines of a polygon represent edges of roads and waterways, boundaries of urban areas, and boundaries of parcels in rural areas. Within one polygon the land use is homogeneous. Land use, as drawn in the map, is added to this file. A database is set up to record the relationship between the land use and the polygons. The vector file is projected on the satellite image by a similarity-transformation, after which for each polygon the class which is most represented by the labelled pixels is computed. Based upon decision rules, this class describes the actual land use. The coupling is executed and the found modifications of the land use are recorded in the database. The combination of the digital map and the satellite image assures good geometry with up to date thematic content. It can be regarded as a base for a geographic information system, although for this the geometry and the precision of the classification of satellite imagery need to be improved. ESA

N88-24844*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ROLE OF SPACE BORNE IMAGING RADARS IN ENVIRONMENTAL MONITORING: SOME SHUTTLE IMAGING RADAR RESULTS IN ASIA
MARC L. IMHOFF and C. H. VERMILLION Nov. 1986 23 p
(NASA-TM-101178; NAS 1.15:101178) Avail: NTIS HC A03/MF A01 CSCL 17I

The synoptic view afforded by orbiting Earth sensors can be extremely valuable for resource evaluation, environmental monitoring and development planning. For many regions of the world, however, cloud cover has prevented the acquisition of remotely sensed data during the most environmentally stressful periods of the year. How synthetic aperture imaging radar can be used to provide valuable data about the condition of the Earth's surface during periods of bad weather is discussed. Examples are given of applications using data from the Shuttle Imaging Radars (SIR) A and B for agricultural land use and crop condition assessment, monsoon flood boundary and flood damage assessment, water resource monitoring and terrain modeling, coastal forest mapping and vegetation penetration, and coastal development monitoring. Recent SIR-B results in Bangladesh are emphasized, radar system basics are reviewed and future SAR systems are discussed. Author

N88-25020# Technische Hogeschool, Eindhoven (Netherlands).
THE APPLICATION OF SATELLITES IN CONNECTION WITH THE ENVIRONMENT
HERMANN BONDI 1986 13 p Presented at the Holst Memorial Lecture, Eindhoven, Netherlands, 3 Dec. 1986
(ETN-88-92474) Avail: NTIS HC A03/MF A01

Satellite observation for geology, crop monitoring, environmental monitoring, resources management, pest control, and oceanography is discussed. ESA

03

GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A88-35156* Colorado Univ., Boulder.
SPACE GEODESY AND EARTHQUAKE PREDICTION
ROGER BILHAM (Colorado, University, Boulder; Lamont Doherty Geological Observatory, Palisades, NY) IN: Aerospace century XXI: Space sciences, applications, and commercial developments; Proceedings of the Thirty-third Annual AAS International Conference, Boulder, CO, Oct. 26-29, 1986. San Diego, CA, Univelt, Inc., 1987, p. 1637-1659. refs
(Contract NSF EAR-86-10036; NAG5-799)
(AAS PAPER 86-307)

Earthquake prediction is discussed from the point of view of a new development in geodesy known as space geodesy, which involves the use of extraterrestrial sources or reflectors to measure earth-based distances. Space geodesy is explained, and its relation to terrestrial geodesy is examined. The characteristics of earthquakes are reviewed, and the ways that they can be exploited by space geodesy to predict earthquakes is demonstrated. C.D.

A88-38023
GEOID ANOMALIES ACROSS PACIFIC FRACTURE ZONES
JEAN-CHARLES MARTY, ANNY CAZENAVE, and BERNARD LAGO (CNES, Toulouse, France) Geophysical Journal (ISSN 0952-4592), vol. 93, April 1988, p. 1-23. CNES-supported research. refs

Geoid step estimates have been obtained along altimeter profiles of the Seasat satellite across five fracture zones (FZs) of the NE Pacific. The geoid offset to age offset ratio Delta h/Delta t is determined as a function of age, and for four of the FZs studied this dependence is found to be different than that predicted by conductive cooling models. Large fluctuations in the Delta h/Delta t-age relationship are noted along three of the FZs, suggesting that the thermal structure of the oceanic lithosphere under a FZ is more complex than is to be expected from conductive cooling alone. R.R.

A88-38024* Stanford Univ., Calif.
THE EFFECT OF A SHALLOW LOW-VISCOSITY ZONE ON THE MANTLE FLOW, THE GEOID ANOMALIES AND THE GEOID AND DEPTH-AGE RELATIONSHIPS AT FRACTURE ZONES
ELIZABETH M. ROBINSON (Stanford University, CA), BARRY PARSONS (Oxford University, England), and MAVIS DRISCOLL (Analytic Sciences Corp., Reading, MA) Geophysical Journal (ISSN 0952-4592), vol. 93, April 1988, p. 25-43. refs
(Contract NAG5-415; NSF EAR-83-06349)

A two-dimensional FEM is used to investigate the flow driven by the horizontal temperature gradient at a fracture zone and to calculate the resulting geoid and topography anomalies. Using a three-layered viscosity structure for the upper mantle, results are presented for the effects of varying: (1) the viscosity contrast between the fluid layers: (2) the Rayleigh number based on the viscosity of the bottom layer; and (3) the thickness of the low-viscosity channel. Good agreement is obtained with the results of geoid anomalies over the Udintsev fracture zone when the viscosity of the top layer is greater than one order of magnitude less than post-glacial rebound values. R.R.

A88-38902
EVIDENCE FROM GEOID DATA OF A HOTSPOT ORIGIN FOR THE SOUTHERN MASCARENE PLATEAU AND MASCARENE ISLANDS (INDIAN OCEAN)
ALAIN BONNEVILLE (CNRS, Centre de Recherches Volcanologiques, Clermont-Ferrand, France), JEAN PIERRE BARRIOT, and ROGER BAYER (Montpellier II, Universite, France) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, May 10, 1988, p. 4199-4212. CNRS-supported research. refs

A high-resolution geoid map of the Madagascar and Mascarene basins is constructed from GEOS 3 and Seasat satellite altimetric data with an accuracy of 0.7 m. Large positive anomalies are due to topographic highs and their regional compensation. The deflection of the lithosphere under volcanic loads and its effect on the geoid are modeled for the Southern Mascarene Plateau, Mauritius, Reunion, and Rodriguez islands. Assuming a purely elastic lithospheric model, the effective flexural rigidity is estimated for the four zones. The highest rigidity occurs under Reunion Island and suggests a recent origin for the volcanism (3-5 Ma). The Southern Mascarene Plateau shows the lowest rigidity, suggesting a near-ridge origin; Rodriguez Island shows the same trend but in another tectonic framework. The topographic and geoid swell is studied as an effect of a thermal mantle plume. Using a conductive model of lithospheric heating, the assumption of 'hotspot migration' for the origin of the Southern Mascarene Plateau and the Mascarene Islands is confirmed. Author

A88-39518#
SATELLITE OBSERVATION OF SURFACE ALBEDO OVER THE QINGHAI-XINZANG PLATEAU REGION
QIANG ZHONG and YINHAI LI (Chinese Academy of Sciences, Lanzhou Institute of Plateau Atmospheric Physics, People's Republic of China) Advances in Atmospheric Sciences (ISSN 0256-1530), vol. 5, no. 1, 1988, p. 57-65. refs

A method to determine the surface albedo over the Quinghai-Xizang plateau region from NOAA polar orbiter AVHRR data is investigated, analyzing several measurements obtained between September and November 1985. The study of the empirical relationship between clear-sky planetary and surface albedos allows for the estimation of surface albedo given only the planetary albedo and vice versa. Estimated surface albedos are compared to observed albedos. The results show that the method used is suitable for detecting the spatial and temporal variation of surface albedo and is relevant for climatological studies. R.B.

A88-40688
GEOID ROUGHNESS AND LONG-WAVELENGTH SEGMENTATION OF THE SOUTH ATLANTIC SPREADING RIDGE

DOMINIQUE GIBERT (Institut Francais de Recherches pour l'Exploitation de la Mer, Centre de Brest, France) and VINCENT COURTILLOT (Paris VI, Universite, France) Nature (ISSN 0028-0836), vol. 333, May 19, 1988, p. 255-258. CNRS-supported research. refs

The short wavelength part of the Seasat altimetry data set is used to derive a map of the 'geoid roughness' in the South Atlantic between 1 N and 39 S. This map reflects changes in the local amplitude of the geoid signal primarily associated with topography. Zones of high roughness correlate with major fracture zones, aseismic ridges and the Mid-Atlantic Ridge. The most remarkable feature is that the roughness is not uniform along the ridge but displays quasi-periodic variations with a wavelength of about 400 km, a segmentation an order of magnitude larger than described so far, which has persisted for at least 60 Myr. This segmentation may reflect either fabric generated at the ridge by normal plate tectonic processes or small-scale convective instabilities rising from a region of the upper mantle about 80 km deep. C.D.

A88-41835* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
EFFECT OF WET TROPOSPHERIC PATH DELAYS ON ESTIMATION OF GEODETIC BASELINES IN THE GULF OF CALIFORNIA USING THE GLOBAL POSITIONING SYSTEM
DAVID M. TRALLI, TIMOTHY H. DIXON, and SCOTT A. STEPHENS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, June 10, 1988, p. 6545-6557. refs

Surface Meteorological (SM) and Water Vapor Radiometer (WVR) measurements are used to provide an independent means of calibrating the GPS signal for the wet tropospheric path delay in a study of geodetic baseline measurements in the Gulf of California using GPS in which high tropospheric water vapor content yielded wet path delays in excess of 20 cm at zenith. Residual wet delays at zenith are estimated as constants and as first-order exponentially correlated stochastic processes. Calibration with WVR data is found to yield the best repeatabilities, with improved results possible if combined carrier phase and pseudorange data are used. Although SM measurements can introduce significant errors in baseline solutions if used with a simple atmospheric model and estimation of residual zenith delays as constants, SM calibration and stochastic estimation for residual zenith wet delays may be adequate for precise estimation of GPS baselines. For dry locations, WVRs may not be required to accurately model tropospheric effects on GPS baselines. R.B.

A88-41969
BASE MAP PRODUCTION FROM GEOCODED IMAGERY
DENNIS ROSS ROSE, IAN LAVERTY (MacDonald Dettwiler and Associates, Ltd., Richmond, Canada), and MARK SONDHEIM (British Columbia Ministry of Environment, Surveys and Resource Mapping Branch, Victoria, Canada) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 67-71. refs

Processes, such as feature extraction, thematic classification, and elevation derivation, used in producing maps from geocoded imagery are discussed. Resultant map accuracies are examined and a sample 1:50,000 scale base map derived entirely from Landsat TM imagery is presented and evaluated. Computerized production of a map based solely on satellite imagery can take less than 24 hours, including input, correction, geocoding of the imagery, and extraction of elevation, panimetric, and thematic data. The cost of this type of map production, which varies according to the type of terrain being mapped, is also examined. R.B.

N88-20713*# Ohio State Univ., Columbus. Dept. of Geodetic Science and Surveying.
DETERMINATION OF EARTH ROTATION BY THE COMBINATION OF DATA FROM DIFFERENT SPACE GEODETIC SYSTEMS
BRENT ALLEN ARCHINAL Feb. 1987 104 p
(Contract NSG-5265)
(NASA-CR-181388; NAS 1.26:181388; REPT-375) Avail: NTIS HC A06/MF A01 CSCL 08E

Formerly, Earth Rotation Parameters (ERP), i.e., polar motion and UTI-UTC values, have been determined using data from only one observational system at a time, or by the combination of parameters previously obtained in such determinations. The question arises as to whether a simultaneous solution using data from several sources would provide an improved determination of such parameters. To pursue this reasoning, fifteen days of observations have been simulated using realistic networks of Lunar Laser Ranging (LLR), Satellite Laser Ranging (SLR) to Lageos, and Very Long Baseline Interferometry (VLBI) stations. A comparison has been done of the accuracy and precision of the ERP obtained from: (1) the individual system solutions, (2) the weighted means of those values, (3) all of the data by means of the combination of the normal equations obtained in 1, and (4) a grand solution with all the data. These simulations show that solutions done by the normal equation combination and grand solution methods provide the best or nearly the best ERP for all the periods considered, but that weighted mean solutions provide nearly the same accuracy and precision. VLBI solutions also provide similar accuracies. Author

N88-23279# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
CONTRIBUTIONS TO GEODESY, PHOTOGRAMMETRY AND CARTOGRAPHY. SERIES 1, NUMBER 46
1987 235 p Presented at the 13th International Cartographic Association (ICA) Conference on Cartography, Morelia, Mexico, 1987 Original contains color illustrations Maps as supplement
(ISSN-0469-4244; ETN-88-92386) Avail: NTIS HC A11/MF A01

Cartography as a management and planning tool; cartography as a communication process; cartographic technology, map compilation and revision; education in cartography; thematic and resources mapping; tourism; urban cartography; and maps for the blind are discussed.

ESA

04

GEOLOGY AND MINERAL RESOURCES

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

A88-32831* Massachusetts Inst. of Tech., Cambridge.
GEODETIC MEASUREMENT OF DEFORMATION EAST OF THE SAN ANDREAS FAULT IN CENTRAL CALIFORNIA
JEANNE SAUBER, SEAN C. SOLOMON (MIT, Cambridge, MA), and MICHAEL LISOWSKI (USGS, Menlo Park, CA) IN: Slow deformation and transmission of stress in the earth. Washington, DC, American Geophysical Union, 1988, 39 p. USGS-supported research. refs
(Contract NAG5-814)

The shear strain rates in the Diablo Range of California have been calculated, and the slip rate along the Calaveras and Paicines faults in Central California have been estimated, on the basis of triangulation and trilateration data from two geodetic networks located between the western edge of the Great Valley and the San Andreas Fault. The orientation of the principal compressive strain predicted from the azimuth of the major structures in the region is N 25 deg E, leading to an average shear strain value that corresponds to a relative shortening rate of 4.5 + or - 2.4 mm/yr. It is inferred that the measured strain is due to compression across the fold of this area. The hypothesized uniform, fault-normal compression within the Coast Ranges is not supported by these results. O.C.

A88-32901
THEMATIC CONFERENCE ON REMOTE SENSING FOR EXPLORATION GEOLOGY, 5TH, RENO, NV, SEPT. 29-OCT. 2, 1986, PROCEEDINGS. VOLUMES 1 & 2
Conference organized by the Environmental Research Institute of Michigan; Sponsored by ARCO Exploration and Technology Co., Exxon Production Research Co., Phillips Petroleum Co., et al. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. Vol. 1, 443 p.; vol. 2, 378 p. For individual items see A88-32902 to A88-32957.

This symposium includes papers on digital terrain model and image integration for geologic interpretation, mapping the Oman ophiolite using TM data, integration of SIR-B imagery with geological and geophysical data in Australia, developing petroleum exploration targets in south-central Texas through digital data integration, and the contribution of Landsat to a geologic expedition in the desert of north-central Sudan, Africa. Consideration is also given to the application of remote sensing to tectonic and metallogenic studies in NE Africa, the use of calibration targets in the measurement of 2.22-micron mineral absorption features in TM data, a geobotanical investigation of an exploration-sized territory, and the remote sensing of geological structure in temperate agriculture terrains. Additional papers are on the identification of clay minerals by feature coding of near-IR spectra, the detection of geologic features in Landsat TM imagery not revealed in Landsat MSS imagery, the remote compositional mapping of rocks using reflected and emitted radiance, and earth observations opportunities from Space Station. I.S.

A88-32902#
APPLICATION OF SYNTHETIC APERTURE RADAR (SAR) TO SOUTHERN PAPUA NEW GUINEA FOLD BELT EXPLORATION
JAMES M. ELLIS and FRANK D. PRUETT (Chevron Overseas Petroleum, Inc., San Ramon, CA) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 15-34. refs

Synthetic-aperture radar (SAR) imagery acquired over an area within the southern Papuan Basin fold and thrust belt was used to construct surface-structure and stratigraphic maps for a hydrocarbon exploration program. Stereoscopic analysis of SAR provided essential geologic information that was used to guide the ongoing field work, to model subsurface structures, and to select well locations. SAR imagery revealed significant mass wasting that led to reevaluation of previously acquired field data. The reprocessing and contrast stretching of the digital radar imagery made it possible to extract additional geologic information from the survey in oversaturated (bright) or flared zones. I.S.

A88-32903#
LANDSAT STRUCTURAL ANALYSIS OF THE RHINE VALLEY AND THE JURA MOUNTAIN AREA, WESTERN EUROPE
Z. BERGER and F. V. CORONA (Exxon Production Research Co., Houston, TX) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 35-48. refs

The results of the Landsat imagery analysis of the structural styles, trends, and timing of deformation of exposed and buried structures in the regions of the Rhine Valley, the Jura Mountain, and the Molasse basin are discussed. The Rhine Valley was found to display structural characteristics of an extensional fault-block regime, whereas the Jura Mountains were shown to be a detached fold-and-thrust belt consisting of thrust faults that have irregular to sinuous fault-line traces, elongated folds that are almost parallel to the exposed thrust faults, and strike-slip faults that occur obliquely to the thrust faults. Detailed analysis of the imagery revealed three different types of topographic expressions in the exposed fault systems of the Rhine Graben region: (1) NNE trending strike-slip faults related to the 'wrench-fault' deformation associated with the Hercynian orogenic event; (2) N- to NNE-trending normal faults associated with an Eocene to Pliocene extensional fault-block events; and (3) possible Hercynian strike-slip faults that were activated as normal faults by the Eocene-Pliocene extensional event. I.S.

A88-32904#
DIGITAL TERRAIN MODEL AND IMAGE INTEGRATION FOR GEOLOGIC INTERPRETATION
R. SIMARD (Canada Centre for Remote Sensing, Ottawa) and R. SLANEY (Geological Survey of Canada, Ottawa) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 49-60. refs

Automatic digital correlation techniques were used to construct an elevation model from two Landsat-5 TM images taken over the Kananaskis Valley, Alberta, Canada, from adjacent orbits with 50 percent overlap. The geology of the valley was taken from a detailed (1 in/2 miles) map and a 16-class geology theme map. The maps were traced manually and digitized, and both sets of TM and geology images were precisely coregistered in the UTM coordinate system with 25 x 25 meter pixels. A series of image products obtained by combining elements from the TM-digital elevation model-geology data sets include an orthographic 'image map', a stereomodel which combines an orthoimage and a synthetic stereomate with geological boundaries, and a geology map. Finally, a series of perspective views was prepared from the TM scene using the geology overlay and the thematic geology map. I.S.

A88-32905#
TARGETING EPITHERMAL ALTERATION AND GOSSANS IN WEATHERED AND VEGETATED TERRAINS USING AIRCRAFT SCANNERS - SUCCESSFUL AUSTRALIAN CASE HISTORIES
S. J. FRASER, A. R. GABELL, A. A. GREEN, and J. F. HUNTINGTON (CSIRO, Div. of Mineral Physics and Mineralogy, North Ryde, Australia) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 63-84. Research sponsored by the Australian Mineral Industries Research Association. refs

Using data from the MEIS-II and Daedalus 1268 ATM scanners, goethitic and hematitic iron-oxide species over gossanous outcrops were mapped, and hydrothermal 'clay' alteration were detected in deeply weathered and vegetated terrains in Queensland, Australia. New processing techniques were developed to complement the improved spectral and radiometric sensitivity of these scanners. 'Image logarithmic residuals' allow interpretation in terms of known reflectivity relationships, by removing pixel-to-pixel brightness variation. 'Directed principal components' and 'least-squares residuals' separate the confusing effects of vegetation and 'clays' in mixed pixels in the 2.2-micron ATM bandpass. The MEIS iron-oxide study revealed that goethitic anomalies occurred at Loch Ness, Lady Annie, and Crystal Creek. Although vegetation can severely restrict the potential of the 2.2-micron ATM bandpass to detect clay alteration, using the above techniques it was possible to separate 'clay' from vegetation responses in mixed pixels at each of our test sites. Author

A88-32906*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MAPPING THE OMAN OPHIOLITE USING TM DATA
MICHAEL ABRAMS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 85-95. refs

Ophiolite terrains, considered to be the onland occurrences of oceanic crust, host a number of types of mineral deposits: volcanogenic massive sulfides, podiform chromite, and asbestos. Thematic Mapper data for the Semail Ophiolite in Oman were used to separate and map ultramafic lithologies hosting these deposits, including identification of the components of the extrusive volcanic sequence, mapping of serpentinization due to various

tectonic processes, and direct identification of gossans. Thematic Mapper data were found to be extremely effective for mapping in this terrain due to the excellent spatial resolution and the presence of spectral bands which allow separation of the pertinent mineralogically caused spectral features associated with the rock types of interest. Author

A88-32907#
DISCRIMINATION OF LITHOLOGIC UNITS, ALTERATION PATTERNS AND MAJOR STRUCTURAL BLOCKS IN THE TONOPAH, NEVADA AREA USING THEMATIC MAPPER DATA
JOHN C. KEPPER, THOMAS P. LUGASKI (Nevada, University, Reno), and JOHN S. MACDONALD (MacDonald Dettwiler and Associates, Richmond, Canada) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 97-115. refs

A88-32908#
ASSOCIATIONS AMONG LINEAMENTS, SUBSURFACE FRACTURES, HYDROCARBON MICROSEEPAGE, AND PRODUCTION IN THE UINTA BASIN, UTAH
ROGER MCCOY, STEPHEN YOUNG (Utah, University, Salt Lake City), MICHAEL J. HAVERTZ (Satellite Exploration Consultants, Inc., Midland, TX), KEITH CLEM, and CYNTHIA BRANDT (Utah Geological and Mineral Survey, Salt Lake City) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 117-130. refs

Two oil fields in the Uinta Basin of Utah were studied for relationships among lineaments, hydrocarbon gas flux, and rates of production. The Monument Butte Field, with production from 3500 to 5800 feet, showed a strong positive relationship among lineament density, near-surface gas flux, and production rates. In contrast, the Altamont-Bluebell Field has much deeper production, 8000-16,000 feet, and the relationship between lineament density and production was weak. Greater promise is shown in the Altamont-Bluebell for the analysis of intersections between lineament sets, particularly E-W lineaments with other sets. It is concluded that the combination of lineament analysis and geochemical surveys can be a successful exploration tool in both the shallow reservoir of the Monument Butte Field, and deep reservoir of the Altamont-Bluebell Field. Author

A88-32912#
INTEGRATION OF SIR-B IMAGERY WITH GEOLOGICAL AND GEOPHYSICAL DATA IN AUSTRALIA
G. J. LYNNE and G. R. TAYLOR (New South Wales, University, Sydney, Australia) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 179-191. refs

SIR-B imagery of the arid region of central Australia is integrated with co-registered Landsat MSS and TIMS thermal data. Multi-band and color ratio composites of SIR-B and TIMS imagery are found to enhance different geological information. The relative abilities of SIR-B and airphotos to discern lineaments are compared, and SIR-B is found to enhance linears perpendicular to the look direction and supress those that are parallel. Lineaments digitized directly from a 1:100,000 print of the SIR-B Amadeus scene are processed to produce a contour plot of fracture density values. Lineament density contours integrated with geological and geophysical data define structural regions in both basement rocks and overlying sediments. Multiple SIR-B imagery acquired over South Australia clearly shows the dependence of radar backscatter on incidence angle. Low incidence angles define topographic variations, while backscatter response at medium to high incidence angles is dependent on surface roughness. Author

A88-32913#
FRACTURE PATTERNS AND PRODUCTION TRENDS, BIG SANDY FIELD, EASTERN KENTUCKY
ROBERT J. PAUKEN (Mobil Exploration and Production Services, Inc., Dallas, TX), J. H. GRIFFITH, and J. H. HALSEY IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 193-216. refs

The major directions of natural fractures were identified and correlated with the production trends in the Big Sandy Gas Field in eastern Kentucky using a broad spectrum of data and types of technology. The initial production values for over 7000 wells were mapped to determine productivity trends; in order to perform the trend analysis, well locations, initial production volumes, and producing horizons were digitized into a computer-accessible database. The photolineaments (most of which were segments of stream valleys or alignments of notches in the interstream divides) were measured on Landsat and airborne SLR imagery. The results of the analysis show a consistent set of fracture trends which appear to be uniform over much of the Appalachian Basin. The calculated productivity trends were found to correspond on a one-to-one basis with the fracture trends, indicating that the photolineament pattern is reflecting the orientation of subsurface fractures which are controlling gas production. I.S.

A88-32914#
ROCK DISCRIMINATION AND ALTERATION MAPPING FOR MINERAL EXPLORATION USING THE CARR BOYD/GEOSCAN AIRBORNE MULTISPECTRAL SCANNER
F. R. HONEY (Geoscan Pty., Ltd., Perth, Australia) and J. L. DANIELS (Carr Boyd Minerals, Ltd., Perth, Australia) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 267-278.

A88-32915*# Nevada Univ., Reno.
CORRELATION BETWEEN HIGH RESOLUTION REMOTE SENSING IMAGERY AND HYDROTHERMAL ALTERATION, TYBO MINING DISTRICT, NEVADA
S. C. FELDMAN and J. V. TARANIK (Nevada, University, Reno) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 279-297. Research supported by ARCO Exploration and Technology Co. refs
(Contract NASW-4050)

A88-32916#
CONTRIBUTION OF LANDSAT TO A GEOLOGIC EXPEDITION IN THE DESERT OF NORTH CENTRAL SUDAN, AFRICA
CLAUDE M. FROIDEVAUX (Phillips Petroleum Co., Bartlesville, OK) and STEVEN J. TKACH (Phillips Petroleum Co., Denver, CO) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 299-305.

A88-32917*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE RADARS FOR GEOLOGIC MAPPING IN TROPICAL REGIONS
J. P. FORD (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) and F. F. SABINS (Chevron Oil Field Research Co., La Habra, CA) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 307-316. refs

This paper presents interpretations of the satellite radar images of cloud-covered portions of Indonesia and Amazonia obtained from NASA's Shuttle imaging radar experiments in 1981 (SIR-A) and 1984 (SIR-B). It was found that different terrain categories

observed from distinctive image textures correlate well with major lithologic associations. The images show geologic structures at regional and local scales. The SIR-B images of East Kalimantan, Indonesia, reveal structural features and terrain distributions that had been overlooked or not perceived in previous surface mapping. Variability in radar response from the vegetation cover is interpretable only in coastal areas or alluvial areas that are relatively level. I.S.

A88-32918#
AFTER EXPLORATION, WHAT? - CASE HISTORIES OF SEVEN DIVERSE PRODUCTION, DEVELOPMENT AND DISTRIBUTION APPLICATIONS OF REMOTE SENSING
ALLEN M. FEDER, CYNTHIA A. SHEEHAN, and DARCY L. VIXO (Western Geophysical Company of America, Houston, TX) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 317-324.

The paper describes seven diverse case histories in successful postexploration applications of remote sensing. The first three case histories involve 8-14-micrometer remote sensing for locating groundwater for drilling, for determining geologic conditions suitable for drilling-waste disposal, and for mapping the advance of a steam-flood front in secondary recovery. The fourth case history involves aeromagnetometry for the measure of the areal extent of a reservoir, and 'stepping-off' production from producing fields. The next two case histories center on Landsat imagery processing and interpretation for pipeline routing in Arctic permafrost and humid tropics terrains. The last case history returns to 8-14 micrometer scanning for efficacious pipeline leak detection. As a suite, these case histories provide examples of innovative applications of remote sensing, with its unique advantages, that make if possible to bridge the critical activities between exploration and final marketing. Author

A88-32920#
LINEAMENTS OF THE NORTHERN DENVER BASIN AND THEIR PALEOTECTONIC AND HYDROCARBON SIGNIFICANCE
S. L. PERRY (Barringer Geoservices, Inc., Golden, CO) and KEENAN LEE (Colorado School of Mines, Golden) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 335-346. refs

Twenty four lineaments in the northern Denver Basin were interpreted using a statistical analysis of mapped linear features from edge-enhanced Landsat MSS imagery (bands 7, 5, and 4), and their paleotectonic and hydrocarbon significance is discussed. In the northern Denver Basin, lineaments trend predominately northeast and northwest and are divided into mountain-flank and basin-interior groups. Several lineaments show relationships to known hydrocarbon accumulations, by paralleling production trends and bounding production domains. I.S.

A88-32922#
GEOLOGIC INTERPRETATION OF AIR PHOTOS AND RADAR IMAGERY FOR HYDROELECTRIC POWER PROJECTS IN UPPER UCAYALI JUNGLE REGION OF PERU
EPIFANIO SUYO RIVERA (Electroperu, S.A., Peru) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 363-371. refs

A88-32923#
THEMATIC MAPPER DATA APPLIED TO MAPPING HYDROTHERMAL ALTERATION IN SOUTH WEST NEW MEXICO
ROBERT W. MAGEE, JOHN MCMAHON MOORE, and JAKE BRUNNER (Imperial College of Science and Technology, London, England) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 373-382. refs

This study evaluates the value of the TM 5/7 clay ratio (which allows the detection of silicic, advanced argillic, and sericitic hydrothermal alteration) and the limonite-sensitive ratios TM 5/1, TM 5/4, TM 3/2, and TM 3/1 as an aid to prospecting for epithermal mineral deposits. In the Summit Mountains used as a test site, all these bands successfully showed the alterations. These ratios were used to produce an alteration map of the Blue Creek Basin of southwest New Mexico, comparable to the map obtained from conventional field mapping methods. The performance of all the ratios was found to be affected by the presence of vegetation. A vegetation masking technique, using TM bands 4, 3, and 2 transformed to the hue saturation and the intensity values, was applied to the band ratios to remove spurious targets, thus making it possible to recognize in the Blue Creek Basin several previously unrecorded localities with the spectral characteristics of hydrothermal alteration. I.S.

A88-32924#
APPLICATION OF REMOTE SENSING TO TECTONIC AND METALLOGENIC STUDIES IN NE AFRICA
SEIFE M. BERHE (Open University, Milton Keynes, England) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 383-391. Sponsorship: Research suported by the World University Service. refs

A model for the regional framework of NE Africa was developed initially using field traverses and bulk processed black and white Landsat MSS images at a scale of 1:500,000. From this broad perspective, interactive digital processing was carried out on selected areas in W Ethiopia, SE Sudan, and N Kenya. Principal component analysis decorrelation stretching and box-car filtering were used to delineate major lithologic and crustal lineaments. Based on this study it was possible to trace five ophiolitic belts, and to subdivide NE Africa into three structurally distinct areas: (1) in NE Sudan-Eritrea there is a complex interaction of northeasterly and northwesterly structures; (2) in W Ethiopia the structural trends are dominantly N-S to northeasterly; (3) in S Ethiopia, Uganda and N Kenya the structural trend is northwesterly, which is a consequence of shearing along northwesterly trending faults. W Ethiopia has been taken as a case study and guidelines for future mineral exploration are discussed. From consideration of the geographical distribution of orefields, geochemical anomalies and lineament maps, it is shown that lineaments may have influenced localization of several ore deposits in this region. Author

A88-32925#
IMPORTANCE OF FAULT MAPPING TO MINERAL/GEOTHERMAL EXPLORATION: RELATIONSHIP TO FLUID MIGRATION AND ORE FORMATION - NORTHWEST WASHINGTON
LOWELL E. BOGART (Geological and Exploration Associates, Port Townsend, WA) and LEIGH A. READDY (Geological and Exploration Associates, Kirkland, WA) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 395-404. refs

A88-32926#
SPECTRAL DISCRIMINATION OF ZEOLITES AND DIOCTAHEDRAL CLAYS IN THE NEAR-INFRARED
WILLIAM J. EHMANN and NORMA VERGO (USGS, Reston, VA) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 417-425. refs

Analysis of laboratory near-infrared spectra of zeolites and dioctahedral clays suggests a means for discriminating between

the two mineral groups. From 0.4-0.7 micron, the spectral curves of both zeolites and dioctahedral clays show increasing reflectance values, with high reflectance values from 0.7-2.5 microns, punctuated by intense molecular water absorptions at 1.41 and 1.90 microns. However, at 2.20 microns, dioctahedral clays show a moderately strong absorption feature due to overtones of the Al-OH bending mode, whereas most zeolites have a local reflectance maximum in this region. Natrolite and analcime are unusual in that they exhibit additional well-defined absorption features in the 2.0-2.5 micron region that probably result from water occupying different molecular sites. Although the spectral difference between the zeolites and clays at 2.20 microns is not resolvable using the Thematic Mapper, it should be apparent when using higher resolution sensors such as the Airborne Imaging Spectrometer. Author

A88-32927*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
USE OF CALIBRATION TARGETS IN THE MEASUREMENT OF 2.22-MICRON MINERAL ABSORPTION FEATURES IN THEMATIC MAPPER DATA
CHRISTOPHER D. ELVIDGE (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 427-438. refs

A mineral absorption index (MAI) has been developed to separate leaf water and mineral absorption in the 2.22-micron Thematic Mapper band. The MAI uses three baselines to estimate and subtract the absorption attributable to vegetation. Digital number data from calibration targets devoid of vegetation are used to establish the positions of the baselines in Thematic Mapper data. Author

A88-32929#
SURFACE EXPRESSION OF SUBSURFACE STRUCTURES IN THE MICHIGAN BASIN
JOHN D. HERMAN and JANE E. WAITES (GeoSpectra Corp., Ann Arbor, MI) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 451-461. refs

Consideration is given to the surface features over subsurface structures associated with selected known oil and gas fields in the Michigan Basin including the Boyd-Peters field in southern St. Clair County, the Rich oil and gas field in northern Lapeer County, the Albion-Scipio field in Calhoun, Jackson, and Hillsdale Counties, and the Stoney Point field in Jackson and Hillsdale Counties. Comparisons were made between bedrock surface contour maps and glacial drift thickness and lithology maps, subsurface structure maps, plots of Landsat lineaments and circular features, Landsat lineament density contour maps automatically produced by computer software, and shaded relief maps derived from digital terrain data tapes by computer software. It is shown that subsurface structures on the southern rim of the Michigan Basin are associated with detectable surface expressions in the form of lineaments and oval features even though these structures are covered by glacial drift. K.K.

A88-32931#
A GEOBOTANICAL INVESTIGATION OF AN EXPLORATION-SIZED TERRITORY
MATHEW R. SCHWALLER (EOSAT Co., Lanham, MD) and STEVEN J. TKACH (Phillips Petroleum Co., Denver, CO) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 483-489. refs

This paper summarizes the final results from a series of geobotanical investigations conducted on Michigan's Keweenaw Peninsula. The investigations were conducted in an area of copper sulfide mineralization covered by deciduous forest. This area was chosen because a 30,000 sample soil geochemical survey covering 20 sq km was available for comparison with airborne Thematic Mapper Simulator (TMS) imagery. Linear discriminant analysis revealed that the TMS thermal channel (10.32-12.33 microns) contributed most, while TMS bands 2 (0.53-0.60 micron), 3 (0.63-0.69 micron), and 5 (1.53-1.73 anomalous and background sites micron) contributed somewhat more modestly to separation of geochemically anomalous and background sites imaged by the TMS. Geobotanical indices based on these bands identified candidate areas that contained elevated concentrations of soil copper at a rate up to 8 times higher than expected by random or systematic sampling. Author

A88-32934#
SPECTRAL GEOBOTANICAL INVESTIGATION OF MINERALIZED TILL SITES
V. SINGHROY (Ontario Centre for Remote Sensing, Toronto, Canada), R. STANTON-GRAY (Perceptron Computing, Inc., Toronto, Canada), and J. SPRINGER (Ontario Geological Survey, Sudbury, Canada) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 523-543. refs

The spectral response of conifers and deciduous tree species growing on three mineralized sites in glaciated and vegetated terrains (a site near White Lake site in Northern Manitoba, a site near Natal Lake in Northern Ontario, and a site near Arnprior in Eastern Ontario) is studied. The till of the White Lake site contains 150 to 3,000 ppm of Zn-Cu-Pb whereas the geochemical values at the Natal Lake and Arnprior sites vary from 60 to 1,500 ppm of Zn-Cu-Pb in the rock in soil. It is shown that, when MEIS II bands are matched to reliable spectral signatures, the data they produce are capable of revealing geochemically stressed vegetation. K.K.

A88-32936#
A COMPARISON OF LINEAMENTS INTERPRETED FROM REMOTELY SENSED DATA AND AIRBORNE MAGNETICS AND THEIR RELATIONSHIP TO GOLD DEPOSITS IN CENTRAL NOVA SCOTIA
J. HARRIS (F. G. Bercha and Associates, Ltd.; Canada Centre for Remote Sensing, Ottawa) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 557-576. refs

A88-32937#
CONFIRMATION OF QUANTITATIVE MORPHOSTRUCTURAL ANALYSIS BY SEISMIC, AEROMAGNETIC AND GEOCHEMICAL DATA IN THE AMAZON BASIN, BRAZIL
FERNANDO PELLON DE MIRANDA and NELSON ADAO BABINSKI (PETROBRAS, Centro de Pesquisas e Desenvolvimento, Rio de Janeiro, Brazil) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 579-587. refs

A88-32938#
THEMATIC MAPPER APPLIED TO ALTERATION ZONE MAPPING FOR GOLD EXPLORATION IN SOUTH-EAST SPAIN
J. A. HUCKERBY, R. MAGEE, J. MCM. MOORE (Imperial College of Science and Technology, London, England), and D. COATES IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 591-599.

A88-32939#
EXPLORATION FOR MERCURY AND LEAD-ZINC-SILVER USING THE AIRBORNE THEMATIC MAPPER, ALMADEN AREA, SPAIN
A. E. HARDING, G. R. GARRARD (Hunting Geology and Geophysics, Ltd., Borehamwood, England), and E. ORTEGA

GIRONES (Minas de Almaden y Attayanes, S.A., Spain) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 601-606. refs

A88-32940#
THE USE OF THEMATIC MAPPER IMAGERY FOR MINERAL EXPLORATION IN THE SEDIMENTARY TERRAIN OF THE SPRING MOUNTAINS, NEVADA
DAVID W. BRICKEY (USGS, Reston, VA) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 607-613. refs

This study reports on an assessment of the mineral potential of the sedimentary rocks in a part of the Spring Mountains of southern Nevada. The mountains are comprised of Precambrian to Jurassic sedimentary rocks of predominately carbonate composition. Known mineralization occurs primarily as vein and replacement ores of base and precious metals in Paleozoic dolomitized limestones, and in Precambrian clastic and carbonate rocks. A color-ratio-composite (CRC) image of Landsat Thematic Mapper (TM) band ratios 5/7, 5/4, and 3/1 was used to locate potentially hydrothermally altered rocks associated with these mineralization types. Subsequent field checking of the TM-defined anomalies located four altered areas in clastic rocks and one in carbonate rocks. TM anomalies caused by unaltered carbonate rocks could be distinguished from altered rocks only with field work. A digital classification of hydrothermally altered rocks was made by using the CRC image. Author

A88-32941*# Nevada Univ., Reno.
AN INTEGRTATED APPROACH TO THE USE OF LANDSAT TM DATA FOR GOLD EXPLORATION IN WEST CENTRAL NEVADA
D. A. MOUAT (Nevada, University, Reno), J. S. MYERS (NASA, Ames Research Center, Moffett Field, CA), and N. L. MILLER (Advanced Exploration Technologies, Vancouver, Canada) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 615-626. refs

This paper represents an integration of several Landsat TM image processing techniques with other data to discriminate the lithologies and associated areas of hydrothermal alteration in the vicinity of the Paradise Peak gold mine in west central Nevada. A microprocessor-based image processing system and an IDIMS system were used to analyze data from a 512 X 512 window of a Landsat-5 TM scene collected on June 30, 1984. Image processing techniques included simple band composites, band ratio composites, principal components composites, and baseline-based composites. These techniques were chosen based on their ability to discriminate the spectral characteristics of the products of hydrothermal alteration as well as of the associated regional lithologies. The simple band composite, ratio composite, two principal components composites, and the baseline-based composites separately can define the principal areas of alteration. Combined, they provide a very powerful exploration tool. Author

A88-32942#
IDENTIFICATION OF CLAY MINERALS BY FEATURE CODING OF NEAR-INFRARED SPECTRA
YASUSHI YAMAGUCHI and RONALD J. P. LYON (Stanford University, CA) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 627-636. refs

A88-32944#
DETECTION OF GEOLOGIC FEATURES IN LANDSAT TM IMAGERY NOT REVEALED IN LANDSAT MSS IMAGERY
T. E. TOWNSEND (Exxon Production Research Co., Houston, TX) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 651-654.

Landsat Thematic Mapper (TM) data are significantly better than Landsat Multispectral Scanner (MSS) data for exploration applications because TM data provide geologic information not previously available. Landsat-4 MSS imagery of Death Valley, California, was compared with simultaneously acquired TM imagery of the same area to determine how the geologic interpretability of the data was enhanced by its greater spatial, spectral, and radiometric resolution. The greater spatial resolution of the TM allowed faults and folds to be interpreted more reliably and allowed secondary features associated with them to be recognized that were not detectable on the MSS imagery. Furthermore, oxidation of basalts was detected because of the better spectral resolution of the system. The additional structural and lithologic information available from TM data promotes improved geologic mapping, which can often be critical to exploration applications. Author

A88-32945#
SPECTRAL REFLECTANCE FROM LICHENS TREATED WITH COPPER
P. J. BECKETT and G. M. COURTIN (Sudbury, Laurentian University, Canada) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 661-666. Research supported by the Laurentian University of Sudbury and Ontario Geoscience Research Grant Program. refs

Reflectance spectra were measured on 'Caribou Lichen' before, and following exposure to copper sulphate solutions. The copper treatment produced shift changes in the visible and 0.75-1.0 micron portions of the spectrum. Metal extraction techniques indicated that about 90 percent of the copper taken up by the lichen was located outside the algal cells and fungal hyphae. The spectral changes in the visible wavelengths correlate with the destruction of algal chlorophyll by the copper taken into the cells. Author

A88-32946#
USE OF DIGITALLY PROCESSED LABORATORY REFLECTANCE SPECTRA FOR THE DEFINITION OF PROBABLE MICROSEEPAGE - INDUCED MINERALOGIC VARIATIONS, LISBON VALLEY, UTAH
DONALD B. SEGAL, IRA S. MERIN, and MICHAEL C. PLACE (Earth Satellite Corp., Chevy Chase, MD) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 667-676. refs

A88-32947#
GEOLOGIC SPATIAL ANALYSIS - A NEW MULTIPLE DATA SOURCE EXPLORATION TOOL
JAY R. ELIASON (Battelle Pacific Northwest Laboratories, Richland, WA) and RICHARD L. THIESSEN (Washington State University, Pullman) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 677-692. refs
(Contract DE-AC06-76RL-01830)

A research program has been initiated at the DOE Pacific Northwest Laboratory to develop quantitative and predictive spatial analysis techniques for determining the relationships between geological, geophysical, and geochemical structures in the solid earth. The geologic spatial analysis (GSA) program involves the development of digitized structural geologic analysis techniques to quantitatively analyze three-dimensional geologic data sets. Applying GSA to specific data sets makes it possible to: (1) evaluate oil and natural gas resources as well as geothermal fluid migration paths, (2) locate and assess mineral deposits, and (3) model ground-water flow systems. K.K.

A88-32948*# Cornell Univ., Ithaca, N.Y.
DISCRIMINATION AND SUPERVISED CLASSIFICATION OF VOLCANIC FLOWS OF THE PUNA-ALTIPLANO, CENTRAL ANDES MOUNTAINS USING LANDSAT TM DATA
J. H. MCBRIDE, E. J. FIELDING, and B. L. ISACKS (Cornell University, Ithaca, NY) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 693-702. refs
(Contract NAS5-28767)

Landsat Thematic Mapper (TM) images of portions of the Central Andean Puna-Altiplano volcanic belt have been tested for the feasibility of discriminating individual volcanic flows using supervised classifications. This technique distinguishes volcanic rock classes as well as individual phases (i.e., relative age groups) within each class. The spectral signature of a volcanic rock class appears to depend on original texture and composition and on the degree of erosion, weathering, and chemical alteration. Basalts and basaltic andesite stand out as a clearly distinguishable class. The age dependent degree of weathering of these generally dark volcanic rocks can be correlated with reflectance: older rocks have a higher reflectance. On the basis of this relationship, basaltaic lava flows can be separated into several subclasses. These individual subclasses would correspond to mappable geologic units on the ground at a reconnaissance scale. The supervised classification maps are therefore useful for establishing a general stratigraphic framework for later detailed surface mapping of volcanic sequences. Author

A88-32949#
ASSESSMENT OF DIGITAL ENHANCEMENT TECHNIQUES USING LANDSAT TM DATA IN MAPPING GEOLOGIC LINEAMENTS, WITH APPLICATION TO THE MACTAQUAC HEADPOND AREA, SOUTHERN NEW BRUNSWICK
R. YAZDANI, E. DERENYI, J. J. CHANDRA, and G. GOUCHER (New Brunswick, University, Fredericton, Canada) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 707-712. refs

A88-32950#
LANDSAT TM DATA AS AN AID IN PLANNING AND INTERPRETATION OF REGIONAL GEOCHEMICAL SURVEYS IN THE CANADIAN SHIELD
JOHN A. C. FORTESCUE (Ontario Geological Survey, Toronto, Canada), VERN H. SINGHROY (Ontario Centre for Remote Sensing, Toronto, Canada), and ROBERTA STANTON-GRAY (PCI, Ltd., Toronto, Canada) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 715-721.

The feasibility of using Landsat TM data to plan and interpret regional geochemical surveys in the Canadian Shield based on lake waters and sediments is assessed. A 112.2 x 15 km area in the District of Algoma was chosen for study; the geological map of the sampled area includes areas of granitic terrain, metavolcanics, and metasediments. It is concluded that Landsat TM data may be of considerable importance to the methodology of regional and geochemical surveying. K.K.

A88-32951*# Dartmouth Coll., Hanover, N.H.
REMOTE SENSING OF GEOBOTANICAL ASSOCIATIONS IN CLASTIC SEDIMENTARY TERRANE
N. J. DEFEO, R. W. BIRNIE (Dartmouth College, Hanover, NH), and K. G. MILLER (Pennsylvania, Millersville University, Millersville) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 723-732. refs
(Contract NASW-4049; JPL-956937)

Landsat Thematic Mapper data have been used to map lithologic units in the heavily forested Ridge and Valley Province, Pennsylvania. This region provides an excellent study area because there is a north-south replication of lithologic units, each with varying slope, aspect, and geobotanical associations. Each of four possible combinations of lithology (sandstone and shale) and aspect (north and south) was found to support a unique forest association. In addition, each of the four lithologic/aspect units has a unique TM spectral signature. A maximum likelihood classification algorithm produced a map that correlates well with the known lithology of the study area. The first principal component of the TM data correlates highly with illumination. The second principal component of the TM data correlates highly with latitude and may reflect senescence changes in this fall scene. Author

A88-32952#
INTEGRATION OF REMOTE SENSING AND OTHER GEO-DATA FOR ORE EXPLORATION - A SW-IBERIAN CASE STUDY
P. VOLK, R. HAYDN (Gesellschaft fuer angewandte Fernerkundung mbH, Munich, Federal Republic of Germany), and J. BODECHTEL (Muenchen, Universitaet, Munich, Federal Republic of Germany) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 733-744. refs
(Contract BMFT-01-QS-0730)

An area in the heart of the Southwest Iberian pyrite belt with potential for unexplored polymetallic pyrite ore (Rio Tinto-Tharsis type) has been the subject of a research project at the Institute for General and Applied Geology. An attempt was made to establish an effective exploration strategy by integrated survey techniques, based on the ore-genetical conditions and the lithological environment. Indirect and direct hints to ore facies were among the two types of thematic information extracted. K.K.

A88-32953#
REMOTE SENSING AND SURFACE GEOCHEMICAL STUDY OF RAILROAD VALLEY, NYE COUNTY, NEVADA - DETAILED GRID STUDY
S. G. BURTELL, V. T. JONES (Exploration Technologies, Inc., Houston, TX), R. A. HODGSON (Geologic Consulting Services, Jamestown, PA), K. OKADA, and T. OHHASHI (Japex Geoscience Institute, Inc., Tokyo, Japan) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 745-759. refs

A two-year combined remote sensing and soil-gas geochemical study conducted in Railroad Valley, Nevada is described. Soil-gas compositional subdivisions subdivide the Currant area into two compositionally different anomalies which are located northwest and southeast of the Currant Creek regional lineament. Near-surface light hydrocarbon data in the Grant Canyon detail area reveal a series of anomalous zones which reflect the updip migration of gases from the Grant Canyon producing area along the valley boundary fault. K.K.

A88-32954#
PYROPHYLLITE AND KAOLINITE ALTERATION - MINERAL DISCRIMINATION BY SAMPLE REFLECTANCE MEASUREMENT
PAUL M. LAWRENCE, RAYMOND E. LETT, NORMAN GROSKOPF (Barringer Research, Ltd., Rexdale, Canada), and GEORGE CARGILL (Utah Mines, Ltd., Toronto, Canada) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 775-784. refs

A88-32956#
PATTERN RECOGNITION AND GEOLOGICAL INTERPRETATION OF SIR-B IMAGES OF CENTRAL AUSTRALIA
G. R. TAYLOR and G. J. LYNNE (New South Wales, University, Sydney, Australia) IN: Thematic Conference on Remote Sensing

for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 799-809. refs

A test area of the northern margin of the Simpson Desert was chosen for study because of the availability of planned SIR-B orbits, its petroleum potential, and the normally arid nature of the region. The application of various preprocessing and pattern recognition filters designed to facilitate geological discrimination is described. It is concluded that the use of SIR-B variance images for pattern recognition provides an objective machine-assisted technique for radar image interpretation that is particularly valid for remote areas where detailed topographic contour data are not available. K.K.

A88-32957#
DISCRIMINATION OF GEOBOTANICAL ANOMALIES IN RUGGED ALPINE TERRAIN USING LANDSAT THEMATIC MAPPER DATA
C. BANNINGER (Graz, Technische Universitaet und Forschungszentrum, Austria) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 813-816.

A88-35160
APPLICATION OF AEROSPACE REMOTE SENSING TO GEOLOGICAL INVESTIGATIONS IN NEVADA AND CALIFORNIA
JAMES V. TARANIK (Nevada, University, Reno) IN: Aerospace century XXI: Space sciences, applications, and commercial developments; Proceedings of the Thirty-third Annual AAS International Conference, Boulder, CO, Oct. 26-29, 1986. San Diego, CA, Univelt, Inc., 1987, p. 1695-1711. refs
(AAS PAPER 86-400)

The current state and future developments of technology in geological remote sensing are discussed. The Landsat satellite is described, and applications of its data to mineral exploration are considered. The airborne Thematic Mapper, Spot satellite, Large Format Camera, Collins Airborne Radiometer and Imaging Spectrometer, and Side-Looking Airborne Radar (SLAR) and their geological remote sensing applications are addressed. Experimental remote sensing techniques with potential for application to geological investigation in Nevada and California are examined, including the Airborne Imaging Spectrometer, Advanced Visible and Infrared Imaging Spectrometer, Spaceborne Imaging Spectrometer, Thermal Infrared Multispectral Scanner, and Spaceborne Imaging Radar. C.D.

A88-35192
POTENTIAL OF LANDSAT THEMATIC MAPPER IMAGE FOR CRYSTALLINE ROCK TYPE DISCRIMINATION - GREGORY RIFT, KENYA
ALESSANDRO TIBALDI and MASSIMO FERRARI (Milano, Universita, Milan, Italy) Geocarto International (ISSN 1010-6049), vol. 3, March 1988, p. 3-12. refs

In order to test the full potential of the computer-enhanced image of original Landsat Thematic Mapper data, the semiarid area of the Gregory Rift Valley (Kenya) was selected. The aim is to estimate the capability of false partially color composite in bands one, three, and four to discriminate among metamorphic and various volcanic rock types. Furthermore signal reflectance differences among rocks of various ages but equal chemical characteristics were evaluated. Field surveys of the authors and published geological data made it possible to gather a great amount of ground truth. Comparison of satellite image interpretation and field geological data has demonstrated the validity of this TM image enhancement in lithotype discrimination, but also has led to better definition of the spatial distribution of the various rock types in the area. Author

A88-35193
COMPUTER PROCESSING OF SATELLITE DATA FOR GEOSTRUCTURAL ZONING OF A COLLISIONAL BOUNDARY, SIGNIFICANCE AND FIELD CHECKS - THE EXAMPLE OF TUNISIA
CARLO MARIA MARINO and ALESSANDRO TIBALDI (Milano, Universita, Milan, Italy) Geocarto International (ISSN 1010-6049), vol. 3, March 1988, p. 13-28. refs

A88-36161
THE USE OF SPACE DATA TO STUDY PRECAMBRIAN STRUCTURES [ISPOL'ZOVANIE KOSMICHESKOI INFORMATSII PRI IZUCHENII DOKEMBRIISKIKH STRUKTUR]
L. N. UIMANOVA (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Geologii Zarubezhnykh Stran, Moscow, USSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 30-36. In Russian.

The possibility of using space photographic data to identify and study the development of Precambrian structures is assessed on the example of Central East Africa. As a rule, these are deep-seated structures which have been repeatedly activated during tectonic-magmatic cycles up to the period of recent riftogenesis. B.J.

A88-36162
THE SOUTH ALAMURYNIAN RING STRUCTURE - A NEW PROMISING AREA TO SEARCH FOR HYDROCARBON DEPOSITS [IUZHNO-ALAMURYNSKAIA KOL'TSEVAIA STRUKTURA-NOVYI VOZMOZHNYI OB'EKT POISKOV ZALEZHEI UGLEVODORODOV]
V. I. POPKOV and A. A. RABINOVICH (Kazakhskii Gosudarstvennyi Nauchno-Issledovatel'skii i Proektnyi Institut Neftianoi Promyshlennosti, Shevchenko, Ukrainian SSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 37-41. In Russian.

Several ring structures were identified on space photographs of Mangyshlak. It is suggested that the South Alamurynian ring structure situated in the northwest Kara Bogaz Gol region may be a promising area for oil and gas exploration. B.J.

A88-36163
QUANTITATIVE ANALYSIS OF A NETWORK OF FAULTS RECOGNIZED ON REMOTE-SENSING IMAGES OF THE MUSHUGAI AREA IN MONGOLIA [OPYT KOLICHESTVENNOGO ANALIZA SETI RAZLOMOV, VYIAVLENNYKH PO AEROKOSMICHESKIM SNIMKAM V MUSHUGAISKOM RAIONE MNR]
ZH. GAN-OCHIR, M. GANZORIG, and Z. ARIUNAA (AN MNR, Institut Fiziki i Tekhniki, Ulan-Bator, Mongolian People's Republic) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 42-47. In Russian. refs

A88-36172
REMOTE SENSING OF THE EARTH'S SURFACE IN THE ULTRAVIOLET RANGE [DISTANTSIONNOE ZONDIROVANIE ZEMNOI POVERKHNOSTI V UL'TRAFIOLETOVOM DIAPAZONE]
V. A. SELIVANOV (Moskovskii Elektrotekhnicheskii Institut Sviazi, Moscow, USSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 111-120. In Russian. refs

The published literature on the remote sensing of the earth's surface in the UV range is reviewed. Particular consideration is given to the history of the question, the reflective properties of natural formations in the UV range, the observation conditions, and UV imaging techniques. It is concluded that UV sensing can provide information in various areas (geology, environment protection, etc.) that does not duplicate information obtainable in the visible range. B.J.

A88-41945
INFLUENCE OF MINERAL COATINGS AND VEGETATION ON TM IMAGERY OVER TERTIARY CALDERA LITHOLOGIES BASIN AND RANGE PROVINCE, WESTERN U.S.

D. M. SPATZ, J. V. TARANIK, and L. C. HSU (Nevada, University, Reno) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 13-25. refs

A88-41955* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MULTISPECTRAL GEOLOGIC REMOTE SENSING OF A SUSPECTED IMPACT CRATER NEAR AL MADAFI, SAUDI ARABIA
J. B. GARVIN and H. W. BLODGET (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 317-323. refs

A multispectral Landsat TM image of a 6-km-diameter circular formation at Al Madafi in NW Saudi Arabia is interpreted by means of color-band composites, band ratios, and principal-components analysis to determine the nature of this feature. The geological characteristics of impact craters are discussed, and the satellite-image analysis techniques are described. Disruptions in the pattern of spectral signatures are seen in the Al Madafi formation and shown to be consistent with an impact origin. T.K.

A88-41975
SYNTHETIC GEOLOGICAL MAP OBTAINED BY REMOTE SENSING - AN APPLICATION TO PALAWAN ISLAND
F. BENARD and C. MULLER (Institut Francais du Petrole, Rueil-Malmaison, France) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 103-109. refs

A88-41978
SHUTTLE IMAGING RADAR RESPONSE FROM SAND DUNES AND SUBSURFACE ROCKS OF ALASHAN PLATEAU IN NORTH-CENTRAL CHINA
HUADONG GUO (Chinese Academy of Sciences, Institute of Remote Sensing Application, Beijing, People's Republic of China), G. G. SCHABER, C. S. BREED (USGS, Flagstaff, AZ), and A. J. LEWIS (Oregon State University, Corvallis) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 137-143. refs

SIR-A and SIR-B images of three sand dunes and two bedrock regions in Alashan Plateau of north-central China have been studied and compared to Landsat imagery and field investigation data. The results of the study show that radar illumination direction is an important factor which results in the echo strength change for the same type and size of sand dunes. The sand dunes in which the slipfaces are oriented to radar beam have a bright-point response and the dunes in which the gentle slopes face the radar beam have a dark signature on the radar image. Two Precambrian metamorphic rockbodies buried beneath the thin layer of alluvial material or aeolian sand have been detected by using these two radar images. Author

A88-41979
DETECTION BY SIDE-LOOKING RADAR OF GEOLOGICAL STRUCTURES UNDER THIN COVER SANDS IN ARID AREAS
B. N. KOOPMANS (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 149-156. refs

Images of SIR-A and SIR-B shuttle radar have been studied for penetration capability of the microwaves in arid areas. In the Red Sea hills (Sudan), the radar information was compared with Landsat Images and Large Format Camera (LFC) photos. Particularly on the latter, much detail could be obtained through stereo analysis. A radar strip over the central Iranian desert was compared with hand-held shuttle photography. In both Sudan and Iran it appeared that the radar images revealed some information of the bedrock in the sandy areas otherwise not visible on the images obtained in the visible or near infrared part of the spectrum, indicating a certain penetration capability of microwaves through thin cover sands. The differences between 'dike lineament' interpretation on radar image and LFC photos are not so much influenced by the penetration capability of microwaves, but much more by the influence radar look direction has on the enhancement or depreciation of lineaments. Author

A88-41980
GEOLOGICAL ANALYSIS OF SEASAT SAR AND SIR-B DATA IN HAITI
PH. REBILLARD (Societe Europeenne de Propulsion, Division de Traitement d'Images, Puteaux, France) and B. MERCIER DE L'EPINAY (Paris VI, Universite, France) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 157-160. refs

Synthetic Aperture Radar data obtained by Seasat in 1978 and by SIR-B in 1984 were registered to the corresponding Landsat MSS data over the Western part of Haiti. Two areas were studied: the island of La Gonave and the Miragoane area. Seasat SAR data were registered to the Landsat data over the island of La Gonave and both Seasat and SIR-B data were compared over the Miragoane area. In both cases, difficulties occurred in the interpretation due to the relief which distorted the radar data, particularly the Seasat data for which the radar incidence angle was 20 degrees; furthermore, on the Miragoane area difficulties occurred using the SIR-B data due to low radar signal. Structural lines and lithological boundaries were pointed out thanks to the compositional and textual informations provided by the radar and MSS data. Geological interpretation maps of La Gonave and the Miragoane area were drawn: boundaries between rocks Eocene of age and rough basalts were precise as well as (1) domes, (2) ancients faults oriented NE-SW, (3) faults oriented NW-SE linked to the La Gonave anticline and (4) faults oriented E-W integrated in the tectonic model of the Caribbean plate. Author

A88-41983
EVALUATION OF DIGITALLY PROCESSED LANDSAT IMAGERY AND SIR-A IMAGERY FOR GEOLOGICAL ANALYSIS OF WEST JAVA REGION, INDONESIA
INDROYONO SOESILO and RICHARD A. HOPPIN (Iowa, University, Iowa City) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 173-182. Research supported by the Indonesian Cultural Foundation. refs

A88-41992
THE USE OF THEMATIC MAPPER IMAGERY FOR GEOMORPHOLOGICAL MAPPING IN ARID AND SEMI-ARID ENVIRONMENTS
A. R. JONES (Reading, University, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 273-280. refs

The evaluation of satellite obtained imagery for geomorphological mapping is discussed with emphasis on the main advantages of such data: a synoptic overview, multi-date coverage, multispectral imagery and digital format which allows the user to employ computer-assisted image processing. The Thematic Mapper (TM) sensor of the Landsat satellites is better suited for geoscientific applications than the earlier Multispectral scanner (MSS) system. This is due to improved spatial and spectral

characteristics. Examples are given, using a test site in southern Tunisia, of the value of TM imagery for geomorphological investigations. To effectively employ such data for such studies, digital image processing must be utilized to extract the necessary information. Examples of techniques such as contrast stretching, image convolution, band ratioing, principal component analysis and unsupervised classification are discussed. Author

A88-42017
REGIONAL GEOLOGIC MAPPING OF DIGITALLY ENHANCED LANDSAT IMAGERY IN THE SOUTHCENTRAL ALBORZ MOUNTAINS OF NORTHERN IRAN
SIMA BAGHERI (New Jersey Institute of Technology, Newark) and RALPH W. KIEFER (Wisconsin, University, Madison) IN: *Remote sensing for resources development and environmental management*; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 555-559. refs

This study evaluates the utility of using Landsat MSS data in regional geologic mapping of lineaments. Both conventional image interpretation techniques and digital enhancement techniques were utilized. The presence and orientation of lineaments can have great structural significance and a correlation may exist between them and zones of weakness characterized by seismic activity and mineral concentrations. The lineaments detected on computer-enhanced imagery of the study area exhibited definite trends providing a regional view of the geological 'grain' of the area. When lineament alignments located by Landsat image analysis were plotted, a correlation was found between lineaments detected on the enhanced scene and earthquake epicenters, as well as the mapped location of phosphate deposits of the study area. Author

A88-42019
COMPARISON BETWEEN INTERPRETATION OF IMAGES OF DIFFERENT NATURE
G. BOLLETTINARI (Morfogeo, Ferrara, Italy) and F. MANTOVANI (Ferrara, Universita, Italy) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 569-571.

Band 7 and FCC Landsat images and SLAR and panchromatic black and white photomosaic images are analyzed to identify and interpret geomorphological and neotectonic features of central and northern Peru. The process used to interpret images and the morphoneotectonics classification used are analyzed, giving the advantages and disadvantages of each type of image and indicating limitations to their interpretation. It is concluded that both small and large scale resolution images are required for this type of regional study. R.B.

A88-42021
GEOLOGICAL ANALYSIS OF THE SATELLITE LINEAMENTS OF THE VISTULA DELTA PLAIN, ZULAWY WISLANE, POLAND
BARBARA DANIEL DANIELSKA, STANISLAW KIBITLEWSKI (Instytut Geologiczny, Warsaw, Poland), and ANDRZEJ SADURSKI (Gdansk, Politechnika, Poland) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 579-584. refs

A88-42022
ANALYSIS OF LINEAMENTS AND MAJOR FRACTURES IN XICHANG-DUKOU AREA, SICHUAN PROVINCE AS INTERPRETED FROM LANDSAT IMAGES
DEFU LU, WENHUA ZHANG, BINGGUANG LIU (Chinese Academy of Geological Sciences, Institute of Geology, Beijing, People's Republic of China), RUISONG XU, and BAOLIN JANG (Chinese Academy of Sciences, Institute of Geologic Technology, Guangzhou, People's Republic of China) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 585-588.

A88-42023
APPLICATION OF REMOTE SENSING IN THE FIELD OF EXPERIMENTAL TECTONICS
J. DEHANDSCHUTTER (Musee Royal de l'Afrique Centrale, Tervuren, Belgium) IN: *Remote sensing for resources development* and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 589-594. refs

A framework of transverse lineaments visible in Landsat MSS imagery of brittle and ductile tectonic domains in the Andes and Central Africa is used to study geological structures indicative of the orientation of the paleo-stress field in which they were created, including tensional joints, vertical faults, quartz dykes and sedimentary basins of pull-apart origin. Various classes of geological structures are shown to repeatedly occupy the same position inside a basic rhomb configuration. Photoelastic stress analyses show the elastic properties of homogenous plates cut by vertical discontinuities to be different from those in the interior of the plate, suggesting that several factors, including the rhombic pattern determine the geometric position of lineaments and structures. Directions of vertical faulting inside the blocks and oblique-slip rotational strain inside the lineaments are predicted. R.B.

A88-42027
APPLICATION OF MEIS-II MULTISPECTRAL AIRBORNE DATA AND CIR PHOTOGRAPHY FOR THE MAPPING OF SURFICIAL GEOLOGY AND GEOMORPHOLOGY IN THE CHATHAM AREA, SOUTHWEST ONTARIO, CANADA
A. B. KESIK, H. GEORGE, and M. M. DUSSEAULT (Waterloo, University, Canada) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 615-617.

A88-42028
REMOTE SENSING METHODS IN GEOLOGICAL RESEARCH OF THE LUBLIN COAL BASIN, SE POLAND
STANISLAW KIBITLEWSKI and BARBARA DANIEL DANIELSKA (Instytut Geologiczny, Warsaw, Poland) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 619-624. refs

A88-42029
PHOTO-INTERPRETATION OF LANDFORMS AND THE HYDROGEOLOGIC BEARING IN HIGHLY DEFORMED AREAS, NW OF THE GULF OF SUEZ, EGYPT
E. A. KORANY (University of Qatar, Doha) and L. L. ISKANDAR (Secondary Schools, Cairo, Egypt) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 625-630. refs

A88-42030
MONITORING GEOMORPHOLOGICAL PROCESSES IN DESERT MARGINAL ENVIRONMENTS USING MULTITEMPORAL SATELLITE IMAGERY
A. C. MILLINGTON, A. R. JONES (Reading, University, England), N. QUARMBY, and J. R. G. TOWNSHEND (NERC, Unit for Thematic Information Services, Reading, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium,

Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 631-637. refs

Methods for geomorphological process monitoring and change detection using digitally processed multitemporal Landsat TM and MSS imagery are evaluated in south-central Tunisia. Three categories of changes are detected - subsampling unit, seasonal and long-term changes. Hydrological and geomorphological changes in Tunisian playas are examined within these categories. Both surface water and groundwater are important in determining salt and sediment budgets on these playas. Author

A88-42033
DETECTING AND MAPPING OF DIFFERENT VOLCANIC STAGES AND OTHER GEOMORPHIC FEATURES BY LANDSAT IMAGES IN 'KATAKEKAUMENE', WESTERN TURKEY
F. SANCAR OZANER (Mineral Research and Exploration Institute, Ankara, Turkey) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 653-656. refs

A88-42034
A REMOTE SENSING METHODOLOGICAL APPROACH FOR APPLIED GEOMORPHOLOGY MAPPING IN PLAIN AREAS
ELISEO POPOLIZIO (Universidad Nacional del Nordeste, Corrientes, Argentina) and CARLOS CANOBA (Rosario, Universidad Nacional, Argentina) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 657-663. refs

A88-42036
AN EVALUATION OF POTENTIAL URANIUM DEPOSIT AREA BY LANDSAT DATA ANALYSIS IN OFFICER BASIN, SOUTH-WESTERN PART OF AUSTRALIA
H. WADA, K. KOIDE (Power Reactor and Nuclear Fuel Development Corp., Tokyo, Japan), Y. MARUYAMA, and M. NASU (Asia Air Survey Co., Ltd., Tokyo, Japan) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 679-683. refs

A88-42049
ANALYSIS OF LANDSAT MULTISPECTRAL-MULTITEMPORAL IMAGES FOR GEOLOGIC-LITHOLOGIC MAP OF THE BANGLADESH DELTA
A. SESOREN (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 759-764. refs

A88-42068* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
REMOTE SENSING FOR NON-RENEWABLE RESOURCES - SATELLITE AND AIRBORNE MULTIBAND SCANNERS FOR MINERAL EXPLORATION
ALEXANDER F. H. GOETZ (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; Colorado, University, Boulder) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 3. Rotterdam, A. A. Balkema, 1986, p. 1009-1014. refs

The application of remote sensing techniques to mineral exploration involves the use of both spatial (morphological) as well as spectral information. This paper is directed toward a discussion of the uses of spectral image information and emphasizes the newest airborne and spaceborne sensor developments involving imaging spectrometers. Author

A88-44646*
STRUCTURAL GEOLOGY AND REGIONAL TECTONICS OF THE MINERAL COUNTY AREA, NEVADA, USING SHUTTLE IMAGING RADAR-B AND DIGITAL AEROMAGNETIC DATA
MARCUS X. BORENGASSER and JAMES V. TARANIK (Cooperative Institute for Aerospace Science and Terrestrial Applications, Reno, Nevada) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, May 1988, p. 967-980. refs (Contract NASA ORDER L-61130-C)

SIR-B and aeromagnetic lineaments show a correlation with known faults within the Walker Lane of the western Basin and Range Province. Walker Lane faults can be extended based on SIR-B data and unmapped Walker Lane features are identified. South of the Pancake Range lineament, Walker Lane faults are seldom recognized but SIR-B data have the potential for delineating structural features in this area. Earthquake hypocenter distribution in profiles across a SIR-B lineament is consistent with that expected from a vertical fault. Field examination indicates that the lineament is an unmapped neotectonic Walker Lane feature. Author

A88-44647
A COMPARATIVE ANALYSIS OF DYKE LINEAMENTS MAPPED FROM SHUTTLE IMAGING RADAR AND LARGE FORMAT CAMERA PHOTOGRAPHY IN HYPERARID AREAS OF THE EASTERN DESERT, EGYPT, AND RED SEA HILLS, SUDAN
B. N. KOOPMANS (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, May 1988, p. 981-995. refs

A88-45634
GEOTECHNICAL APPLICATIONS OF REMOTE SENSING AND REMOTE DATA TRANSMISSION; PROCEEDINGS OF THE SYMPOSIUM, COCOA BEACH, FL, JAN. 31-FEB. 1, 1986
A. I. JOHNSON, ED. (International Committee on Remote Sensing and Data Transmission, Arvada, CO) and C. B. PETTERSSON, ED. (Brown and Root, Inc., Houston, TX) Symposium sponsored by ASTM. Philadelphia, PA, American Society for Testing and Materials, 1988, 286 p. For individual items see A88-45635 to A88-45643.

Papers and discussions concerning the geotechnical applications of remote sensing and remote data transmission, sources of remotely sensed data, and glossaries of remote sensing and remote data transmission terms, acronyms, and abbreviations are presented. Aspects of remote sensing use covered include the significance of lineaments and their effects on ground-water systems, waste-site use and geotechnical characterization, the estimation of reservoir submerging losses using CIR aerial photographs, and satellite-based investigation of the significance of surficial deposits for surface mining operations. Other topics presented include the location of potential ground subsidence and collapse features in soluble carbonate rock, optical Fourier analysis of surface features of interest in geotechnical engineering, geotechnical applications of U.S. Government remote sensing programs, updating the data base for a Geographic Information System, the joint NASA/Geosat Test Case Project, the selection of remote data telemetry methods for geotechnical applications, the standardization of remote sensing data collection and transmission, and a comparison of airborne Goodyear electronic mapping system/SAR with satelliteborne Seasat/SAR radar imagery. R.B.

A88-45635
CASE STUDIES ON THE APPLICATION OF REMOTE SENSING DATA TO GEOTECHNICAL INVESTIGATIONS IN ONTARIO, CANADA
VERNON H. SINGHROY (Ontario Centre for Remote Sensing, Toronto, Canada) IN: Geotechnical applications of remote sensing

and remote data transmission; Proceedings of the Symposium, Cocoa Beach, FL, Jan. 31-Feb. 1, 1986. Philadelphia, PA, American Society for Testing and Materials, 1988, p. 9-45. refs

The contribution and limitations of remote sensing data to the planning and construction of cross-country natural gas pipelines, the search for suitable near-surface construction materials, the evaluation of sites for the disposal of hazardous water, and the identification of conditions likely to give rise to mine roof instabilities, are examined, using Landsat TM and Seasat SAR data taken before, during, and after construction of pipelines in southern Ontario. Airborne thermography was used to delineate an area of near-surface aggregate overlain by a layer of sand-silt till 3 to 7 mm thick. Infrared and geophysical data were used for mapping a potential nuclear waste disposal site, identifying dikes and faults and delineating surficial materials. Visible infrared and thermal data were used to detect areas of instability in the roof of a gypsum mine. It is concluded that the amount of moisture retained within the soil and in fractures at the time of data acquisition is a main link between remote sensing and geotechnical investigations. R.B.

A88-45638
A SATELLITE-BASED INVESTIGATION OF THE SIGNIFICANCE OF SURFICIAL DEPOSITS FOR SURFACE MINING OPERATIONS
JOSEPH H. J. LEACH and C. W. MALLETT (CSIRO, Div. of Geomechanics, Indooroopilly, Australia) IN: Geotechnical applications of remote sensing and remote data transmission; Proceedings of the Symposium, Cocoa Beach, FL, Jan. 31-Feb. 1, 1986. Philadelphia, PA, American Society for Testing and Materials, 1988, p. 122-137. refs

The use of NOAA-AVHRR, Landsat MSS, and SIR imagery to determine the distribution, structure, and form of surficial deposits in the vicinity of large-scale mining operations in the Bowen Basin of Queensland, Australia is examined, pointing out the capabilities and limitations of geotechnical applications of remote sensing and discussing possible future developments in satellite systems. The use of satellite imagery to obtain data on structural lineaments and the location and variation within surficial deposits is discussed. The use of TM and SPOT systems for geotechnical applications is examined, and it is suggested that a potential comprehensive geotechnical remote sensing system should be able to generate steroscopic images in the visible to midinfrared spectrum with a ground resolution of 20 m or less, be able to image in the thermal IR with a ground resolution of about 80 m and to generate day/night pairs from this imagery, and include a multiband radar imaging system with a variable look angle and an effective ground resolution comparable to that of the visible imaging system. R.B.

A88-45641
GEOTECHNICAL APPLICATIONS OF THREE NEW U.S. GOVERNMENT REMOTE SENSING PROGRAMS
BRUCE F. MOLNIA (National Academy of Sciences, Washington, DC) IN: Geotechnical applications of remote sensing and remote data transmission; Proceedings of the Symposium, Cocoa Beach, FL, Jan. 31-Feb. 1, 1986. Philadelphia, PA, American Society for Testing and Materials, 1988, p. 183-189; Discussion, p. 190, 191. refs

The geotechnical data provided by the USGS's National High-Altitude Photography Program (NHAP) and Side-Looking Airborne Radar (SLAR) Program, and NASA's Shuttle Imaging Radar (SIR) Program are discussed. Applications of data from these programs include regional structural interpretation, delineation of drainage characteristics, evaluation of surface wetness characteristics, and assessment of rock and soil surface texture and grain size. The NHAP provides black and white and color infrared imagery at a nominal scale of 1:80,000, and enlargements at a scale of 1:24,000, covering 95 percent of the U.S. The SLAR has mapped 27 percent of the conterminous U.S. and 23 percent of Alaska, providing strip data at a scale of 1:250,000 and historic data at a scale of 1:400,000. The SIR-A imagery taken from the Shuttle covers 10 to the 7th sq km, at an incidence angle of 47 deg and a resolution of 40 m. The SIR-B provided images of 8 X 10 to the 6th sq km at a resolution of 20 m with an incidence angle of 47 deg. R.B.

A88-45642
THE JOINT NASA/GEOSAT TEST CASE PROJECT
IN: Geotechnical applications of remote sensing and remote data transmission; Proceedings of the Symposium, Cocoa Beach, FL, Jan. 31-Feb. 1, 1986. Philadelphia, PA, American Society for Testing and Materials, 1988, p. 197-200.

A summary of a report on the Joint NASA/Geosat Test Case Project which analyzes Landsat MSS digital and photographic data to evaluate the geological usefulness of remote sensing technology, especially for mineral and petroleum exploration, is presented. Images were with a ground resolution of about 80 m in four spectral bands of eight test sites in the semiarid portions of the western US and the Appalachian mountains. Ground-based measurements were taken to determine the reflectance properties of rocks, soils, and natural vegetation, showing that rocks of similar lithology can exhibit different reflectance properties at different sites. It was found that such ground-based measurements are required for effective lithographic mapping. R.B.

A88-45771
AIRBORNE RESISTIVITY MAPPING
ALEX BECKER (California, University, Berkeley) IEEE *Transactions on Antennas and Propagation* (ISSN 0018-926X), vol. 36, April 1988, p. 557-562. refs

A brief overview is presented of the theory and techniques for mapping the electrical resistivity of surficial formations by interpreting airborne electromagnetic induction data. Although the method has not yet reached its full potential, useful information can be obtained on the thickness, the conductivity, and the depth below the surface of any conductive unconsolidated material. Practical applications of this geophysical method include the mapping of aquifers, the delineation of salt-water intrusions, and the estimation of the depth of valley fill material. The instrumentation is described and both time- and frequency-domain systems are discussed. Methods and examples of automated data interpretation are given. On the basis of the results available to date it is concluded that with present equipment and using the limited methods of intepretation described, one can map the thickness of the uppermost layer (be it conductive or resistive) to a depth somewhat greater than 50 m with an accuracy of about 10-20 m. I.E.

N88-20754*# Massachusetts Inst. of Tech., Cambridge.
GEODETIC MEASUREMENT OF DEFORMATION EAST OF THE SAN ANDREAS FAULT IN CENTRAL CALIFORNIA
JEANNE M. SAUBER, MICHAEL LISOWSKI, and SEAN C. SOLOMON 1988 39 p Prepared in cooperation with Geological Survey, Menlo Park, Calif.
(Contract NAG5-814; NGT5-0103)
(NASA-CR-182709; NAS 1.26:182709) Avail: NTIS HC A03/MF A01 CSCL 08E

Triangulation and trilateration data from two geodetic networks located between the western edge of the Great Valley and the San Andreas fault have been used to calculate shear strain rates in the Diablo Range and to estimate the slip rate along the Calaveras and Paicines faults in Central California. Within the Diablo Range the average shear strain rate was determined for the time period between 1962 and 1982 to be 0.15 + or - 0.08 microrad/yr, with the orientation of the most compressive strain at N 16 deg E + or - 14 deg. The orientation of the principal compressive strain predicted from the azimuth of the major structures in the region is N 25 deg E. It is inferred that the measured strain is due to compression across the folds of this area: the average shear straining corresponds to a relative shortening rate of 4.5 + or - 2.4 mm/yr. From an examination of wellbore breakout orientations and the azimuths of P-axes from earthquake focal mechanisms the inferred orientation of maximum compressive stress was found to be similar to the direction of maximum compressive strain implied by the trend of local fold structures. Results do not support the

hypothesis of uniform fault-normal compression within the Coast Ranges. From trilateration measurements made between 1972 and 1987 on lines that are within 10 km of the San Andreas fault, a slip rate of 10 to 12 mm/yr was calculated for the Calaveras-Paicines fault south of Hollister. The slip rate of the Paicines fault decreases to 4 mm/yr near Bitter. Author

N88-22847*# University of Southern Illinois, Carbondale. Surficial Processes Research Group.
GROUNDWATER SAPPING VALLEYS: EXPERIMENTAL STUDIES, GEOLOGICAL CONTROLS AND IMPLICATIONS TO THE INTERPRETATION OF VALLEY NETWORKS ON MARS Final Contractor's Report, 1 Feb. 1985 - 31 Jan. 1988
R. CRAIG KOCHEL 15 May 1988 77 p
(Contract NAGW-707)
(NASA-CR-182718; NAS 1.26:182718) Avail: NTIS HC A05/MF A01 CSCL 03B

An integrated approach using experimental laboratory models, field studies of terrestrial analogs, and remote studies of terrestrial field sites were applied to the goals of understanding the nature and morphology of valley networks formed by groundwater sapping. In spite of problems with scaling, the experimental studies provide valuable insights into concepts relating to the initiation, development, and evolution of valleys by groundwater sapping. These investigations are also aimed at developing geomorphic criteria for distinguishing valleys formed by surface runoff from those formed by groundwater sapping processes. Channels that were field classified as sapping vs. runoff were successfully distinguished using statistical analysis of their respective morphologies; therefore, it may be possible to use similar techniques to interpret channel genesis on Mars. The terrestrial and flume studies provide the ground truth dataset which can be used (and will be during the present year) to help interpret the genesis of valley networks on Mars. Author

N88-24021*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
AIRBORNE AND SPACEBORNE RADAR IMAGES FOR GEOLOGIC AND ENVIRONMENTAL MAPPING IN THE AMAZON RAIN FOREST, BRAZIL Abstract Only
JOHN P. FORD and JAMES J. HURTAK (Technological Marketing Analysis Corp., San Francisco, Calif.) *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1, p 129 1986
Avail: NTIS HC A99/MF E03

Spaceborne and airborne radar image of portions of the Middle and Upper Amazon basin in the state of Amazonas and the Territory of Roraima are compared for purposes of geological and environmental mapping. The contrasted illumination geometries and imaging parameters are related to terrain slope and surface roughness characteristics for corresponding areas that were covered by each of the radar imaging systems. Landforms range from deeply dissected mountain and plateau with relief up to 500 m in Roraima, revealing ancient layered rocks through folded residual mountains to deeply beveled pediplain in Amazonas. Geomorphic features provide distinct textural signatures that are characteristic of different rock associations. The principle drainages in the areas covered are the Rio Negro, Rio Branco, and the Rio Japura. Shadowing effects and low radar sensitivity to subtle linear fractures that are aligned parallel or nearly parallel to the direction of radar illumination illustrate the need to obtain multiple coverage with viewing directions about 90 degrees. Perception of standing water and alluvial forest in floodplains varies with incident angle and with season. Multitemporal data sets acquired over periods of years provide an ideal method of monitoring environmental changes. Author

N88-24022# Technological Marketing Analysis Corp., San Francisco, Calif.
SUBSURFACE MORPHOLOGY AND GEOARCHAEOLOGY REVEALED BY SPACEBORNE AND AIRBORNE RADAR Abstract Only
J. J. HURTAK *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1, p 130 1986
Avail: NTIS HC A99/MF E03

The Shuttle Imaging Radar (SIR-A) aboard the Space Shuttle Columbia penetrated the extremely dry deserts of the eastern Sahara, revealing previously unknown buried valleys, geologic structures, and possible Stone Age occupation sites, not detectable by LANDSAT. Radar responses from bedrock and gravel surfaces were also able to provide information in areas covered by very dry sand up to a depth of six meters. The enhancement of many geologic structures and the delineation of adjunct units partly mantled by sand, make the SIR-A a valuable adjunct of conventional geographic mapping tools. The use of radar imaging to determine the subsurface fluvial features in southern Egypt and Sudan is compared with the detection of subsurface stream canals in the tropical terrain of Guatemala-Belize. Radar penetraion of tropical vegetation and soil varies with the wavelength of the incident signals. Subsurface features with potential tectonic or geomorphic significance may also be revealed in other orbital radar. The CV 990 imaging of tropical terrain detected the presence of an extensive canal drainage network beneath the jungle cover of Guatemala, providing the specific geologic locations of landforms which were sites of episodic human habitation. Radar imagery represents a large-scale of perspective of providing extensive information improving both the quality and quanity of subsurface morphology and geoarcheaology targets through penetration of foliage, silt, and root cover to map ancient man-made roads, causeways, and natural signatures disclosing the larger environmental design. Author

N88-24031# Purdue Univ., West Lafayette, Ind. Dept. of Geosciences.
AN INTEGRATED STUDY OF THE ALTO PARANAIBA KIMBERLITE PROVINCE, MINAS GERAIS, BRAZIL: A POSSIBLE TOOL FOR DIAMOND EXPLORATION Abstract Only
ARVIND CHATURVEDI *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 258-259 1986
Avail: NTIS HC A99/MF E03

The initial results from an integrated study of the Alto Paranaiba area utilizing remote sensing, geophysical, and geological data are presented. The Alto Paranaiba area is economically important due to the local occurrences of kimberlite and diamonds. Kimberlites in the area are confined to a narrow NW-SE oriented strip of Precambrain metasediments and occur as diatremes and dikes. Visual imterpretation of LANDSAT MSS imagery permits the delineation of the regional geology and structure of the Alto Paranaiba area. The Precambrain metasediments are easily distinguished from each other based on photo-recognition criteria. Analysis of an X-band SLAR mosaic facilitates a more detailed interpretation of the geology and structure in the vicinities of Coromandel, Monte Carmelo, and Patrocinio where most of the known kimberlites appear to be concentrated. Subtle linear and circular features, not seen on LANDSAT MSS imagery, are expressed clearly on the SLAR mosaic because of the increased resolution, look direction, and larger scale. Initial results indicate that some circular and linear features appear to be related to the known kimberlites in the area. However, several circular features, located near fractures and or fracture intersections, are not shown on previously published geological maps of the area and need to be investigated in greater detail. Author

N88-24050# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
REMOTE SENSING AND STRUCTURAL RUPTURE: APPLICATION EXAMPLES IN THE STUDY OF TECTONICS [O SENSORIAMENTO REMOTO E A ESTRUTURA RUPTIL: EXEMPLOS DE APLICACOES EM ESTUDOS TECTONICOS]
ATHOS RIBEIRODOSSANTOS *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium

and 6th SELPER Plenary Meeting, Volume 1 p 429-434 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The regional distribution of the linear structural features is best characterized in small scale remote sensing products. The development of structural studies utilizing remote sensing data has provided a systematic procedure of photointerpretation with the purpose of the extraction of structural information in a regional scale. Some of these procedural methodology, potentiality, limitations, and results are shown and discussed. The remote sensing techniques contribute good results in the regional tectonic studies. With these techniques, both brittle and brittle-ductile tectonics can be deduced. Author

N88-24051# Rio Grande do Sul Univ., Porto Alegre (Brazil).
ANALYSIS AND INTERPRETATION OF IMAGE LITHOSTRUCTURE: AN APPLICATION OF THE MULTICONCEPT IN THE METAMORPHIC BELT OF SUL DE SANTANA DA BOA VISTA (RS) [ANALISE E INTERPRETACAO LITOESTRUTURAL DE IMAGENS. UMA APLICACAO DO CONCEITO MULTI NA FAIXA METAMORFICA AO SUL DE SANTANA DA BOA VISTA - RS]
MARISA T. G. DEOLIVEIRASCHUCK, NELSON AMORETTILIS-BOA, and NILO CLEMENTEEICK *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 435-446 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

A belt of metamorphic rocks was analyzed through the visual interpretation of radar and photographic images, applying the multiconcept. On the radar images part of a big folded structure, of the antiform type, which is fractured by faulting, was regionally defined. On the aerial photography a detail was worked through the litho and structural photoanalysis and photointerpretation; and seven photogeologic units could be defined. By means of photogeologic criteria the king of faulting as well as the relative block movement was qualitatively defined in some cases. A lot of geologic information could be obtained comparing these different images. A possible sequence of geologic events, which have caused the actual rock spatial position, could be established. Author

N88-24052# Instituto de Economia e Pesquisas, Aracaju (Brazil).
STUDY OF FRACTURING FOR GROUNDWATER RESEARCH IN THE SERGIPE STATE WITH REMOTE SENSING PRODUCTS [ESTUDOS DE FRATURAMENTOS PARA PESQUISA DE AGUA SUBTERRANEA NO ESTADO DE SERGIPE COM PRODUTOS DE SENSORIAMENTO REMOTO]
OSVALDO SOUZASAMPAIO, JUERCIO TAVARESDEMATTOS, and PAULO VENEZIANI (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 447-452 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

For groundwater prospecting in Sergipe Crystalline Complex, a systematic interpretation of the remote sensing data was conducted and enabled the delineation of some potential areas for groundwater exploration in the future. The method used includes the analysis of terrain relief and drainage for delineating the principal joint and fault systems and characterizing the favorable morphostructures. Owing to the fact that the Precambrain complex is extremely compact and impermeable, the only groundwater reservoirs occur in the fractured zones in the crystalline rocks, so that morphostructure mapping is the way for groundwater prospecting. Author

N88-24069# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
UTILIZATION OF LANDSAT-TM , FOR AIDING IN THE LOCALIZATION OF ARCHEOLOGICAL SITES IN THE STATE OF SAO PAULO [UTILIZACAO DE IMAGENS LANDSAT/TM, PARA AUXILIAR NA LOCALIZACAO DE SITIOS ARQUEOLOGICOS NO ESTADO DE SAO PAULO]
VITALINA PAGLIUCA CICIVIZZO (Sao Paulo Univ., Brazil) and TANIA MARIA SAUSEN *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 579-582 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

A methodology for TM/LANDSAT images, for the identification of geomorphological forms and spectral patterns that may serve as indicators for the localization of archaeological sites was developed. As a result, maps with the identification of the possible localization of archaeological sites will be developed as well as the characterization of spectral and geomorphological patterns that prompt the identification of such sites. Author

N88-24088# Universidad Nacional de San Juan (Argentina).
DUNE FIELDS IN CENTRAL WESTERN ARGENTINA [CAMPOS DE DUNAS EN EL CENTRO-OESTE ARGENTINO]
GRACIELA M. SUVIRES *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 724-732 1986 In SPANISH; ENGLISH summary
Avail: NTIS HC A99/MF E03

Important accumulations of wind blown sands extend over some sections of plains and pediments. The three dune fields existing in the area are called: Medanos Grandes (great dunes) in the south end of Pie de Palo range between 660 to 750 masl; Las Chacras dune to the southwestern end of Valle Fertil range between 690 to 800 masl; and Mascasin dunes between 450 to 550 masl. These dune fields contain longitudinal, transverse, parabolic, and barchanoid sand dunes with interdune basins. Author

N88-24097# Mineracao Taboca S.A., Manaus (Brazil).
CRITERIA FOR PLANIMETRIC AND ALTIMETRIC CORRECTION OF MAPS RESTITUTED FROM AERIAL PHOTOGRAPHS IN 1:100,000 SCALE [CRITERIOS PARA CORRECAO PLANIMETRICA E ALTIMETRICA DE MAPAS RESTITUIDOS A PARTIR DE FOTOGRAFIAS AEREAS EM ESCALA 1:100000]
FRANCISCO A. DUPAS *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 807-811 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The aim is to introduce a simple method for correcting the scale of level curve charts restituted from aerial photographs in a 1:100,000 approximate scale used for planning the Pitinga mine facilities. The mine is located some 250 km north of Manaus (AM-Brazil) and the region displays moderately undulated relief. Through prominences of the relief and geodesic points, topographic surveys are performed so as to allow the determination of the east and north scale of the restituted chart, that later may be amplified or reduced. With a corrected area of 3000 sq km, the drainage maps were already in use for three years and have demonstrated sufficient precision for the general planning of the mine. To trace the level curves a microcomputer and a plotter were used. The original program was in FORTRAN and adapted to BASIC. Author

N88-24098# Universidad Nacional de San Juan (Argentina).
GEOMORPHOLOGIC SECTOR MAPS OF NIQUIZANGA-MAYARES, PROVINCE OF SAN JUAN, ARGENTINA [MAPA GEOMORFOLOGICO SECTOR NIQUIZANGA-MAYARES, PROVINCIA DE SAN JUAN-ARGENTINA]
GRACIELA M. SUVIRES *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium

and 6th SELPER Plenary Meeting, Volume 1 p 812-818 1986 In SPANISH; ENGLISH summary
Avail: NTIS HC A99/MF E03

In the investigated area, the plains of the San Juan and Bermejo Rivers are made up by extensive abandoned flood plains characterized by the abundance of winding channels and meanders. After this fluvial action wide extensions of the area were covered by thick aeolian deposits. The alluvial plain of Bermejo River is formed by smaller landforms. Author

N88-24100# IBGE/DRN/BA SEPLAN, Salvador (Brazil).
LITHOSTRUCTURAL INTERPRETATION OF CHAPDA DO CACHIMBO (PA-AM-MT), BASED ON RADAR AND LANDSAT IMAGERY [INTERPRETACAO LITO-ESTRUTURAL DA CHAPADA DO CACHIMBO (PA-AM-MT), BASEADA EM IMAGENS DE RADAR E LANDSAT]
MARIO IVAN CARDOSODELIMA *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 826-839 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The Cachimbo Plateau is situated at the bordering zones of the states of Para, Amazonas, and Mato Grosso, in the Brazilian Amazon. By using radar (X-band) and MSS LANDSAT (bands 5 and 7) imagery, photogeologic interpretation of the region was performed, and the principal units were identified: metamorphic basement, sedimentary metavolcanic sequence, volcanic-plutonic suite, sedimentary sequence 1, sedimentary sequence 2, basic plutonic 1 and 2, and sedimentary sequence 3. The sedimentary sequence 1 covers do Cachimbo Plateau and was divided into 17 units. Psamitic types dominate the northern portion while in the southwestern sector psamitic-carbonatic ones occur. Regarding the structural aspects, the Cachimbo Plateau comprises a vast basin with WNW-ESE axis. The northern border of the basin is unwarped and presents cuesta features. Folds related to vertical and compressible movements are manifested at the southern sectors and expose interference models. The previsional metalogeny for the Cachimbo Plateau denotes potential deposits of Cu, Co, Ag, U, Fe, Mn, barite, magnesite, diamond, phsophate, limestone, coal, and bauxite. Moreover at the north and south it is limited by two important gold and tin provinces (Tapajos and Floresta-Juruena). Author

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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.

A88-33694
DIAGNOSTIC STUDY OF THE FRAM STRAIT MARGINAL ICE ZONE DURING SUMMER FROM 1983 AND 1984 MARGINAL ICE ZONE EXPERIMENT LAGRANGIAN OBSERVATIONS
JEAN-CLAUDE GASCARD, PIERRE-FRANCOIS JEANNIN (Paris VI, Universite, Paris, France), CLAUDE KERGOMARD (Lille I, Universite, Villeneuve-d'Ascq, France), and MICHEL FILY (Grenoble I, Universite, Saint-Martin-d'Heres, France) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, April 15, 1988, p. 3613-3641. Navy-supported research. refs
(Contract CNRS-ASP-PNEDC-950057; CNRS-ATP-85-430510; CNRS-ATP-86-430010; EEC-CLI-083-F)

A88-33695
RADAR SIGNATURES OF OIL FILMS FLOATING ON THE SEA SURFACE AND THE MARANGONI EFFECT
WERNER ALPERS (Bremen, Universitaet, Federal Republic of Germany) and HEINRICH HUEHNERFUSS (Hamburg, Universitaet, Federal Republic of Germany) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, April 15, 1988, p. 3642-3648. refs
(Contract DFG-WA-124/12-1; BMFT-01-QS-86174)

Airborne radar backscattering experiments carried out recently by Singh et al. (1986) over sea surfaces covered with mineral oil films show that the radar cross section depression has a maximum as a function of incidence angle. In this paper it is shown that Singh et al.'s measurements can be explained by the Marangoni effect if the assumption is made that the mineral oil spill contained surface active material as 'impurities'. The Marangoni effect causes a resonance-type wave damping in the short gravity wave region when the sea surface is covered with a viscoelastic film. Maximum wave damping was observed by Singh et al. at frequencies around 8 Hz. Marangoni theory predicts such a maximum for surface active compounds of medium to low wave damping ability with a dilational modulus of the order of 0.01 N/m1. Furthermore, it is demonstrated that the Ku band and C band radar backscattering depression curves do not contradict each other. It is pointed out that when converting the radar data into information on depression of spectral energy density of short surface waves, one has to take into account that the radar backscattering at low incidence angles is dominated by specular reflection, while at intermediate incidence angles it is dominated by Bragg scattering. Author

A88-33920
RANGE VARIATIONS OF THE TROPOSPHERIC PROPAGATION OF ULTRASHORT RADIO WAVES ABOVE THE SEA [VARIATSII DAL'NOSTI TROPOSFERNOGO RASPROSTRANENIIA UK RADIOVOLN NAD MOREM]
A. R. GLINER, S. N. KRIVONOZHKIN, and B. M. SHEVTSOV (AN SSSR, Tikhookeanskii Okeanologicheskii Institut, Vladivostok, USSR) Radiofizika (ISSN 0021-3462), vol. 31, no. 2, 1988, p. 238-240. In Russian. refs

Tropospheric variations of the propagation range of ultrashort waves above the sea were studied experimentally using NOAA-satelite observations over the northern part of the Indian Ocean at frequencies of 137.5 and 137.62 MHz. Distributions of the number of range-variation measurements observed in May and in December are presented. The distributions are appreciably asymmetric and disclose a structure that may be connected with fluctuations of the field-attenuation function. B.J.

A88-34643#
NONLINEAR MULTICHANNEL ALGORITHMS FOR ESTIMATING SEA SURFACE TEMPERATURE WITH AVHRR SATELLITE DATA
CHARLES C. WALTON (NOAA, Washington, DC) Journal of Applied Meteorology (ISSN 0894-8763), vol. 27, Feb. 1988, p. 115-124. refs

The familiar linear multichannel sea surface temperature algorithms (MCSST) for estimating sea surface temperature with AVHRR satellite data describe the solution in terms of a constant gamma parameter multiplied by the measured brightness temperature difference of two of the window channels. A nonlinear algorithm is developed in this paper which is similar in form to the MCSST algorithm but with the gamma parameter having a specific two- or three-channel temperature dependence. Simulation studies show that the linear and nonlinear algorithms provide nearly identical accuracies for a wide range of atmospheric conditions if the satellite data are error free. When random or noncorrelative error sources are present in the multichannel AVHRR data, it is found that the nonlinear algorithms significantly reduce their effect upon the final solution relative to the linear MCSST solution. These results are verified with actual AVHRR data obtained in January-March 1982 and 1983. The algorithm estimates of surface temperature are compared with buoy measurements in the North Atlantic and North Pacific. Author

A88-35058
TOPEX/POSEIDON - A CONTRIBUTION TO THE WORLD CLIMATE RESEARCH PROGRAM
ROBERT H. STEWART (California, University, La Jolla) and MICHEL LEFEBVRE (CNES, Toulouse, France) IN: Aerospace century XXI: Space missions and policy; Proceedings of the

Thirty-third Annual AAS International Conference, Boulder, CO, Oct. 26-29, 1986. San Diego, CA, Univelt, Inc., 1987, p. 117-128. refs
(AAS PAPER 86-306)

NASA and France's CNES will conduct a joint tides-and-currents measurement program, using the Topex/Poseidon satellite mission. The satellite carries altimeters for measuring satellite altitudes above sea level, and is supported by a precision orbit-determination system, a data analysis/distribution system, and a Principal Investigator program for scientific studies based on the satellite observations. Launch of the satellite is scheduled for 1991, so that the data obtained will coincide with that from the U.S. Navy's Remote Ocean Sensing System and ESA's ERS-1. O.C.

A88-35153
MARINE OBSERVATION SATELLITE-1 (MOS-1) AND ITS SENSORS
YUJI MIYACHI, YASUSHI HORIKAWA (National Space Development Agency of Japan, Tokyo), and YOSHIKAZU KAMIYA (National Space Development Agency of Japan, Los Angeles, CA) IN: Aerospace century XXI: Space sciences, applications, and commercial developments; Proceedings of the Thirty-third Annual AAS International Conference, Boulder, CO, Oct. 26-29, 1986. San Diego, CA, Univelt, Inc., 1987, p. 1611-1621.
(AAS PAPER 86-288)

The Japanese Marine Observation Satellite-1 (MOS-1), launched in 1987, initiated Japan's program of earth observation by remote sensing. In this paper, the mission objectives, spacecraft characteristics, and development status of the MOS-1 satellite are presented. The three on-board sensors are briefly described. C.D.

A88-35199* Colspan, Inc., Boulder, Colo.
PASSIVE MICROWAVE DATA FOR SNOW AND ICE RESEARCH - PLANNED PRODUCTS FROM THE DMSP SSM/I SYSTEM
RONALD WEAWER, ROGER G. BARRY (Cooperative Institute for Research in Environmental Science, Boulder, CO), and CHARLES MORRIS (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) EOS (ISSN 0096-3941), vol. 68, Sept. 29, 1987, p. 769, 776, 777. refs
(Contract NAGW-641)

Recommendations which have been made for processing and distributing passive microwave data for snow and ice research obtained with the Defense Meteorological Satellite Program (DMSP) Special Sensor Microwave Imager (SSM/I) are discussed. The general objectives for SSM/I data are reviewed, and the sensor and data flow are described. The SSM/I sea ice products are discussed, and algorithm/product validation is addressed. Proposed services and implementation after SSM/I launch are summarized. C.D.

A88-35986
A METHOD FOR CALCULATING THE EFFECTIVE EMISSIVITY OF A GROOVE STRUCTURE
ZHIMIN ZHANG (Oxford University, England) IN: Optical systems for space applications; Proceedings of the Meeting, The Hague, Netherlands, Mar. 30-Apr. 1, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 270-277. refs

A method for accurately and simply calculating the effective emissivity of a grooved surface is described, and the uncertainties are analyzed. This method was used to calculate the directional and hemispheric emissivities of a grooved surface. The method also allows an accurate determination of the normal and hemispheric emissivity of a cylindrically baffled grooved plate source. It is concluded that the proposed approach can provide an accurate radiance calibration for the ATSR (Along Track Scanning Radiometer) in connection with the measurement of sea surface temperature. B.J.

A88-36159
SATELLITE OBSERVATIONS AND THE NUMERICAL SIMULATION OF THE INTERACTION BETWEEN A SYNOPTIC EDDY AND A FRONTAL ZONE IN THE OCEAN [SPUTNIKOVYE NABLIUDENIIA I CHISLENNOE MODELIROVANIE VZAIMODEISTVIIA SINOPTICHESKOGO VIKHRIA S FRONTAL'NYM RAZDELOM V OKEANE]
V. B. LOBANOV and E. V. IAROSHCHUK (AN SSSR, Tikhookeanskii Okeanologicheskii Institut, Vladivostok, USSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 16-21. In Russian. refs

A88-36160
EVALUATION OF THE POSSIBILITY OF DETERMINING CONCENTRATIONS OF VARIABLE COMPONENTS OF OCEAN WATER FROM AVERAGED SPECTRA OF THE DIFFUSE OPTICAL REFLECTION COEFFICIENT [OTSENKA VOZMOZHNOSTI VOSSTANOVLENIIA KONTSENTRATSII PEREMENNYKH KOMPONENTOV OKEANSKOI VODY PO USREDNENNYM SPEKTRAM KOEFFITSIENTA DIFFUZNOGO OTRAZHENIIA SVETA]
V. P. LEVENTUEV (Vsesoiuznyi Nauchno-Issledovatel'skii Institut Morskogo Rybnogo Khoziaistva i Okeanografii, Moscow, USSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 22-29. In Russian. refs

A88-36241*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASSESSMENT OF POLAR CLIMATE CHANGE USING SATELLITE TECHNOLOGY
DOROTHY K. HALL (NASA, Goddard Space Flight Center, Greenbelt, MD) Reviews of Geophysics (ISSN 8755-1209), vol. 26, Feb. 1988, p. 26-39. refs

Using results of selected studies, this paper highlights some of the problems that exist in the remote sensing of snow and ice, and demonstrates the importance of remote sensing for the study of snow and ice in determining the effect of temperature increase, due to the atmospheric CO2 increase, on the cryospheric features. Evidence obtained from NOAA, Nimbus, and other satellites, that may already indicate a global or at least a regional warming, includes an increase in permafrost temperature in northern Alaska and the retreat of many of the world's small glaciers in the last 100 years. It is emphasized that remote sensing is of major importance as the method of obtaining data for monitoring future changes in cryospheric features. I.S.

A88-36841* National Center for Atmospheric Research, Boulder, Colo.
A SYSTEM FOR REMOTE MEASUREMENTS OF THE WIND STRESS OVER THE OCEAN
WILLIAM G. LARGE and J. A. BUSINGER (National Center for Atmospheric Research, Boulder, CO) Journal of Atmospheric and Oceanic Technology (ISSN 0739-0572), vol. 5, April 1988, p. 274-285. refs
(Contract NASA ORDER W-15969; N0014-85-F-031)

The DISSTRESS system for remote measurements of the surface wind stress over the ocean from ships and buoys is described. It is fully digital, utilizing the inertial dissipation technique. Parallel processing allows anemometer data to be filtered in natural frequency space; that is, the filter cutoffs shift linearly with the mean wind speed of the data to be filtered. The construction of the digital Butterworth bandpass filters is presented in detail. The performance of the system is evaluated by analyzing the results from 28 days of operation during the Frontal Air-Sea Interaction Experiment. The mean wind speed is checked, the anemometer response function is established, and drag coefficients are compared to previous studies. The capability of the system is demonstrated by continuous time series of the friction velocity computed every 20 min. The conclusion is that the surface wind stress can be measured more reliably and accurately (20 percent) with this system than from anemometer wind speeds and a bulk formula. Author

A88-36843
PROCESSING, COMPRESSION AND TRANSMISSION OF SATELLITE IR DATA FOR NEAR-REAL-TIME USE AT SEA
PETER CORNILLON, DAVID EVANS (Rhode Island, University, Kingston), OTIS B. BROWN, ROBERT EVANS, PAUL EDEN (Miami, University, FL) et al. Journal of Atmospheric and Oceanic Technology (ISSN 0739-0572), vol. 5, April 1988, p. 320-327. refs
(Contract N00014-81-C-0062)

A method for acquisition, processing, and analysis of digital, satellite-derived SST fields on a research vessel at sea in near-real-time (within 10 h of the satellite pass) is discussed. Such imagery provides a general view of the SST field over a large area (700 x 900 km) centered on a 128 x 128 pixel, full-resolution view of the study area. The ability to send these images to the research vessel in a reasonable amount of time (about 1 h, using ATS-3) was a result of a three-level approach to data compression. To perform data compression, first, the overall image was decimated by two while the central 128 x 128 pixel portion was retained in full resolution. Second, a 1-bit-deep cloud mask was derived from the image. Third, the remaining SST values were encoded as SST steps from the previous pixel on a given scan line. Overall, the data were reduced by 75-80 percent. An error-correcting protocol, KERMIT, was used to establish low error rate data communications through the ATS-3 VHF links. A moderate capability digital display unit facilitates display and manipulation of the resultant imagery. Author

A88-37143
THE OCEAN AND THE ATMOSPHERE
H. CHARNOCK (Southampton, University, England) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 321-326.

The use of satellite remote-sensing data in the construction of numerical models of the ocean-atmosphere (OA) system is briefly discussed. A general description of the oceans is given, with an emphasis on the features which can be characterized by remote sensing, and the treatment of the oceans as the lower boundary of the atmosphere in global climate models is outlined. It is suggested that the fully coupled OA models required to explain complex energy-transfer phenomena will require computer power much greater than that currently available. T.K.

A88-37144
REMOTE SENSING OF SEA-SURFACE WINDS
T. H. GUYMER (Institute of Oceanographic Sciences, Wormley, England) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 327-357. refs

The theoretical basis and practical implementation of satellite microwave remote-sensing techniques for sea-surface winds are reviewed and illustrated with diagrams and graphs, maps, and sample images based on Seasat data. Methods discussed include scatterometry, altimetry, SAR, and SMMR. The design and operation of the Seasat instruments are described, and data-reduction procedures are explained. Particular attention is given to the positioning of synoptic features, the time-averaged wind distribution, and wind stress curl. The instrumentation of current (Nimbus 7 and Geosat) and planned (ERS-1 and NROSS) oceanographic satellites is briefly considered, and the need for data of extremely high accuracy is stressed. T.K.

A88-37148
THE ALONG-TRACK SCANNING RADIOMETER WITH MICROWAVE SOUNDER
KEITH MUIRHEAD (ESA, Earthnet Programme Office, Frascati, Italy) and DAVE ECCLES (SERC, Rutherford Appleton Laboratory, Didcot, England) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 411-423. refs

The design, operation, and projected performance of the Along-Track Scanning Radiometer with Microwave Sounder (ATSR/M) for the ERS-1 oceanographic remote-sensing satellite (scheduled for Ariane launch in 1989) are reviewed. The ATSR/M employs a multichannel IR radiometer, a circular scanning scheme providing two independent looks at each area, an active cooling system, and a nadir-pointing dual-channel microwave sounder; it is designed to provide sea-surface temperatures of 0.5-K accuracy (with 80-percent cloud cover) in 500-km swaths of 50-km sq resolution cells. Consideration is given to the ERS-1 platform and payload components, the ground segment and data-distribution system, the development history of ATSR/M, pixel formatting for the IR radiometer, general data-processing methods, and the specific ATSR/M data products. T.K.

A88-37149
PLANS FOR ERS-1 DATA ACQUISITION, PROCESSING AND DISTRIBUTION
D. A. BATEMAN and A. HASKELL (Royal Aircraft Establishment, Farnborough, England) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 425-439.

The scientific aims and instruments of the ERS-1 oceanographic remote-sensing satellite (scheduled for Ariane launch in 1989) are discussed, and the ground segment and data-distribution system are described in detail. The major payload components are an SAR operating in both wind and wave modes, a radar altimeter, the Along-Track Scanning Radiometer with Microwave Sounder, the Precise Range and Range-rate Equipment, and a laser retroreflector. The fast-delivery data products (available within 3 h of the observation) for each instrument are listed, and particular attention is given to the procedures and installations to be used at the UK Processing and Archiving Facility (at RAE Farnborough) to generate and distribute off-line SAR, altimeter, and wave-mode products. A drawing of the satellite and flow charts of the data-processing system are provided. T.K.

A88-37270#
OCEAN-ATMOSPHERE INTERACTIONS IN LOW LATITUDE AUSTRALASIA
R. J. ALLAN and M. WEGENER (South Australia, Flinders University, Bedford Park, Australia) IN: National Space Engineering Symposium, 3rd, Canberra, Australia, June 30-July 2, 1987, Preprints of Papers. Barton, Australia/Brookfield, VT, Institution of Engineers/Brookfield Publishing Co., 1987, p. 189-191. Research supported by the Australian Marine Sciences and Technologies Advisory Committee. refs

This paper illustrates the logistics involved in developing a project for integrating conventional meteorological and oceanographical data with remotely sensed Geosynchronous Meteorological Satellite (GMS) and National Oceanic and Atmospheric Administration (NOAA) polar-orbiting satellite imagery to investigate the dominant mechanisms influencing large-scale ocean-atmosphere interactions in low-latitude Australasia. The study aims to produce and interpret a comprehensive set of wind, cloudiness-convective, sea surface temperature (SST) and radiative flux fields over the region 10 deg N - 20 deg S, 115 deg E - 135 deg E, during the 1987 and 1988 summer (December-February) and winter (June-August) monsoon seasons. Author

A88-37679
ACTIVE TWO-ELEMENT MICROWAVE INTERFEROMETRY OF THE SEA SURFACE [AKTIVNAIA DVUKHELEMENTNAIA MIKROVOLNOVAIA INTERFEROMETRIIA MORSKOI POVERKHNOSTI]
A. V. IVANOV (AN SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) Radiofizika (ISSN 0021-3462), vol. 31, no. 3, 1988, p. 263-273. In Russian. refs

The paper presents a theoretical assessment of the feasibility of using active two-element interferometers to measure the

three-dimensional spatial-temporal spectral densities of both sea surface reflectance variations and the sea surface layer velocity field. An algorithm for the processing of scattering data is presented, and an analysis is made of the sensitivity and resolution of the proposed technique. B.J.

A88-37720
DISTRIBUTION AND CHEMISTRY OF SUSPENDED PARTICLES FROM AN ACTIVE HYDROTHERMAL VENT SITE ON THE MID-ATLANTIC RIDGE AT 26 DEG N
ROBERT P. TROCINE and JOHN H. TREFRY (Florida Institute of Technology, Melbourne) Earth and Planetary Science Letters (ISSN 0012-821X), vol. 88, no. 1-2, April 1988, p. 1-15. refs
(Contract NOAA-NA-85WCC06144)

A88-38690* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE DATA MANAGEMENT FOR EFFECTIVE DATA ACCESS
PATRICK D. HOGAN and THOMAS L. KOTLAREK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: International Conference on Data Engineering, 3rd, Los Angeles, CA, Feb. 3-5, 1987, Proceedings. Washington, DC, IEEE Computer Society Press, 1987, p. 494-500.

The management of data generated from satellite missions has not always led to effective access of that data by the scientific community. NASA has tried to alleviate this problem for ocean scientists, by initiating a program, the NASA Ocean Data System (NODS). The menu-based user interface that NODS employs allows a user to make request and receive answers within a short time of accessing the system. A catalog system, which holds information about oceanographic data sets may be queried to determine the suitability of a particular data set. Once a candidate data set is found, the user is directed to the person or place which actually holds the data. NODS also has an archive system that holds data from ocean-observing satellites. The archive may be queried to obtain a manageable data subset that can be delivered in a useful form. Author

A88-38691* California Univ., La Jolla.
SNOW MELT ON SEA ICE SURFACES AS DETERMINED FROM PASSIVE MICROWAVE SATELLITE DATA
MARK R. ANDERSON (California, University, La Jolla) IN: Large scale effects of seasonal snow cover. Wallingford, England, International Association of Hydrological Sciences (IAHS Publication, No. 166), 1987, p. 329-342. Research supported by the Mellon Foundation. refs
(Contract NAGW-1028)

SMMR data for the year 1979, 1980 and 1984 have been analyzed to determine the variability in the onset of melt for the Arctic seasonal sea ice zone. The results show melt commencing in either the Kara/Barents Seas or Chukchi Sea and progressing zonally towards the central Asian coast (Laptev Sea). Individual regions had interannual variations in melt onset in the 10-20 day range. To determine whether daily changes occur in the sea ice surface melt, the SMMR 18 and 37 GHz brightness temperature data are analyzed at day/night/twilight periods. Brightness temperatures illustrate diurnal variations in most regions during melt. In the East Siberian Sea, however, daily variations are observed in 1979, throughout the analysis period, well before any melt would usually have commenced. Understanding microwave responses to changing surface conditions during melt will perhaps give additional information about energy budgets during the winter to summer transition of sea ice. Author

A88-39079
COMPARISON OF UNIFIED FULL-WAVE SOLUTIONS FOR NORMAL INCIDENCE MICROWAVE BACKSCATTER FROM SEA WITH PHYSICAL OPTICS AND HYBRID SOLUTIONS
E. BAHAR, M. A. FITZWATER (Nebraska, University, Lincoln), and D. E. BARRICK (Ocean Surface Research, Inc., Boulder, CO) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 365-377. NOAA-supported research. refs
(Contract N00014-87-K-0177)

The unified full-wave solution for electromagnetic wave scatter from a rough surface is expressed as an integral similar in form to physical optics solutions. However, it correctly predicts return for small and intermediate roughness scales where the physical optics approach fails. This full-wave solution is used here to evaluate microwave sea surface backscatter at normal incidence for both the like-polarized and cross-polarized linear components. Surface heights and slopes are assumed to be Gaussian, the sea is characterized by its surface height spectral density function, and both perfectly and finitely conducting surfaces are considered. Results from this complete full-wave evaluation are compared with approximations, involving single-scale (specular point) and two-scale models. For both of these models, however, it is necessary to assume a spectral wavenumber, v(d), where spectral splitting between the large and the small scales of the rough surface occurs. The full-wave solution is used as a guide in the selection of v(d) and to study the accuracy and sensitivity of the different approximations to v(d). It is also shown that results for cross-polarized backscatter based on the physical optics or two-scale models are totally inadequate. Author

A88-39081
SATELLITE DETECTED CYANOBACTERIA BLOOM IN THE SOUTHWESTERN TROPICAL PACIFIC - IMPLICATION FOR OCEANIC NITROGEN FIXATION
CECILE DUPOUY (Office de la Recherche Scientifique et Technique d'Outre-Mer, Plouzane, France), MICHEL PETIT (Office de la Recherche Scientifique et Technique d'Outre-Mer, Montpellier, France), and YVES DANDONNEAU (Office de la Recherche Scientifique et Technique d'Outre-Mer, Noumea, New Caledonia) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 389-396. Research supported by the Office de la Recherche Scientifique et Technique d'Outre-Mer, CNRS, and CNES. refs

Tropical seas are major sites for extensive cyanobacterial (blue-green algal) developments. The oceanic nitrogen fixation caused by such blooms may be of relatively great importance in regard to the global nitrogen budget. A Nimbus-7 Coastal Zone Color Scanner (CZCS) image on January 4, 1982, shows a large phytoplankton bloom (90,000 sq/km) around New Caledonia and the Vanuatu archipelago, located east of Australia in the Coral Sea (165 deg E, 20 deg S). The bloom is caused by cyanobacteria, presumably Oscillatoria (Trichodesmium) spp., which occur systematically in this region. This assertion was not controlled by simultaneous sea-truths, but several indices and current knowledge of the region indicate that the hypothesis is reasonable. By using the CZCS image, an estimation is made for the nitrogen fixation of the bloom. It suggests that such a biological event plays a significant role in the global nitrogen oceanic budget. Author

A88-39083
SURFACE TEMPERATURES AND SEA ICE TYPING FOR NORTHERN BAFFIN BAY
KONRAD STEFFEN (Zuerich, Eidgenoessische Technische Hochschule, Zurich, Switzerland) and JOHN E. LEWIS (McGill University, Montreal, Canada) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 409-422. refs

The northern region of Baffin Bay (74-79 deg N and 70-78 deg W) is known as the North Water Polynya - a region of inhomogeneous ice cover during the winter and spring months. During the winters of 1978/79 and 1980/81, a series of low-level aircraft flights were conducteed over the North Water covering a length of 2300 km. Surface thermal infrared (TIR) temperatures were measured and visual surface ice characteristics photographed with the aid of a searchlight attached to the aircraft. Corrections procedures were applied to the TIR data which produced a temperature accuracy of + or - 0.15 C. A matching was made between visual ice types and ice surface temperatures along with ice properties using the aircraft and ice/meteorological data collected at a base station near Resolute Bay, Northwest Territories. Also, surface temperatures outside the spatial extent

of the aircraft measurements were extrapolated by means of NOAA-VHRR TIR imagery. From the two sets of data, regional surface temperature maps were constructed. Results indicated that grey-white ice for thicknesses of 0.15-0.3 m was the dominant type of ice especially during January and February with a marked increase of white ice percentage toward the end of the ice season. Ice-free areas or warm water actually constituted only a very small percentage of the total area for both winter seasons. Author

A88-39084
METHODOLOGY FOR AN OPERATIONAL MONITORING OF REMOTELY-SENSED SEA SURFACE TEMPERATURES IN INDONESIA
J. P. GASTELLU-ETCHEGORRY (Gadjah Mada University, Yogyakarta, Indonesia) and T. BOELY (Office de la Recherche Scientifique et Technique d'Outre-Mer, Paris, France) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 423-438. refs

Operational SST monitoring was tested with the study of large-scale SST features in Indonesia from July 1981 to June 1985. Digital data were provided by digitizing 208 weekly SST charts of NOAA-NES. The pixel size corresponded to 1 deg 15 min longitude and latitude. These data displayed a 0.5 deg K rms error compared with 1985 in situ measurements. Iterative interactive factorial analyses combined with a parallelepiped classifier as a clustering technique enhanced the SST spatiotemporal features. The study area was divided into zones in which pixels had similar SST profiles, and dates of occurrence of thermal anomalies were pointed out. Sea fronts and upwellings were mapped through spatiotemporal analyses of thermal gradients. This study stresses the possibility of operational SST monitoring for Indonesia, allowing simple data manipulation with hardware easily maintained locally. Author

A88-39085
SURFACE CURRENTS OFF THE WEST COAST OF IRELAND STUDIED FROM SATELLITE IMAGES
A. P. CRACKNELL and W. G. HUANG (Dundee, University, Scotland) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 439-446. refs

The surface current in the spring of 1984 off the west coast of Ireland has been mapped from NOAA-8 thermal infrared images. The 'feature-tracking method' has been used to derive flow vectors from advective sea surface temperature feature displacements and elapsed time. This feature-tracking method has a great advantage which gives a synoptic and spatial view of the velocity distribution over in situ measurements. Sequential images obtained on orbits 5596, 5610 and 5627 during the period of April 25-27, 1984, have been used and geometrically corrected. With the 24 hours and 48 hours differences, the measurement accuracy achieved in the speed of sea features was + or - 1.8 cm/s. The surface current pattern agrees with the main current pattern obtained by ships and drift bottles. A cyclonic eddy centered at 57 deg 04 min N 10 deg 59 min W has been studied. A very pronounced feature recognized is the sea surface front between mixed coastal water and stratified Atlantic water along the whole west coast of Ireland. The front is characterized by cyclonic and anticyclonic eddies which have time scales of the order of 1 to 7 days and length scales of the order of 30 km. Author

A88-39284* Columbia Univ., New York, N.Y.
POLYNYAS IN THE SOUTHERN OCEAN
ARNOLD L. GORDON (Columbia University, NY) and JOSEFINO C. COMISO (NASA, Goddard Space Flight Center, Greenbelt, MD) Scientific American (ISSN 0036-8733), vol. 258, June 1988, p. 90-97.

The formation of large regions of open ocean in the pack ice near Antarctica called polynyas is discussed. The role of the meridional circulation pattern of the Southern Ocean, of buoyancy, and of wind in the formation of polynyas is shown. The different characteristics and causes of coastal and open-ocean polynyas are pointed out. C.D.

A88-39746#
AN EVALUATION OF THE PERFORMANCE OF THE ECMWF OPERATIONAL SYSTEM IN ANALYZING AND FORECASTING EASTERLY WAVE DISTURBANCES OVER AFRICA AND THE TROPICAL ATLANTIC
R. J. REED, A. HOLLINGSWORTH, W. A. HECKLEY, and F. DELSOL (European Centre for Medium Range Weather Forecasts, Reading, England) Monthly Weather Review (ISSN 0027-0644), vol. 116, April 1988, p. 824-865. NOAA-supported research. refs (Contract NSF ATM-84-21396)

A88-40059* Maryland Univ., Cambridge.
THE DISPERSAL OF THE AMAZON'S WATER
FRANK E. MULLER-KARGER (Maryland, University, Cambridge), CHARLES R. MCCLAIN (NASA, Goddard Space Flight Center, Greenbelt, MD), and PHILIP L. RICHARDSON (Woods Hole Oceanographic Institution, MA) Nature (ISSN 0028-0836), vol. 333, May 5, 1988, p. 56-59. NSF-supported research. refs

New information obtained with NASA's Coastal Zone Color Scanner and with drifting buoys reveals that the discharge of the Amazon is carried offshore around a retroflection of the North Brazil Current and into the North Equatorial Countercurrent towards Africa between June and January each year. From about February to May, the countercurrent and the retroflection weaken or vanish, and Amazon water flows northwestward toward the Caribbean Sea. C.D.

A88-40353#
SIR-B EXPERIMENTS IN JAPAN. III - OIL-POLLUTION EXPERIMENT
TOSHIYUKI OKUYAMA, HIDEYUKI INOMATA, HARUNOBU MASUKO, and KENJI NAKAMURA Radio Research Laboratory, Journal (ISSN 0033-8001), vol. 35, March 1988, p. 39-54. refs

Artificial oil slicks were produced in accordance with the scheduled Shuttle Imaging Radar (SIR-B) orbit. The purpose was to evaluate the ability of spaceborne Synthetic Aperture Radar (SAR) to monitor oil spills at sea. Oleyl alcohol was used to produce these slicks because its surface tension was very similar to that of crude oil. Techniques were established for producing such artificial slicks. The slicks were observed by SIR-B, by an airborne X-band/Ka-band scatterometer developed by RRL, and by an airborne Ocean Color Scanner chartered by Toba Merchant Marine College (TMMC). Sea-truth data such as surface wind speed and direction, sea current speed and direction, wave height, and so on were collected by the boat which produced the slicks, and by observation vessels. Author

A88-40356#
SIR-B EXPERIMENTS IN JAPAN. VI.
TOSHIO IGUCHI and HIDEYUKI INOMATA Radio Research Laboratory, Journal (ISSN 0033-8001), vol. 35, March 1988, p. 85-104. refs

During the Shuttle Imaging Radar (SIR-B) mission in October 1984, Synthetic Aperture Radar (SAR) images were taken off the coast of Japan. An artificial oil slick was produced within the SAR swath to investigate its effect on the backscattered signal. Not only the slick but also the long-wave pattern was visible in the images. Image data was analyzed to examine how well wave spectra could be deduced from it and how much the oil slick reduced the backscattered signal. Wave spectra derived from SIR-B images were compared with simultaneous wave-buoy observations. Waves at the time of flight were nearly perpendicular to the SAR flight direction and were composed of two major systems: a swell of about 200-m wavelength and wind waves with 70-m wavelength. Both the swell and wind-wave peaks were identifiable in the SAR image spectra after stationary response correction. The peak frequencies derived from SIR-B images and from the wave gauge agreed satisfactorily. The presence of oleyl alcohol on the ocean surface was found to reduce radar backscatter by about 1.4 dB. This was smaller than the modulation caused by the long-wave field in the images. Several filters were applied to the oil-slick image to suppress the long-wave pattern and to enhance the slick image. The resulting filtered images are shown. Author

A88-40834
THE DETERMINATION OF THE PARAMETERS OF THE DIURNAL THERMOCLINE USING SATELLITE AND SHIP-BASED MEASUREMENTS [OB OPREDELENII PARAMETROV SUTOCHNOGO TERMOKLINA PO SPUTNIKOVYM I POPUTNYM SUDOVYM IZMERENIIAM]
K. N. FEDOROV and A. I. GINZBURG (AN SSSR, Institut Okeanologii, Moscow, USSR) Meteorologiia i Gidrologiia (ISSN 0130-2906), April 1988, p. 82-91. In Russian. refs

A88-41257
MAGNETIC LINEATIONS ON THE FLANKS OF THE MARQUESAS SWELL - IMPLICATIONS FOR THE AGE OF THE SEAFLOOR
SARAH E. KRUSE (MIT, Cambridge, MA) Geophysical Research Letters (ISSN 0094-8276), vol. 15, June 1988, p. 573-576. refs
(Contract NSF OCE-86-09526)

A88-41398
POSSIBILITY OF REPLACING COMPLEX VALUES OF PERMITTIVITY WITH REAL VALUES [O VOZMOZHNOSTI ZAMENY KOMPLEKSNYKH ZNACHENII DIELEKTRICHESKOI PRONITSAEMOSTI VESHCHESTVENNYMI]
A. A. VLASOV Radiotekhnika i Elektronika (ISSN 0033-8494), vol. 33, May 1988, p. 1068-1071. In Russian. refs

It is shown that the application of a method which replaces complex values of permittivity with real values can reduce the number of unknowns in certain remote-sensing problems. The determination of the emissivity of the sea surface is mentioned as an example. B.J.

A88-42039
THE JRC PROGRAM FOR MARINE COASTAL MONITORING
J. A. BEKKERING (CEC, Joint Research Centre, Ispra, Italy) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 699-702. refs

An overview of a project using remote sensing techniques, in situ measurements, and a computer-run model to study coastal transport of pollution in the northern Adriatic sea is given. The project is a collaborative effort of EEC member states to develop an operative system capable of monitoring and forecasting major marine events in coastal areas. Nimbus 7 CZCS, NOAA AVHRR, and Landsat TM imagery is used in research and new sensors are being investigated to enlarge the number of marine parameters detectable. Campaigns are undertaken to provide in situ biological, chemical, physical, atmospherical, under and over water optical measurements, and airborne sensor data. The computer model being developed should predict the propagation, transformation, and sedimentation of pollutants and nutrients. R.B.

A88-42047
SEA SURFACE TEMPERATURE STUDIES IN NORWEGIAN COASTAL AREAS USING AVHRR- AND TM THERMAL INFRARED DATA
J. P. PEDERSEN (Tromso, Universitetet, Norway) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 749-754. refs

This work presents an algorithm for deriving sea surface temperatures from infrared satellite data. The algorithm is based upon physical solution of the equation of radiative transfer. The theory for calculating the atmospheric transmittance and radiance is briefly discussed. Calculated trasmittances are compared to values reported by others. Results froam applications of the algorithm on NOAA/AVHRR-data are presented. Finally, sea surface temperature data derived from the Landsat/Thematic Mapper are presented. Due to lack of TM calibration data, the temperatures are derived from comparisons of digital values and in situ measured temperatures at known locations in the data set. Author

A88-42050
DETERMINATION OF SPECTRAL SIGNATURE OF NATURAL WATER BY OPTICAL AIRBORNE AND SHIPBORNE INSTRUMENTS
D. SPITZER and M. R. WERNAND (Nederlands Instituut voor Onderzoek der Zee, Texel, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 771-773.

The advanced spectral irradiancemeter, the coastal optical remote sensing airborne radiometer, and the portable four channel radiometer were developed, calibrated, tested, and applied for numerous measurements in and above various coastal and oceanic regions to determine the temporally and locally dependent signatures of diverse water types. The Indonesian marine environments remote sensing experiments performed in the coastal waters northeast of Java, within the framework of the Snellius II expedition are discussed. Also, the spectral, spatial and time resolutions of these instruments and data acquisition systems are determined. R.B.

A88-42443
MESOSCALE VARIABILITY IN CURRENT METER MEASUREMENTS IN THE CALIFORNIA CURRENT SYSTEM OFF NORTHERN CALIFORNIA
MICHELE M. RIENECKER, CHRISTOPHER N. K. MOOERS (Institute for Naval Oceanography, Bay Saint Louis, MS), and ROBERT L. SMITH (Oregon State University, Corvallis) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, June 15, 1988, p. 6711-6734. Navy-sponsored research. refs

Current meter data from the OPTOMA program moorings (deployed from October 1984 to July 1985), located on the continental rise offshore of Point Reyes-Point Arena and from a LLWOD program mooring (deployed from September 1982 to August 1983) located about 250 km offshore were analyzed for information regarding the mesoscale variability in the California Current system (CCS). In addition, the oceanic response to local wind forcing, eddies, and offshore jets was investigated. The results of the analysis revealed a remarkable horizontal inhomogeneity and nonstationarity of the CCS, suggesting that a more extensive current meter array is required to fully investigate the mesoscale variability in the region covered. I.S.

A88-42444
SEA SURFACE FLOW ESTIMATION FROM ADVANCED VERY HIGH RESOLUTION RADIOMETER AND COASTAL ZONE COLOR SCANNER SATELLITE IMAGERY - A VERIFICATION STUDY
JAN SVEJKOVSKY (California, University, La Jolla) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, June 15, 1988, p. 6735-6743. refs
(Contract NOAA-NA-80AAD00120)

A refined technique for estimating surface currents from the displacement of features in sequential advanced very high resolution radiometer (AVHRR) and coastal zone color scanner (CZCS) images is presented. It is used to calculate flow fields in two regions along the California coast, and the results are compared to concurrent drifter drogue observations. There is overall agreement to within approximately 6 cm/s, with somewhat better agreement at velocities less than 40 cm/s. The poorer performance of the technique at high velocities was due to difficulties in identifying and tracking features in areas of rapid flow. The accuracy of the measurements is primarily affected by the analyst's precision in tracking each feature which, in turn, depends on how well the 2- to 6-km features preserve their identity from one image to the next. A 12- to 24-hour interval yielded the best results in this study. The directional component of the satellite-derived flow field was representative of subsurface flow patterns down to at least 100 m. Although velocities obtained from AVHRR infrared and CZCS visible images may not always represent flow at the same depth, the measurements were practically identical with the data used. Author

A88-42445* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
MOISTURE AND LATENT HEAT FLUX VARIABILITIES IN THE TROPICAL PACIFIC DERIVED FROM SATELLITE DATA
W. TIMOTHY LIU (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, June 15, 1988, p. 6749-6760. refs

This paper describes a method of determining latent heat flux and the ocean-atmosphere moisture from sea surface temperature, precipitable water, and surface wind speed data derived from 1980-1983 observations of SMMR aboard Nimbus 7 above tropical Pacific. The observation period included a very intense El Nino-Southern Oscillation (ENSO) episode. It was found that, during the early phase of the 1982-1983 ENSO, a surface convergence center moved east leading the anomalous equatorial westerlies. At this center, the low wind and high humidity caused negative (low) latent heat flux anomalies, despite anomalously high sea surface temperatures. Latent heat flux was found to play an important role in the seasonal cooling of the upper ocean, except in areas covered by major surface convergence zones and in areas of ocean upwelling. I.S.

A88-42446* Institute of Ocean Sciences, Sidney (British Columbia).
TIME EVOLUTION OF SURFACE CHLOROPHYLL PATTERNS FROM CROSS-SPECTRUM ANALYSIS OF SATELLITE COLOR IMAGES
KENNETH L. DENMAN (Department of Fisheries and Oceans, Institute of Ocean Sciences, Sidney, Canada) and MARK R. ABBOTT (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California, University, La Jolla) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, June 15, 1988, p. 6789-6798. Research supported by the Department of Fisheries and Oceans of Canada. refs

The rate of decorrelation of surface chlorophyll patterns as a function of the time separation between pairs of images was determined from two sequences of CZCS images of the Pacific Ocean area adjacent to Vancouver Island, Canada; cloud-free subareas were selected that were common to several images separated in time by 1-17 days. Image pairs were subjected to two-dimensional autospectrum and cross-spectrum analysis in an array processor, and squared coherence estimates found for several wave bands were plotted against time separation, in analogy with a time-lagged cross correlation function. It was found that, for wavelengths of 50-150 km, significant coherence was lost after 7-10 days, while for wavelengths of 25-50 km, significant coherence was lost after only 5-7 days. In both cases, offshore regions maintained coherence longer than coastal regions. I.S.

A88-42447*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE AND AIRCRAFT PASSIVE MICROWAVE OBSERVATIONS DURING THE MARGINAL ICE ZONE EXPERIMENT IN 1984
PER GLOERSEN (NASA, Goddard Space Flight Center, Greenbelt, MD) and WILLIAM J. CAMPBELL (USGS, Tacoma, WA) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, June 15, 1988, p. 6837-6846. NASA-Navy-ESA-supported research. refs

This paper compares satellite data on the marginal ice zone obtained during the Marginal Ice Zone Experiment in 1984 by Nimbus 7 with simultaneous mesoscale aircraft (in particular, the NASA CV-990 airborne laboratory) and surface observations. Total and multiyear sea ice concentrations calculated from the airborne multichannel microwave radiometer were found to agree well with similar calculations using the Nimbus SMMR data. The temperature dependence of the determination of multiyear sea-ice concentration near the melting point was found to be the same for both airborne and satellite data. It was found that low total ice concentrations and open-water storm effects near the ice edge could be reliably distinguished by means of spectral gradient ratio, using data from the 0.33-cm and the 1.55-cm radiometers. I.S.

A88-42448* Woods Hole Oceanographic Institution, Mass.
TEMPORAL VARIATIONS OF PARTICLE FLUXES IN THE DEEP SUBTROPICAL AND TROPICAL NORTH ATLANTIC - EULERIAN VERSUS LAGRANGIAN EFFECTS
W. G. DEUSER (Woods Hole Oceanographic Institution, MA), F. E. MULLER-KARGER (Maryland, University, Cambridge), and C. HEMLEBEN (Tubingen, Universitat, Federal Republic of Germ any) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, June 15, 1988, p. 6857-6862. DFG-supported research. refs (Contract NGT-21-002-822; NSF OCE-76-21280; NSF OCE-78-19813; NSF OCE-80-24130; NSF OCE-81-17002; NSF OCE-82-19588; NSF OCE-84-17909; NSF OCE-85-01955)

The flux of particles measured by sediment traps in the deep water of the Sargasso Sea and western tropical North Atlantic undergoes pronounced temporal variation. In the Sargasso Sea the variability is largely due to seasonal changes in mixed-layer depth and attendant changes in primary productivity affecting a wide region. By contrast, the variability in the western tropical Atlantic appears to be caused by patches of elevated nutrient and pigment concentrations which have their origin in the plumes of the Amazon and Orinoco rivers. Coastal zone color scanner scenes demonstrate the great seasonal and interannual differences in the direction and dispersal patterns of the plumes. The river plumes break up into irregular patches which may pass through the catchment area of a sediment trap at varying rates, thereby creating the impression of almost random temporal flux variability at a fixed trap site. Author

A88-42449
EMPIRICAL ORTHOGONAL FUNCTION ANALYSIS OF ADVANCED VERY HIGH RESOLUTION RADIOMETER SURFACE TEMPERATURE PATTERNS IN SANTA BARBARA CHANNEL
GARY S. E. LAGERLOEF (Science Applications International Corp., Bellevue, WA) and ROBERT L. BERNSTEIN (SeaSpace, Inc., San Diego, CA) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, June 15, 1988, p. 6863-6873. Research sponsored by the U.S. Department of the Interior, Science Applications International Corp., and U.S. Navy. refs

This paper demonstrates an application of empirical orthogonal function (EOF) analysis to oceanographhic and meteorological data sets sampled over space and time. Using yearlong AVHRR sea-surface temperature data for the Santa Barbara Channel, the method is used to extract the dominant spatial and temporal variance modes. It was found that the heavily dominant first mode of spatial variance for Santa Barbara Channel is consistent with a quasi-permanent front and associated strong temperature contrast between the two predominant water masses in the channel. A second spatial variance mode was found to be consistent with recurring eddies in the west central part of the channel. In contrast with the spatial variance modes, the first mode of temporal variance was found to be overwhelmingly dominant and reflected the basin-wide annual temperature cycle, having little spatial structure. This mode lagged the first spatial mode by about 90 days, which suggests two decoupled spatial annual cycles. I.S.

A88-42450
SATELLITE OBSERVATIONS OF TIDAL UPWELLING AND MIXING IN THE ST. LAWRENCE ESTUARY
YVES GRATTON, GORDON MERTZ (Quebec, Universite, Rimouski, Canada), and JACQUES A. GAGNE (Department of Fisheries and Oceans, Institute Maurice Lamontagne, Mont-Joli, Canada) Journal of Geophysical Research (ISSN 0148-0227), vol. 93, June 15, 1988, p. 6947-6954. Research supported by the Department of Fisheries and Oceans of Canada, Universite du Quebec, and NSERC. refs

Satellite thermal images (NOAA 9) of the St. Lawrence estuary are used to confirm the existence of a persistent cold spot due to tidal upwelling at the head of the lower St. Lawrence estuary and to show that cold water may be found episodically up to 100 km downstream of the head. This extended cold anomaly may exist in two spatial configurations: one confined to near the south shore, the other being centered over midestuary. The various physical

agencies likely to contribute to the growth of this anomaly are discussed, and it is concluded that wind, internal tides, and advection of cold water from the head region are the most significant factors. Author

A88-43217
CIRCULATION PATTERNS IN AVHRR IMAGERY
R. A. VAUGHAN (Dundee, University, Scotland) and I. D. DOWNEY (Salford, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 597-600. refs

AVHRR sea surface temperature data acquired in April 1984 are used to study the development of circulation patterns in the northeast Atlantic and around the eastern coast of Scotland. The data indicate that mesoscale eddies dominate the mixing process within the Rockall Trough. The relative temperature gradients were determined from the satellite data following correction for atmospheric effects using multichannel split window algorithms. Sources of error responsible for the differences found between the satellite-derived and buoy temperatures are discussed. R.R.

A88-43218
A MODEL OF SATELLITE RADAR ALTIMETER RETURN FROM ICE SHEETS
J. K. RIDLEY and K. C. PARTINGTON (London, University College, Dorking, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 601-624. refs

A theoretical model of satellite radar altimeter return has been developed, with application to the measurement of the form and mass balance of polar ice sheets. Altimeter returns over three widely spaced regions of the ice-sheet are shown to be strongly influenced by volume scattering as well as surface scattering. The results suggest that careful retracking of waveform data should be performed in these regions, and that failure to account for the depth of radar penetration can result in estimated elevations up to 3.3 m lower than the actual elevation (depending on local conditions and retracking method). R.R.

A88-43226
THE EFFECT OF DISSOLVED 'YELLOW SUBSTANCE' ON THE QUANTITATIVE RETRIEVAL OF CHLOROPHYLL AND TOTAL SUSPENDED SEDIMENT CONCENTRATIONS FROM REMOTE MEASUREMENTS OF WATER COLOUR
S. TASSAN (CEC, Joint Research Centre, Ispra, Italy) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 787-797. refs

A88-43664
RADIOMETRIC INVESTIGATION OF THE SEA-WAVE BREAKING PROCESS [RADIODISTANTSIONNYE ISSLEDOVANIIA PROTSESSA OBRUSHENIIA MORSKOI VOLNY]
I. V. CHERNYI and E. A. SHARKOV (AN SSSR, Institut Kosmicheskikh Issledovanii, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1988, p. 17-28. In Russian. refs

The interactions between electromagnetic radiation and the rough sea surface during the wave breaking cycle were investigated using photography and measurements carried out from an experimental vessel in the Indian Ocean with a radiometer and a scatterometer integrated with an analog magnetic recorder. Two wave-breaking cycle stages (spray and foam formation) could be identified. The results of an analysis of the high-frequency spectrum of the scatterometer signal suggest that the speckle structure of the scattered signal field (horizontal polarization) depends on spray formation over the rough sea surface. I.S.

A88-43665
PARAMETERS OF EDDY STRUCTURES AND MUSHROOM CURRENTS IN THE BALTIC SEA DERIVED FROM SATELLITE IMAGERY [PARAMETRY VIKHREVYKH STRUKTUR I GRIBOVIDNYKH TECHENII V BALTIISKOM MORE PO SPUTNIKOVYM IZOBRAZHENIIAM]
I. A. BYCHKOVA and S. V. VIKTOROV (Gosudarstvennyi Okeanograficheskii Institut, Leningrad, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1988, p. 29-35. In Russian. refs

A88-43669
METHOD FOR RAPIDLY ESTIMATING GEOPHYSICAL PARAMETERS OF THE OCEAN-ATMOSPHERE SYSTEM FROM SATELLITE MICROWAVE RADIOMETRY [OPERATIVNYI METOD OTSENKI GEOFIZICHESKIKH PARAMETROV SISTEMY OKEAN-ATMOSFERA PO DANNYM SPUTNIKOVOGO SVCH-RADIOMETRICHESKOGO ZONDIROVANIIA]
V. M. POLIAKOV and V. P. SAVORSKII (AN SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1988, p. 58-66. In Russian. refs

This paper describes a method for rapidly estimating geophysical parameters of the atmosphere and the sea surface from measurements of satellite-borne microwave radiometers. The procedure relies on determining direct multivariate regression correlations between the radiometer output signals and the variations of spatial (latitudinal) distributions of various geophysical parameters, such as the sea surface temperature and the integral water vapor content of the atmosphere. The latitudinal SST profile obtained with radiometer signals from Cosmos-1151 and the regressional correlation developed for the northern Atlantic Ocean agree with data yielded by the rigorous solution of the inverse problem. I.S.

A88-43835* National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
MASS EXTINCTIONS, ATMOSPHERIC SULPHUR AND CLIMATIC WARMING AT THE K/T BOUNDARY
MICHAEL R. RAMPINO (NASA, Goddard Institute for Space Studies, New York; New York University, NY) and TYLER VOLK (New York University, NY) Nature (ISSN 0028-0836), vol. 332, March 3, 1988, p. 63-65. Research supported by Columbia University and NASA. refs

The possible climatic effects of a drastic decrease in cloud condensation nuclei (CCN) associated with a severe reduction in the global marine phytoplankton abundance are investigated. Calculations suggest that a reduction in CCN of more than 80 percent and the resulting decrease in marine cloud albedo could have produced a rapid global warming of 6 C or more. Oxygen isotope analyses of marine sediments from many parts of the world have been interpreted as indicating a marked warming coincident with the demise of calcareous nannoplankton at the K/T boundary. Decreased marine cloud albedo and resulting high sea surface temperatures could have been a factor in the maintenance of low productivity in the 'Strangelove Ocean' period following the K/T extinctions. C.D.

A88-44005*# National Aeronautics and Space Administration. John C. Stennis Space Center, Bay Saint Louis, Miss.
REMOTE SENSING TECHNOLOGY AND APPLICATIONS
C. F. SCHUELER (NASA, John C. Stennis Space Center, Bay Saint Louis, MS) IN: Advanced topics in manufacturing technology: Product design, bioengineering; Proceedings of the Symposium, ASME Winter Annual Meeting, Boston, MA, Dec. 13-18, 1987. New York, American Society of Mechanical Engineers, 1987, p. 79-84.
(Contract NAGW-814)

Electro-optical imaging sensors form the principal devices that are typically used to obtain images of earth from satellite platforms, and substantial improvements in optics, electro-optical detection devices, cooling subsystems and composite structures have enabled the high quality performance exhibited by the current instrumentation. This paper reviews the fundamentals of system design for imaging sensors such as the Thematic Mapper on board Landsat, points out the key areas of current R&D, and briefly alludes to some important applications. Author

N88-20676# Joint Publications Research Service, Arlington, Va.
SPECTRAL REFLECTIVE CHARACTERISTICS OF SEA SURFACE Abstract Only
V. V. KAZARYAN and V. P. KOROVIN *In its* JPRS Report: Science and Technology. USSR: Earth Sciences p 1-2 26 Feb. 1988 Transl. into ENGLISH from Vestnik Leningradskogo Universiteta, Seriya 7: Geologiya, Geografiya (Leningrad, USSR), no. 1, Mar. 1987 p 97-99
Avail: NTIS HC A04/MF A01

A multichannel type SP-4 spectropolarimeter operating in the 400 to 760 nm band from an aircraft was used to measure the spectral brightness of the sea surface and study the brightness variation as a function of various hydrophysical characteristics. It was found that the spatial resolution of the instrument increased with decreasing measurement altitude, but that this increased dispersion and standard deviation of the measured values. The spectral distribution of sea surface brightness differed for various water areas. Over the ocean there was a characteristic maximum at 470 to 490 nm, in littoral waters it is shifted to 490 to 535 nm. Author

N88-20678# Joint Publications Research Service, Arlington, Va.
MUSHROOM-SHAPED CURRENTS (EDDY DIPOLES) UNDER ROTATION AND STRATIFICATION CONDITIONS Abstract Only
A. I. GINZBURG, A. G. KOSTYANOY, A. M. PAVLOV, and K. N. FEDOROV *In its* JPRS Report: Science and Technology. USSR: Earth Sciences p 3 26 Feb. 1988 Transl. into ENGLISH from Doklady Akademii Nauk SSSR (Moscow, USSR), v. 292, no. 4, Feb. 1987 p 971-974
Avail: NTIS HC A04/MF A01

The mushroom shaped currents detected from satellite images are a combination of narrow jet flows and plane eddy dipoles. A study was made to clarify the following aspects of this phenomenon: behavior of eddy dipoles under different conditions related to the presence or absence of stratification and different methods for inducing a disturbance allowing the possibility of a change in the sign and intensity of a relative angular momentum locally introduced into a fluid rotating as a solid body. The experimental apparatus included a rotating platform and a cylindrical basin filled with fresh water or a two layer fluid which was spun in a clockwise direction until solid body rotation was attained. The experimental configuration corresponded to an f-plane for which the beta-effect due to parabolic level curvature is negligible. A dye was used to ease observation of disturbance development. Various means were used to generate disturbances. The experiments revealed that in a fluid rotating system it is possible to stimulate currents on the f-plane by any of the various types of local disturbance in either a uniform or stratified fluid resulting in the formation of eddy dipole(s). Author

N88-20714*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 1987 AIRBORNE ANTARCTIC OZONE EXPERIMENT: THE NIMBUS-7 TOMS DATA ATLAS
ARLIN J. KRUEGER, PHILIP E. ARDANUY, FRANK S. SECHRIST, LANNING M. PENN, DAVID E. LARKO, SCOTT D. DOIRON, and REGINALD N. GALIMORE (Science Applications Research, Lanham, Md.) Mar. 1988 246 p
(NASA-RP-1201; REPT-88B0107; NAS 1.61:1201) Avail: NTIS HC A11/MF A01 CSCL 04B

Total ozone data taken by the Nimbus-7 Total Ozone Mapping Spectrometer (TOMS) played a central role in the successful outcome of the 1987 Airborne Antarctic Ozone Experiment. The near-real-time TOMS total ozone observations were suppled within hours of real time to the operations center in Punta Arenas, Chile, over a telecommunications network designed specifically for this purpose. The TOMS data preparation and method of transfer over the telecommunications links are reviewed. This atlas includes a complete set of the near-real-time TOMS orbital overpass data over regions around the Palmer Peninsula of Antarctica for the period of August 8 through September 29, 1987. Also provided are daily polar orthographic projections of TOMS total ozone measurements over the Southern Hemisphere from August through November 1987. In addition, a chronology of the salient points of the experiment, along with some latitudinal cross sections and time series at locations of interest of the TOMS total ozone observations are presented. The TOMS total ozone measurements are evaluated along the flight tracks of each of the ER-2 and DC-8 missions during the experiment. The ozone hole is shown here to develop in a monotonic progression throughout late August and September. The minimum total ozone amount was found on 5 October, when its all-time lowest value of 109 DU is recorded. The hole remains well defined, but fills gradually from mid-October through mid-November. The hole's dissolution is observed here to begin in mid-November, when it elongates and begins to rotate. By the end of November, the south pole is no longer located within the ozone hole. Author

N88-20780*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TIDAL ESTIMATION IN THE PACIFIC WITH APPLICATION TO SEASAT ALTIMETRY
BRAULIO V. SANCHEZ and DAVID E. CARTWRIGHT (National Academy of Sciences - National Research Council, Washington, D. C.) Dec. 1987 27 p
(NASA-TM-100694; REPT-88B0061; NAS 1.15:100694) Avail: NTIS HC A03/MF A01 CSCL 08C

The techniques for computing the eigenfunctions of the velocity potential (Proudman functions) set out in Sanchez, et al. (1986) in relation to the Atlantic-Indian Oceans are here applied to the Pacific Ocean, using a 6x6 degree grid of 510 points (455 points for the associated stream functions). Normal modes are computed from the first Proudman functions and have natural periods from 43.9h downward. Tidal syntheses are derived from these modes by direct application of the (frictionless) dynamic equations and by least-squares fitting of Proudman functions to the dynamically interpolated tide-gauge data of Schwiderski (1983). The modes contributing the most energy to the principal harmonic tidal constituents are different in the two computations: their natural periods are typically in the range of 9 to 16h for semidiurnal, and 14 to 43h for diurnal tides. The rms of fit for the Proudman functions is, in all cases, better than the corresponding value for the same number of spherical harmonics. Author

N88-20800# Scripps Institution of Oceanography, La Jolla, Calif. Space Inst.
RADIATIVE PROCESSES AFFECTING OCEAN MIXED-LAYER HEAT CONTENT AND THEIR MONITORING FROM SATELLITE
CATHERINE GAUTIER *In* Hawaii Univ., Dynamics of the Oceanic Surface Mixed Layer p 229-247 1987
(Contract N00014-86-K-0752; NSF OCE-82-14791)
Avail: NTIS HC A14/MF A01 CSCL 08C

Radiation flux observations (satellite and surface) from various studies are examined to assess their possible roles in modifying the ocean's mixed layer heat content. Several processes are investigated. First, observations indicate that the magnitude and extent of sea surface temperature (SST) diurnal warming events (changes of up to 3 degrees C), which affect air-sea heat fluxes, can be effectively monitored by satellite. Second, although still not well understood, a mechanism is suggested that would involve convective lines in upper ocean turbulent mixing generation. The mechanism has a strong diurnal variability, resulting in nighttime cooling in bursts concurrent with wind stress bursts, and might generate bursts of turbulent mixing. Third, mixings effect on photosynthesis and the potential influence of photoplankton distribution on mixing and thermal stratification are discussed. Lastly, several satellite methods for computing net surface radiation flux are reviewed and assessed. Author

N88-21567 Centre National d'Etudes Spatiales, Toulouse (France). Groupe de Recherches de Geodesie Spatiale.
STUDY OF THE DYNAMIC TOPOGRAPHY OF OCEANS BY MEANS OF SATELLITE ALTIMETRY [ETUDE DE LA TOPOGRAPHIE DYNAMIQUE DES OCEANS PAR ALTIMETRIE SATELLITAIRE]

J. F. MINSTER *In its* Climatology and Space Observations p 763-813 Sep. 1987 In FRENCH
Avail: CEPADUES-Editions, 111 rue Nicolas-Vauquelin, 31100 Toulouse, France

Measuring problems and the correction of altimetric data are reviewed. The analysis refers to the results obtained with Seasat and GEOS3. The different methods of signal processing to extract the variability due to the mesoscale dynamic topography are described. Observations at large wavelength including tidal waves are discussed. It is concluded that the necessary accuracy to assess the ocean climatic role is attainable if all aspects of measurement are optimized. ESA

N88-21568 Institut Francais de Recherche pour l'Exploitation de la Mer, Brest (France).
BASIC NETWORKS OF TOGA: DETERMINATION OF THERMAL PROFILES BY XBT AND OF SEA LEVEL BY TIDE GAGE
J. R. DONGUY *In* CNES, Climatology and Space Observations p 815-819 Sep. 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, 111 rue Nicolas-Vauquelin, 31100 Toulouse, France

French participation in TOGA is reviewed. It includes the extension of the Pacific XBT network to the Atlantic and Indian oceans. The good monitoring of thermal structure anomalies which was obtained with El Nino in 1982 to 1983 guided network extension. The comparison of the data from XBT network with the data from the tide-gage network reveals a good correlation in the equatorial area between the thermocline depth and the sea level. ESA

N88-21570 Scott Polar Research Inst., Cambridge (England).
THE ROLE OF REMOTE SENSING IN THE STUDY OF POLAR ICE SHEETS
DAVID J. DREWRY *In* CNES, Climatology and Space Observations p 835-847 Sep. 1987
Avail: CEPADUES-Editions, 111 rue Nicolas-Vauquelin, 31100 Toulouse, France

Remote sensing methods including radar and laser altimetry to observe the configuration of ice sheets; microwave radiometry to measure short term accumulation and ablation patterns; microwave and infrared radiometry from the surface temperature; and imaging techniques to measure a variety of parameters by using specific techniques are reviewed. The measurement of ice thickness, however, is a major problem, and airborne methods are indicated for the time being. ESA

N88-21571 Laboratoire d'Oceanographie Dynamique et de Climatologie, Paris (France).
ELEMENTS OF SEA ICE DYNAMICS AND THERMODYNAMICS
J. C. GASCARD *In* CNES, Climatology and Space Observations p 849-884 Sep. 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, 111 rue Nicolas-Vauquelin, 31100 Toulouse, France

A classical thermodynamical model is described and compared with observational results related to Arctic conditions. Examples of sea ice dynamics and sea ice thickness distribution are described. Remote sensing is discussed and applications from the Seasat SAR and AVHRR/TQVS on NOAA are presented. ESA

N88-21572 Max-Planck-Inst. fuer Meteorologie, Hamburg (West Germany).
SEA ICE OBSERVATIONS AND MODELS
P. LEMKE *In* CNES, Climatology and Space Observations p 885-895 Sep. 1987
Avail: CEPADUES-Editions, 111 rue Nicolas-Vauquelin, 31100 Toulouse, France

The natural variability of sea ice is described and an attempt is made to describe sea ice fluctuations with simple thermodynamics. More advanced dynamic-thermodynamic models are also discussed. Sea ice anomalies are expected to appreciably affect the structure of the atmosphere and ocean circulations. In view of the long relaxation time of these anomalies, they are of considerable interest for the problem of long term weather prediction and climatic change. ESA

N88-21575# Technische Hogeschool, Delft (Netherlands). Orbital Mechanics Section.
FROM SATELLITE ALTIMETRY TO OCEAN TOPOGRAPHY, A SURVEY OF DATA PROCESSING TECHNIQUES
K. F. WAKKER, R. C. A. ZANDBERGEN, G. H. M. VANGELDORP, and B. A. C. AMBROSIUS 1987 41 p Presented at the EARSeL Symposium on Remote Sensing Needs in the 1990's, Oceanography/Sea Ice Workshop, Noordwijkerhout, Netherlands, 4-8 May 1987 Revised Sponsored by ESA-ESOC, Darmstadt, Fed. Republic of Germany; The Netherlands Space Research Organisation, Utrecht, Netherlands; and Begeleidirgscommissie Remote Sensing, Delft, Netherlands
(ETN-88-91841) Avail: NTIS HC A03/MF A01

Satellite altimetry missions and altimeter data processing are reviewed. Orbit computation accuracy is addressed. Examples of geophysical products obtained from Seasat altimeter measurements are discussed. ESA

N88-21625# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
MARGINAL ICE ZONE EXPERIMENT (MIZEX) 1984 VARAN-S DATA SET
N. LANNELONGUE, D. VAILLANT, J. PERBOS, and W. J. CAMPBELL Nov. 1985 61 p
(ETN-88-92032) Avail: NTIS HC A04/MF A01

Side-looking airborne radar was installed in a B-17 aircraft to map ice, at 200 to 3000 m altitude with 20 km swath width. The X-band digital radar provided 5 mosaics of 100 km by 100 km. The long range and low speed of the B17 are highly advantageous for ice mapping. ESA

N88-22267# Centre National d'Etudes Spatiales, Toulouse (France). Centre Spatial.
DEFINITION AND IMPLEMENTATION STUDY FOR THE VARAN-S RADAR [ETUDE DE DEFINITION ET DE MISE EN OEUVRE DU RADAR VARAN-S]
N. LANNELONGUE and D. VAILLANT 1 Aug. 1985 178 p In FRENCH
(CNES-CT/DRT/TIT/RL-143-T; ETN-88-92030) Avail: NTIS HC A09/MF A01

The Varan-S side looking radar was developed to implement high resolution imagery for oceanographic applications. It works as a synthetic aperture radar. The technical parameters required for oceanographic utilization and the onboard equipment necessary to implement the radar system are described. The ground-based data processing is also discussed. The specifications are given. ESA

N88-22447*# Bohan (Walter A.) Co., Park Ridge, Ill.
NIMBUS-7 CZCS. COASTAL ZONE COLOR SCANNER IMAGERY FOR SELECTED COASTAL REGIONS. NORTH AMERICA - EUROPE. SOUTH AMERICA - AFRICA - ANTARCTICA. LEVEL 2 PHOTOGRAPHIC PRODUCT
1984 99 p Original contains color illustrations
(Contract NAS5-29079)
(NASA-CR-180755; NAS 1.26:180755) Avail: NTIS HC A05/MF A01 CSCL 08B

The Nimbus-7 Coastal Zone Color Scanner (CZCS) is the first spacecraft instrument devoted to the measurement of ocean color. Although instruments on other satellites have sensed ocean color, their spectral bands, spatial resolution, and dynamic range were optimized for geographical or meteorological use. In the CZCS, every parameter is optimized for use over water to the exclusion of any other type of sensing. The signal-to-noise ratios in the spectral channels sensing reflected solar radiance are higher than those required in the past. These ratios need to be high because the ocean is such a poor reflecting surface that the majority of the signal seen by the reflected energy channels at spacecraft altitudes is backscattered solar radiation from the atmosphere

rather than reflected solar energy from the ocean. The CZCS is a conventional multichannel scanning radiometer utilizing a rotating plane mirror at a 45 deg angle to the optic axis of a Cassegrain telescope. The mirror scans 360 deg; however, only 80 deg of data centered on the spacecraft nadir is collected for ocean color measurements. Spatial resolution at spacecraft nadir is 825x825 m with some degradation at the edges of the scan swath. The useful swath width from a spacecraft altitude of 955 km is 1600 km. Author

N88-22504# Pacific Northwest Labs., Richland, Wash.
OCEAN GENERAL CIRCULATION MODELS: REPORT ON PROCEEDINGS OF A MEETING OF OCEAN AND CLIMATE MODELERS
C. R. SHERWOOD and J. P. DOWNING Jan. 1988 101 p Presented at the Meeting on Ocean and Climate Modelers: Ocean General Circulation Models, Sequim, Wash., 30 Jul. 1987
(Contract DE-AC06-76RL-01830)
(DE88-005530; PNL-SA-15557; CONF-8707147-SUMM) Avail: NTIS HC A06/MF A01

The proceedings of a meeting of ocean general circulation modelers and oceanographers are summarized. New developments in coupling ocean general circulation models and atmospheric general circulation models, improvements in the representation of mixed layer and sea ice processes, optimization of model codes for parallel processing on the next generation of supercomputers and ocean data sets and their limitations are among the topics discussed. Author

N88-22506# Naval Postgraduate School, Monterey, Calif.
HYDROGRAPHIC DATA FROM THE OPTOMA (OCEAN PREDICTION THROUGH OBSERVATION, MODELING AND ANALYSIS) PROGRAM: OPTOMA 23, 9-19 NOVEMBER 1986 Progress Report, Nov. 1986 - Sep. 1987
J. E. JOHNSON, PAUL A. WITTMANN, and CHRISTOPHER N. MOOERS 8 Jan. 1988 95 p
(AD-A189868; NPS-68-88-001) Avail: NTIS HC A05/MF A01 CSCL 08C

The OPTOMA (Ocean Prediction Through Observation, Modeling and Analysis) program, seeks to understand the mesoscale (fronts, eddies, and jets) variability and dynamics of the California Current System (CCS) and to determine the scientific limits to practical mesoscale ocean forecasting. OPTOMA 23 is the last of the OPTOMA surveys and it is unique in that this was the first effort to integrate concurrent satellite, drifting buoy, ship, and aircraft data in a comprehensive oceanographic, meteorological, and acoustical study of the CCS. Specific goals of the airborne surveys were to: provide synoptic data for objective analysis of various parameters (e.g., SST from AXBT and PRT-5, mixed layer depth, thermal structure); provide initialization, boundary condition updating, and verification fields for dynamical model forecasts; and coordinate the observational strategy of the R/V POINT SUR by using near real time analyses to vector the ship into areas of interesting mesoscale activity. GRA

N88-22508# Woods Hole Oceanographic Institution, Mass.
REAL-TIME ENVIRONMENTAL ARCTIC MONITORING (R-TEAM) Interim Technical Report
ALESSANDRO BOCCONCELLI Nov. 1987 83 p
(Contract N00014-86-C-0135)
(AD-A189948; WHOI-87-50) Avail: NTIS HC A05/MF A01 CSCL 08C

The R-TEAM mooring is designed to collect oceanic environmental data in Arctic regions and to transmit these data to shore on a daily basis via ARGOS satellite telemetry. An ascent module comes to the surface once a day and transmits directly to ARGOS (ice free surface). When not transmitting the module remains in its rest position most of the time, well away from the surface, thus diminishing the risks of damage at the ice interface. The R-TEAM's design life is one year in situ. The mooring must be capable of deployment in depths of up to 4500 and must be able to withstand a maximum current speed of 2 knots at the surface. At an early stage two different transit options were considered. The variable ballast elevator seemed more directly compatible with our existing capabilities. UHF and MF transmitters, antennae, and associated electronic were designed and built to system specifications. The prototype mooring was deployed at 2700 m at 39 deg N, 30 deg W on June 2, 1987 and entirely recovered 62 days later. By and large this experimental deployment was very successful but the test also revealed two deficiencies which need to be corrected. GRA

N88-23357 Max-Planck-Inst. fuer Meteorologie, Hamburg (West Germany).
INVESTIGATION OF THE IMAGING OF OCEAN SURFACE WAVES USING A SYNTHETIC APERTURE RADAR [UNTERSUCHUNG DER ABBILDUNG VON OZEANOBERFLAECHENWELLEN DURCH EIN SYNTHETIC APERTURE RADAR]
CLAUS BRUENING 1987 98 p In GERMAN
(SER-A-WISS-ABHANDL-84; ETN-88-91470) Avail: Fachinformationszentrum Karlsruhe, 7514 Eggenstein-Leopoldshafen 2, Fed. Republic of Germany, 20 DM

The imaging of long, wind-induced ocean waves by a SAR using a two-dimensional Monte Carlo simulation model was investigated. It is shown that the nonlinear distortions in the SAR-imaging are essentially due to phase modulation and Doppler broadening of the SAR-signal by the subscale orbital velocities of backscattered SAR-signal. The pronounced azimuthal decay of the spectral energy density in the SAR-variance spectrum is due to the Doppler-broadening-induced reduction of the azimuthal resolution, and limits the signal-to-noise ratio of the signal. The validity of the SAR-simulation model was demonstrated by comparison with SAR-variance spectra taken by the Shuttle Imaging Radar. ESA

N88-23358# World Climate Programme, Geneva (Switzerland).
THE WOCE CORE PROJECT PLANNING MEETING ON THE GYRE DYNAMICS EXPERIMENT
Sep. 1987 47 p Meeting held in London, United Kingdom, 2-5 Sep. 1986
(WCP-139; WMO/TD-192; ETN-88-92209) Avail: NTIS MF A01; print copy avail. at World Meteorological Organization, Case Postale No. 5, CH-1211 Geneva 20, Switzerland

Aspects which a study of ocean gyre dynamics should address were defined. The ocean surface layer, ocean interior, and deep circulation were discussed. Apart from a deep circulation experiment in the Brazil basin, the favored site is the North Atlantic. ESA

N88-24024# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
COMPARISON OF SURFACE CURRENT DETERMINED FROM SATELLITE-TRACKED BUOY WITH SHIPBOARD WIND DATA DURING THE 4TH BRAZILIAN ANTARCTIC EXPEDITION, 10-14 MARCH, 1986
MERRITT R. STEVENSON, EDUARDO M. B. ALONSO, CARLOS L. DASILVA, JR., and REINALDO SOLEWICZ *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SEELPER Plenary Meeting, Volume 1 p 181 1986
Avail: NTIS HC A99/MF E03

A drifting buoy developed by INPE was launched on the 10th of March and tracked by the system ARGOS, using NOAA-6 and NOAA-9 satellites until the 14th of March, when the buoy was recovered by the oceanographic support ship Barao de Teffe. After the launch of the buoy, a set of oceanographic stations was occupied at which time wind measurements were made from the ship. Other wind measurements were also made at hourly intervals, and combined with station winds to form a times series for the experiment. Prior to and at the time of buoy launch, the wind was from the SW and parallel to the axis of the Strait. During the following 8 hours, winds were weak or calm. Afterward the wind changed direction and blew from the NE with speeds increasing to more than 30 knots and gusts to 48 knots during the following day. Wind continued strong and generally from the NE and E

until the 14th of March when the buoy was recovered. During the experiment about 40 buoy positions were determined by service ARGOS in Toulouse, France. A comparison was made of the wind and buoy trajectories in terms of time lag. Author

N88-24058# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
NEAR SURFACE CURRENT DETERMINED FROM INPE'S SATELLITE-TRACKED BUOY, DURING 6-26 NOVEMBER, 1985
MERRITT R. STEVENSON and EDUARDO M. B. ALONSO *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 494-500 1986
Avail: NTIS HC A99/MF E03

A field experiment was made to test INPE's drifting, oceanographic buoy during the 6th through the 26th of November, 1985. Buoy measurements obtained during the 10th through the 20th of November were made from the Brazilian hydrographic ship Alte, Saldanha, near 24 deg 8 min S, 45 deg 13 min W. Within the buoy, a UHF transmitter compatible with the System ARGOS, transmitted sensor data via an omnidirectional antenna. The System ARGOS aboard polar orbiting satellites received, recorded, and retransmitted the buoy signals. Geographic fixes were determined from the Doppler frequency of the buoy transmissions, in combination with the known orbital characteristics of the satellite receiving the signals. Positional accuracy of the buoy was estimated by determining positional differences with respect to the five mean positions, and then combining these differences to make an overall estimate of the positional error. The experiment suggests that the INPE drifting buoy is capable of obtaining useful measurements of near surface currents. Author

N88-24126*# Alaska Univ., Fairbanks. Geophysical Inst.
INFLUENCE OF THE YUKON RIVER ON THE BERING SEA Final Report
KENNESON G. DEAN and C. PETER MCROY 1988 22 p Original contains color illustrations
(Contract NAS5-28769)
(NASA-CR-182802; NAS 1.26:182802) Avail: NTIS HC A03/MF A01 CSCL 08C

Physical and biological oceanography of the northern Bering Sea including the influence of the Yukon River were studied. Satellite data acquired by the Advanced Very High Resolution Radiometer (AVHRR), the LANDSAT Multispectral Scanner (MSS) and the Thematic Mapper (TM) sensor were used to detect sea surface temperatures and suspended sediments. Shipboard measurements of temperature, salinity and nutrients were acquired through the Inner Shelf Transfer and Recycling (ISHTAR) project and were compared to digitally enhanced and historical satellite images. The satellite data reveal north-flowing, warm water along the Alaskan coast that is highly turbid with complex patterns of surface circulation near the Yukon River delta. To the west near the Soviet Union, cold water, derived from an upwelling, mixes with shelf water and also flows north. The cold and warm water coincide with the Anadyr, Bering Shelf and Alaskan coastal water masses. Generally, warm Alaskan coastal water forms near the coast and extends offshore as the summer progresses. Turbid water discharged by the Yukon River progresses in the same fashion but extends northward across the entrance to Norton Sound, attaining its maximum surface extent in October. The Anadyr water flows northward and around St. Lawrence Island, but its extent is highly variable and depends upon mesoscale pressure fields in the Arctic Ocean and the Bering Sea. Author

N88-24129# Science Applications International Corp., College Station, Tex.
EXAMPLES OF ICE PACK RIGIDITY AND MOBILITY CHARACTERISTICS DETERMINED FROM ICE MOTION
JAMES K. LEWIS, RONALD E. ENGLEBRETSON, and WARREN W. DENNER Jan. 1988 19 p
(Contract N00014-87-C-0173)
(AD-A191163; SAIC-87/1869) Avail: NTIS HC A03/MF A01 CSCL 08L

A method has been developed to determine ice pack rigidity and mobility using observed ice motion. With this method, one may determine how solidly the ice pack is frozen in near real-time. Spatial and temporal variations in the freezing and thawing of the ice pack can also be studied. This method was developed to study how well numerical ice modeling techniques were reproducing actual sea ice processes. The ice pack rigidity parameter is now being used to compare observed periods of ice pack thawing and freezing with models from the same regions and times. Various degrees of ice rigidity and mobility were studied using remotely-sensed ice motion data off the north coast of Alaska during 1975 and 1979. Characteristics of the time histories of pack ice speed were used to infer changes in the rigidity of pack ice. Summer-time ice rigidities were detected first in late June 1975 and lasted through September. However, in 1979 considerably higher rigidities were found in August while summer-like rigidities were detected into late November. Analyses of atmospheric pressure distributions suggest that less mechanical breakup occurred in the summer of 1979, resulting in the greater rigidities during August of that year. GRA

06

HYDROLOGY AND WATER MANAGEMENT

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

A88-34674
PRINCIPLES OF THE REMOTE MONITORING OF FRESH-WATER QUALITY [PRINTSIPY AEROKOSMICHESKOGO MONITORINGA KACHESTVA POVERKHNOSTNYKH VOD SUSHI]
K. IA. KONDRAT'EV (AN SSSR, Institut Ozerovedeniia, Leningrad, USSR) and A. A. GITEL'SON (AN SSSR, Gidrokhimicheskii Institut, Rostov-on-Don, USSR) Akademiia Nauk SSSR, Doklady (ISSN 0021-3454), vol. 299, no. 3, 1988, p. 590-595. In Russian. refs

Principles for the monitoring of fresh-water quality on the basis of satellite multispectral observations are presented. The proposed approach makes it possible to determine such water characteristics as concentrations of chlorophyll, petroleum, and dissolved organic matter; temperature; mineralization; pH; turbidity; oxygen content; and electroconductivity. B.J.

A88-35196
QUANTITATIVE ANALYSIS OF DISTRIBUTION OF SUSPENDED SEDIMENTS IN THE YELLOW RIVER ESTUARY FROM MSS DATA
WEN-YAO LIU and V. KLEMAS (College of Marine Studies, Newark, DE) *Geocarto International* (ISSN 1010-6049), vol. 3, March 1988, p. 51-62. refs

A88-35198* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF SNOW
J. L. FOSTER, D. K. HALL, and A. T. C. CHANG (NASA, Goddard Space Flight Center, Greenbelt, Md) EOS (ISSN 0096-3941), vol. 68, Aug. 11, 1987, p. 682-684. refs

The snow parameters affecting sensor responses at different wavelengths are discussed. The effects of snow depth and background radiation on gamma ray sensors and of crystal size, contaminants, snow depth, liquid water, and surface roughness on visible and near-infrared sensors are considered. The influence of temperature, crystal size, and liquid water on thermal infrared sensors and of liquid water, crystal size, water equivalent depth, stratification, snow surface roughness, density, temperature, and soil condition on microwave sensors are addressed. C.D.

A88-35399
QUANTITATIVE DESCRIPTION AND CLASSIFICATION OF DRAINAGE PATTERNS
DEMETRE P. ARGIALAS (Louisiana State University, Baton Rouge), JOHN G. LYON (Ohio State University, Columbus), and OLIN W. MINTZER (U.S. Army, Engineer Topographic Laboratories, Fort Belvoir, VA) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, April 1988, p. 505-509. Research supported by the Louisiana State University. refs

A structural pattern recognition methodology is presented for computer-assisted description and classification of drainage patterns. Eight patterns types were quantitatively described and classified. The methodology to classify these patterns consisted of drainage pattern models, hierarchical and relational models, attribute extraction, and classification strategies. The results indicated that a digital computer can assist human interpretation on such patterns. Author

A88-36166
SALINE SALT AND WATER SURFACE MAPPING ON THE BASIS OF DATA FROM THE GYUNESH-84 REMOTE-SENSING EXPERIMENT [KARTOGRAFIROVANIE ZASOLENNYKH ZEMEL' I VODNOI POVERKHNOSTI PO REZUL'TATAM KOMPLEKSNOGO AEROKOSMICHESKOGO EKSPERIMENTA 'GIUNESH-84']
A. SH. MEKHTIEV, P. IU. NAGIEV, E. M. DZHAFAROV, B. IA. DOLGOPOLOV, and E. A. MAMEDOV (AN ASSR, Nauchno-Proizvodstvennoe Ob'edinenie Kosmicheskikh Issledovanii, Baku, Azerbaidzhan SSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 66-74. In Russian. refs

A88-37136
USE OF RADAR AND SATELLITE IMAGERY FOR THE MEASUREMENT AND SHORT-TERM PREDICTION OF RAINFALL IN THE UNITED KINGDOM
K. A. BROWNING (Meteorological Office, Bracknell, England) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 189-208. refs

The techniques and hardware being developed at the UK Meteorological Office to process radar data and satellite imagery for use in numerical rainfall prediction are discussed. The major components of the system include multiple unmanned radar sites with on-site minicomputers, a central network computer to combine the radar data and generate integrated rainfall maps, a ground station to receive and preprocess cloud images from GEO satellites, automatic forecasting algorithms based on simple extrapolation, interactive image-display terminals for comparison of satellite and radar data, and automated tailoring and distribution of rainfall measurements and predictions. The operation of these components is described in detail and illustrated with diagrams, maps, and sample images. T.K.

A88-37414
SATELLITE DETECTION OF BLOOM AND PIGMENT DISTRIBUTIONS IN ESTUARIES
RICHARD P. STUMPF (NOAA, Assessment and Information Services Center, Washington, DC) and MARY A. TYLER (Versar, Inc., Columbia, MD) Remote Sensing of Environment (ISSN 0034-4257), vol. 24, April 1988, p. 385-404. refs
(Contract NSF OCE-81-09928; NSF OCE-83-10407)

A technique to obtain estimates of relative chorophyll concentration in turbid water using satellite spectral data is described. The method is capable of identifying chlorophyll blooms in estuaries where the reflectance is between 0.01 and 0.07. With a simple uniform atmospheric correction to AVHRR and CZCS satellite data, maps of the vector orientation in bands j and i are used to show the location of blooms in the Chesapeake Bay in the springs of 1981 and 1982. With some calibration, the method may provide estimates of chlorophyll for concentrations greater than 5 microg/l. R.R.

A88-39078 San Diego State Univ., Calif.
REMOTE SENSING AND IMAGE PROCESSING REQUIREMENTS FOR EULERIAN FLOW FIELD ESTIMATIONS
DOUGLAS A. STOW (San Diego State University, CA) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 351-364. Research sponsored by the University of California and NASA. refs

The application of remote sensing and image processing to the development of numerical models for deriving estimates of a hydrodynamic surface flow field is considered. Remote sensing and image processing provide time-sequential tracer distribution information over a water surface as input to the flow estimating numerical model. Technical and scientific aspects of remote sensing tracers, platforms, and sensors are discussed, in addition to image processing procedures related to atmospheric corrections, geometric/radiometric processing, and spatial aggregation. R.R.

A88-39080
COMPARISON OF MEASURED SUSPENDED SEDIMENT CONCENTRATIONS WITH SUSPENDED SEDIMENT CONCENTRATIONS ESTIMATED FROM LANDSAT MSS DATA
JERRY C. RITCHIE (USDA, Hydrology Laboratory, Beltsville, MD) and CHARLES M. COOPER (USDA, Sedimentation Laboratory, Oxford, MS) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 379-387. refs

Landsat MSS data for 27 days between January 1983 and June 1985 for Moon Lake, Mississippi were analyzed as a means of determining the suspended sediment concentrations of lake surface water. Pixel values and radiance and reflectance measurements from Landsat data for 14 of the scenes were used to develop simple and multiple regression equations. The coefficient of determination for the relationship between measured and estimated suspended sediment concentrations was found to be greater than 0.80. The best estimates were obtained in the 50-250 mg/l concentration range. R.R.

A88-39089
RANGELAND RUNOFF CURVE NUMBERS AS DETERMINED FROM LANDSAT MSS DATA
A. W. ZEVENBERGEN (Landbouwhogeschool, Wageningen, Netherlands), A. RANGO, J. C. RITCHIE, E. T. ENGMAN (USDA, Hydrology Laboratory, Beltsville, MD), and R. H. HAWKINS (Utah State University, Logan) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 495-502. refs

A relationship has been found between satellite data and hydrologically defined runoff curve numbers (CN) for a limited number of watersheds. Watershed CNs calculated from rainfall-runoff data on small range land basins were correlated with Landsat multispectral scanner data transformed into 19 reflectance index models (RIM). In this study, nine small watersheds were found where sufficient CN and Landsat data were available. After eliminating the redundant or poorly correlated RIMs, five significant and highly correlated RIM versus CN regression relationships were selected as promising for use in rangeland studies. More testing should be done to validate the approach; however, the results indicate that satellite data may eventually be employed to directly and efficiently estimate rangeland CNs. This empirical approach has potential for use in planning studies and comprehensive range resources models. Author

A88-41946
APPLICATION OF LANDSAT THEMATIC MAPPER DATA TO ASSESS SUSPENDED SEDIMENT DISPERSION IN A COASTAL LAGOON
JOHN R. JENSEN, ELIJAH W. RAMSEY, III, BJORN KJERFVE, KAREN MAGILL, and JIM SNEED (South Carolina, University, Columbia) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 26-35. refs

The techniques used to estimate the suspended sediment content of water in the Laguna de Terminos (Mexico) and adjacent coastal areas from a Landsat-5 TM image obtained on November

25, 1984 under cloud-free conditions are described. The steps applied include conversion of digital data to radiance values and bandwidth normalization, correction for atmospheric scattering and radiative transfer, application of a chromaticity-transform algorithm, and principal-component analysis. The results are presented in tables, graphs, and maps and briefly characterized, with reference to the predictions of a numerical model of sediment circulation in the lagoon. The highest correlation (r = -0.61) with predicted sediment concentration is found for the atmospherically corrected chromaticity level related to TM band 2. T.K.

A88-41949* National Aeronautics and Space Administration. John C. Stennis Space Center, Bay Saint Louis, Miss.
A GRIDDING APPROACH TO DETECT PATTERNS OF CHANGE IN COASTAL WETLANDS FROM DIGITAL DATA
R. E. PELLETIER and D. D. DOW (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 119-128. refs

The conversion of land to water or water to land in the Grand Bayou wetlands area from 1972 to 1981 is evaluated on the basis of Landsat MSS band 2 and 4 images. A postclassification (land vs water) procedure is employed, and grids 1, 5, 10, 25, and 50 pixels square are superimposed on the classified data in an effort to reduce the effects of poor georegistration of the images (simulated by shifting one set of grids two pixels vertically and horizontally). The results are presented in tables, maps, and sample images and characterized in detail. Grids 5 or 10 pixels square are found to give percentage land/water change values and locations similar to those obtained in pixel-by-pixel analysis of nearly perfectly matched images. T.K.

A88-41950
USING LANDSAT TO DERIVE CURVE NUMBERS FOR HYDROLOGIC MODELS
KENT M. MCGREGOR (North Texas State University, Denton, TX) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 129-135. refs

As a watershed becomes more urbanized, floods occur more frequently. Cities are structurally complex, so it is difficult to monitor changes in urban land use/cover which affect streamflow. Computer processing of data from LANDSAT or similar sensors can potentially provide fast and accurate determination of the surface character for input into hydrological models. Experiments conducted on the eight square mile Cottonwood Creek drainage in Dallas, Texas indicated good agreement between predicted runoff using the Soil Conservation TR-20 hydrologic model and actual streamflow measured at gauging stations. Author

A88-41957
TOWARD AN INTEGRATED SYSTEM FOR SATELLITE REMOTE SENSING OF WATER QUALITY IN THE GREAT LAKES
THOMAS M. LILLESAND, RICHARD G. LATHROP, JR., and JOHN R. VANDE CASTLE (Wisconsin, University, Madison) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 342-347. Research supported by the University of Wisconsin and William and Flora Hewlett Foundation.
(Contract NOAA-NA-84AAD00065)

Water quality in the Great Lakes is a highly dynamic phenomenon that varies widely over both time and space. Monitoring requirements range from those involving small areas and short timeframes, to those involving the entire Great Lakes system and the identification of long-term trends. No single operational satellite system is optimal for meeting all of these requirements. However, data from the SPOT high resolution visible (HRV) sensors, the Landsat Thematic Mapper (TM), and the NOAA Advanced Very High Resolution Radiometer (AVHRR) can all play a potentially important role in the overall monitoring process. The calibration and integration of the different spatial resolutions, spectral resolutions, and spatial and temporal coverage patterns provide a framework for an operational monitoring system for the Great Lakes. Author

A88-42026
SPRING MOUND AND AIOUN MAPPING FROM LANDSAT TM IMAGERY IN SOUTH-CENTRAL TUNISIA
ARWYN RHYS JONES and ANDREW MILLINGTON (Reading, University, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 607-613. refs

Spring mounds and aioun, two rare geomorphological expressions of groundwater upwelling on playas in south-central Tunisia are studied through lineament analysis of Landsat TM imagery. The hydrogeology of the region, the identification of features on satellite imagery, and the digital processing of MSS and TM imagery of playa facies are discussed. Lineament directional trends are identified and analyzed, showing strong underlying hydrogeological controls on spring mounds and aioun related to Alpine folding and associated faulting and jointing. It is concluded that the detection of these features using remotely sensed imagery has many advantages over conventional ground survey. R.B.

A88-42038
A METHODOLOGY FOR INTEGRATING SATELLITE IMAGERY AND FIELD OBSERVATIONS FOR HYDROLOGICAL REGIONALISATION IN ALPINE CATCHMENTS
R. ALLEWIJN (Vrije Universiteit, Amsterdam, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 693-697. refs

A88-42040
SIMPLE CLASSIFIERS OF SATELLITE DATA FOR HYDROLOGIC MODELLING
R. S. DRAYTON (Cardiff, University College, Wales), T. R. E. CHIDLEY, and W. C. COLLINS (Aston, University, Birmingham, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 709-711.

Hydrological models are normally based on parameters extracted from conventional maps such as drainage density and land cover. In this paper the use of parameters derived from thematic classifications of satellite imagery is examined. The advantage of this technique is that the satellite image becomes an up-to-date, easily managed source of data for monitoring of water resources. The methods of classification range from simple density slicing to supervised classification. A model was constructed in which run-off characteristics were regressed on thematic classifications. The problem of achieving sufficient variance in the hydrological parameters within one satellite image are discussed, and recommendations for distributed modeling are made. Author

A88-42041
A HYDROLOGICAL COMPARISON OF LANDSAT TM, LANDSAT MSS AND BLACK AND WHITE AERIAL PHOTOGRAPHY
M. J. FRANCE and P. D. HEDGES (Aston, University, Birmingham, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 717-720. refs

Landsat TM is evaluated for its accuracy in delineating, mapping

and measuring, water bodies, drainage networks, catchment areas and landcover. A comparison is made with results from Landsat MSS imagery and 1:50000 scale black and white aerial photography, for the same area in North Wales, UK. Landsat TM is found to have significant advantages over Landsat MSS for recording drainage network information. Lakes as small as 0.6 hectares can be identified using Landsat TM imagery and the delineation of small streams aids in accurately defining catchment boundaries. Author

A88-42042
APPLICATION OF REMOTE SENSING IN HYDROMORPHOLOGY FOR THIRD WORLD DEVELOPMENT - A RESOURCE DEVELOPMENT STUDY IN PARTS OF HARYANA (INDIA)
A. S. JADHAV (Department of Geography, Kolhapur, India) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 721-724.

A88-42043
REMOTE SENSING OF FLOW CHARACTERISTICS OF THE STRAIT OF ORESUND
L. JONSSON (Lund, Universitet, Sweden) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 725-729.

The results of the use of NOAA and Landsat imagery of the strait of Oresund for extracting information on the large-scale flow pattern and for possibly distinguishing certain flow phenomena are examined. The hydrography of the region is discussed, pointing out the need for investigating interferences with coastal waters due to the heavy demand for using the coastal waters for different purposes. Remotely sensed data on large-scale water circulation is used in connection with numerical flow models to increase knowledge of hydrodynamic processes and circulation patterns in coastal waters. R.B.

A88-42044
THE QUANTIFICATION OF FLOODPLAIN INUNDATION BY THE USE OF LANDSAT AND METRIC CAMERA INFORMATION, BELIZE, CENTRAL AMERICA
S. T. MILLER (Aston, University, Birmingham, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 733-738. refs

A88-42045
REMOTE SENSING AS A TOOL FOR ASSESSING ENVIRONMENTAL EFFECTS OF HYDROELECTRIC DEVELOPMENT IN A REMOTE RIVER BASIN
W. MURRAY PATERSON and STEWART K. SEARS (Ontario Hydro, Toronto, Canada) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 739-744. refs

The development of new hydroelectric generation projects in Ontario (Canada) requires environmental studies to be carried out at various stages in the project life cycle. The feasibility of using remotely-sensed Landsat satellite data to assist in these studies is assessed based on a pilot project carried out in a remote northern Ontario river basin. Results suggest that remote sensing technology offers a potentially effective and economical means of collecting, interpreting and presenting environmental information for studies related to broad level river basin planning, conceptual assessments, project scoping, impact assessment, and postdevelopment project follow-up and monitoring.

A88-42046
ENVIRONMENTAL ASSESSMENT FOR LARGE SCALE CIVIL ENGINEERING PROJECTS WITH DATA OF DTM AND REMOTE SENSING
TAICHI OSHIMA, ATSUSHI RIKIMARU (Hosei University, Tokyo, Japan), YOUICHI KATO, and MASAHARU NAKAMURA (Pasco Corp., Tokyo, Japan) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 745-748.

A study in which Digital Terrain Model (DTM) and remote sensing data were used to evaluate the danger of landslides at a dam resevoir construction site in the mountain region of Japan is discussed. Conditions such as topography, geology, vegetation and water resources were used in connection with DTM and Landsat MSS data to map grades of weathered granite and landslide danger. The site proposed for development was selected from ground investigation and results of photointerpretation. R.B.

A88-42048* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
SATELLITE DATA IN AQUATIC AREA RESEARCH - SOME IDEAS FOR FUTURE STUDIES
JOUKO T. RAITALA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 755-758. refs

Attempts to apply aquatic remote sensing to the preparation of parametric map-like presentations, quantitative evaluations and time-related investigations in various water areas in Finland are presented. The potential use of Landsat MSS data in aquatic area studies, including limology, aquatic botany, geomorphology and engineering is evaluated using computer-aided digital remote sensing techniques. MSS data may provide information about depth, Secchi disc values, humus content in water, and productivity. Aquatic vegetation classification using MSS is possible only where vegetation units are large enough in respect to the 0.5 hectares ground resolution. Multitemporal satellite imagery has been used to evaluate alterations in the littoral areas of some Finnish water reservoirs between successive periods of high water. It is concluded that although MSS data can be of use in aquatic studies, it should be used in connection with field data and/or TM and SPOT data. R.B.

A88-42051
CLASSIFICATION OF BOTTOM COMPOSITION AND BATHYMETRY OF SHALLOW WATERS BY PASSIVE REMOTE SENSING
D. SPITZER and R. W. J. DIRKS (Nederlands Instituut voor Onderzoek der Zee, Texel, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 775-777.

The use of remote sensing data in the development of algorithms to remove the influence of the watercolumn on upwelling optical signals when mapping the bottom depth and composition in shallow waters. Calculations relating the reflectance spectra to the parameters of the watercolumn and the diverse bottom types are performed and measurements of the underwater reflection coefficient of sandy, mud, and vegetation-type seabottoms are taken. The two-flow radiative transfer model is used. Reflectances within the spectral bands of the Landsat MSS, the Landsat TM, SPOT HVR, and the TIROS-N series AVHRR were computed in order to develop appropriate algorithms suitable for the bottom depth and type mapping. Bottom depth and features appear to be observable down to 3-20 m depending on the water composition and bottom type. R.B.

A88-42053
A STUDY WITH NOAA-7 AVHRR-IMAGERY IN MONITORING EPHEMERAL STREAMS IN THE LOWER CATCHMENT AREA OF THE TANA RIVER, KENYA
J. W. VAN DEN BRINK (DHV Consulting Engineers, Amersfoort, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 783-785. refs

A88-43666
STATISTICAL ANALYSIS OF THE NEAR-SURFACE DISTRIBUTIONS OF CHLOROPHYLL AND TEMPERATURE FIELDS ON THE BASIS OF REMOTE IMAGERY FROM CZCS AND AVHRR SCANNERS [STATISTICHESKII ANALIZ PRIPOVERKHNOSTNYKH RASPREDELENII POLEI KHLOROFILLA I TEMPERATURY PO SPUTNIKOVYM IZOBRAZHENIIAM SKANEROV CZCS I AVHRR]
M. M. KAHRU (AN ESSR, Institut Termofiziki i Elektrofiziki, Tallinn, Estonian SSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1988, p. 36-43. In Russian. refs

Remote images obtained by CZCS and AVHRR scanners were used to analyze distributions of the near-surface phytoplankton pigment concentration (PPC) and sea-surface temperature (SST) near the California coast. The spectra of spatial variability and rms coherence in the 2-100-km wavelength interval were estimated. It was found that the PPC spectra are more variable than the SST spectra and are less steep. Two patterns of variability were observed for the PPC and SST fields in the California Current, corresponding to the presence or the absence of pronounced transverse currents from the upwelling zone. I.S.

A88-43673
A COMPARATIVE ANALYSIS OF METHODS FOR COMPRESSING SPECTROPHOTOMETRIC DATA IN THE ESTIMATION OF HYDROLOGICAL PARAMETERS [SRAVNITEL'NYI ANALIZ METODOV SZHATIIA SPEKTROFOTOMETRICHESKOI INFORMATSII PRI OTSENKE GIDROLOGICHESKIKH PARAMETROV]
T. FARAGO (Baja Csillagvizsgalo Intezet, Budapest, Hungary) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1988, p. 90-98. In Russian. refs

Several data-compression algorithms applied to remote spectrophotometry data on inland water bodies are discussed. Special consideration is given to methods for determining high-information-content spectral bands and integral signatures, such as color coordinates and principal-component expansion coefficients. Three feature-selection methods were compared in the analysis of chlorophyll concentration, concentration of suspended matter, and concentrations of suspended organic and mineral components in the Svir' Bay of Ladoga Lake and in adjacent regions of the lake, using spectrophotometric data obtained aboard experimental aircraft. I.S.

A88-44120
DETERMINATIONS OF SUSPENDED SEDIMENT CONCENTRATIONS FROM MULTIPLE DAY LANDSAT AND AVHRR DATA
JOHN G. LYON, KEITH W. BEDFORD, CHIEH-CHENG J. YEN (Ohio State University, Columbus), DEBORAH H. LEE (U.S. Army, Corps of Engineers, Detroit, MI), and DAVID J. MARK (U.S. Army, Corps of Engineers, Vicksburg, MS) Remote Sensing of Environment (ISSN 0034-4257), vol. 25, June 1988, p. 107-115. Research supported by Ohio State University. refs
(Contract NOAA-NA-81AAD00095; NOAA-NA-84AAD00079)

A combination of satellite data, on-site sampling, and hydrodynamic and water quality model simulations was used to evaluate surface sediment concentrations in Sandusky Bay, Lake Erie. Both satellite brightness values and categorizations of total suspended sediment concentrations from Landsat and AVHRR data were evaluated for the period of June 10-28, 1981. The satellite data products displayed many of the trends in concentration recorded by the on-site data, and were similar to the results of hydrodynamic and water quality (HWQ) model simulations reported elsewhere. Author

A88-44311#
MILLIMETER-WAVE MULTIPATH MEASUREMENTS ON SNOW COVER
UVE H. W. LAMMERS, DALLAS T. HAYES, and RICHARD A. MARR (USAF, Rome Air Development Center, Hanscom AFB, MA) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. 26, May 1988, p. 259-267. refs

Multipath data were obtained at frequencies of 35.1, 98.1, and 140.1 GHz over a pathlength of 179.5 m by measuring height-gain patterns between 0.2 and 4.0 m with a vertically moving receiving antenna. Grazing angles from this geometry range between 0.5 and 2 deg measured interference patterns between direct and snow-reflected rays were generally coherent in appearance and on occassion exhibited cancellation depths greater than 20 dB. A computer program models the reflection as a coherent process, with the underlying snow surface represented by a series of linear sloping segments derived from actual terrain heights. The reflection coefficient near a 2-deg grazing angle ranged from 0.53 to 0.20 over matted grass, from 0.66 to 0.34 over freshly fallen snow, and from 0.85 to 0.71 over old snow. The higher numbers correspond to 35.1 GHz, the lower numbers correspond to 140.1 GHz. I.E.

A88-44447
COASTAL MONITORING BY REMOTE SENSING
THOMAS VOIGT (Department of Remote Sensing, Berlin, German Democratic Republic) and DIETRICH WEISS (Coastal Water Management, Stralsund; Department of Coastal Research, Rostock-Warnemuende, German Democratic Republic) Jena Review (ISSN 0448-9497), vol. 32, no. 4, 1987, p. 164-167. refs

The use of remote sensing for coastal monitoring in the interest of environmental protection and water management is discussed. An example of monitoring the coast of the Fischland peninsula in the GDR is presented. Properties of radiation behaviour in coastal water which influence the suitability of a remote sensing method are examined, including the spectral distribution of light extinction in the water, the directionality of reflectance of the water body, and the spectral distribution of the light reflected by the sea floor. Flight planning and photography and the quantitative restitution for bathymetry and depth mapping are also discussed. R.B.

A88-45115
THE 'TSUKUSYS' IMAGE PROCESSING SYSTEM AND ITS UTILIZATION IN THEMATIC MAPPER INVESTIGATIONS OF WATER QUALITY CONDITIONS
TAKASHI HOSHI (Tsukuba, University, Japan), KIYOSHI TORII (Kyoto University, Japan), and TOMOYUKI ISHIDA (Iwate University, Japan) Geocarto International (ISSN 1010-6049), vol. 3, June 1988, p. 27-36. refs

The 'Tsukusys' image processing system has been developed to analyze remote sensing data, particularly Landsat Multispectral Scanner (MSS) imagery. As Thematic Mapper (TM) data have only been available in Japan since 1985, that imagery was acquired to test the extension of 'Tsukusys' to improved spatial and spectral resolution data. The TM data were used to analyze water quality condition in and around the Kojima Bay, Japan where water pollution is an extremely important issue. The results of this endeavor indicate that the 'Tsukusys' image processing system can be utilized successfully for the analysis of TM data with some minor modifications to software processing. Author

A88-45118
ON THE REGIONAL CHARACTERISTICS OF ACTUAL EVAPOTRANSPIRATION DERIVED FROM LANDSAT MSS AND ELEVATION DATA
SATOSHI UCHIDA and TAKASHI HOSHI (Tsukuba, University, Ibaraki, Japan) Geocarto International (ISSN 1010-6049), vol. 3, June 1988, p. 57-66. refs

The system to estimate actual evapotranspiration (ET) over

wide area has been developed. The method of estimation is based on modified Penman's method and utilized Landsat MSS, elevation and ground observed meteorological data. The distinctive feature of this system is that it estimates ET not by directly using spectral data but by combining empirical parameters. Therefore once landuse data are produced from Landsat MSS data, various climatic condition can be applied to calculation. To examine the regional characteristics of ET, several watershed areas are selected in Japan. Then both local characteristics of landuse and topography and regional characteristics of climate are found to be equally influencing the amount of ET. Moreover, the calculation in the case of occurring landuse conversion according to land grading is executed. Its result has given the possibility to parameterize the amount of ET using a few parameters, that is the regional averaged value of albedo and/or soil heat flux constant. Author

A88-45636
LINEAMENTS: SIGNIFICANCE, CRITERIA FOR DETERMINATION, AND VARIED EFFECTS ON GROUND-WATER SYSTEMS - A CASE HISTORY IN THE USE OF REMOTE SENSING
KATHY D. PETER (USGS, Albuquerque, NM), KENNETH E. KOLM (Colorado School of Mines, Golden), JOE S. DOWNEY, and THOMAS C. NICHOLS, JR. (USGS, Denver, CO) IN: Geotechnical applications of remote sensing and remote data transmission; Proceedings of the Symposium, Cocoa Beach, FL, Jan. 31-Feb. 1, 1986. Philadelphia, PA, American Society for Testing and Materials, 1988, p. 46-68. refs

A88-45637
ESTIMATION OF RESERVOIR SUBMERGING LOSSES USING CIR AERIAL PHOTOGRAPHS - EXAMPLE OF THE ERTAN HYDROPOWER STATION ON THE YALONG RIVER IN SOUTHWEST CHINA
HUI LIN (Chinese Academy of Sciences, Institute of Geography, Beijing, People's Republic of China) IN: Geotechnical applications of remote sensing and remote data transmission; Proceedings of the Symposium, Cocoa Beach, FL, Jan. 31-Feb. 1, 1986. Philadelphia, PA, American Society for Testing and Materials, 1988, p. 89-98.

A88-45643
OVERVIEW OF REMOTE DATA TRANSMISSION SYSTEMS
RICHARD W. PAULSON (USGS, Reston, VA) IN: Geotechnical applications of remote sensing and remote data transmission; Proceedings of the Symposium, Cocoa Beach, FL, Jan. 31-Feb. 1, 1986. Philadelphia, PA, American Society for Testing and Materials, 1988, p. 203-212.

Remote data transmission systems for monitoring the environment are reviewed, including the Argos system, geostationary meteorological satellite systems, and the meteorburst technique which relies on micrometeor trails in the atmosphere to reflect radio messages between a hydrologic station and an interrogation site. The snow telemetry hydrologic data collection system, Landsat series of satellites, synchronous meteorological and geostationary operational environmental satellites are discussed. Specific elements of these systems are examined and major operators and users of the systems are identified. R.B.

N88-21561 Centre National d'Etudes des Telecommunications, Issy-les-Moulineaux (France).
MEASUREMENT OF THE WATER CONTENT OF SOIL FROM SPACE AND APPLICATION TO THE REGIONAL WATER BALANCE [MESURES DU CONTENU EN EAU DES SOLS DEPUIS L'ESPACE ET APPLICATION AU BILAN HYDRIQUE REGIONAL]
DANIEL VIDAL-MADJAR *In* CNES, Climatology and Space Observations p 609-628 Sep. 1987 In FRENCH; ENGLISH summary
Avail: CEPADUES-Editions, 111 rue Nicolas-Vauquelin, 31100 Toulouse, France

Work done to measure the regional soil water budget is described. The parameters which are measurable are identified and it is possible to define strategies for applications to climatology. It is shown that measurement from space of soil moisture is possible either by infrared thermal radiation measurement or by radar measurements. Advantages of each method are discussed. ESA

N88-22455# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PROJECT CODEAMA/FUNCATE (TEST-AREA OF BARREIRINHA-AM): FIELD REPORT
TOMOYUKI OHARA, PAULO ROBERTO MARTINI, SERGIO DOSANJOSFERREIRAPINTO, and NELIO NOGUEIRADONAS-CIMENTO Mar. 1988 55 p In PORTUGUESE; ENGLISH summary
(INPE-4500-RPE/563) Avail: NTIS HC A04/MF A01

The places studied during the multidisciplinary survey realized in the test-area of Barreirinha - Amazon State (CODEAMA Project), with the purpose of testing the use of MSS/LANDSAT images and checking the accuracy of the information obtained and incorporated in geomorphological and hydrical system (inundation areas) maps, in the scale of 1:100,000 are described. The multidisciplinary survey was carried out from January 30 to February 14, 1985, investigating nearly 360 kilometers of fluvial and/or terrestrial survey, from which 64 places were described. The Appendix presents the map of localization of the places studied, in the scale of 1:250,000, which holds all the studied places. Author

N88-22466# Dornier-Werke G.m.b.H., Friedrichshafen (West Germany).
FEASIBILITY STUDY FOR A 2ND GENERATION SYSTEM FOR AIRBORNE MARITIME POLLUTION SURVEILLANCE Final Report, 12 Dec. 1987
JOERG KOEPP and JOSEF SCHOBER Bonn, Federal Republic of Germany BMFT 30 Apr. 1987 739 p Partly in ENGLISH and GERMAN Sponsored by BMFT
(ETN-88-92108) Avail: NTIS HC A99/MF E03

The feasibility of a sensor system for maritime pollution monitoring was established. Operational requirements for a sensor system, the technical description of possible mission equipment, and proposals for an optimal sensor-package are presented. Planning data for development and costs are given. ESA

N88-23303# Begeleidingscommissie Remote Sensing, Delft (Netherlands).
TURBIDITY PATTERNS IN THE DELTA WATERS OF SOUTHWEST NETHERLANDS ON THEMATIC MAPPER (TM) AND MULTISPECTRAL SCANNER (MSS) SATELLITE IMAGES [TROEBELHEIDSPATRONEN IN DE DELTAWATEREN VAN ZW NEDERLAND OP TM EN MSS SATELLIETBEELDEN]
J. STRONKHORST 1986 26 p In DUTCH
(BCRS-86-06; GWWS-405; ETN-88-91553) Avail: NTIS HC A03/MF A01

Operational water quality measuring using LANDSAT Thematic Mapper (TM) and Multispectral Scanner (MS) is discussed. Image processing using the Remote Sensing Data processing system RESEDA is presented. The turbidity pattern in the Fore-delta, the Eastern Scheldt and the Western Scheldt (Netherlands) are discussed. The results show the limitations of LANDSAT that was designed for remote sensing of land, for water quality control in the delta waters with respect to spectral, radiometric, as well as spatial resolution. For the time being LANDSAT TM and MSS cannot be used for an operational water quality measuring system. ESA

N88-23359# National Marine Fisheries Service, Monterey, Calif. Fisheries Environmental Group.
HYDROGRAPHIC OBSERVATIONS IN THE NORTHWESTERN WEDDELL SEA MARGINAL ICE ZONE DURING MARCH 1986
D. M. HUSBY and R. D. MUENCH Jan. 1988 39 p Prepared in cooperation with Science Applications International Corp., Bellevue, Wash.
(PB88-173240; NOAA-TM-NMFS-SWFC-106) Avail: NTIS HC A03/MF A01 CSCL 08C

Temperature and salinity observations were made from the surface down to 1500 m, in the central northwestern Weddell Sea, during March 1986. These observations sampled the three water masses characterizing the region. The uppermost, Surface Water, layer extended down to 30-50 m, had temperature from near freezing (-1.8 C) up to about 0 C and salinities of 33-34 ppt. A layer of Weddell Winter Water underlay the Surface Water, extending down to about 100 m, and had temperatures of -1.5 to -1.7 C and a salinity of about 34.46 ppt. The Weddell Warm Deep Water extended from the bottom of the Winter Water down to more than 1500 m, displaying temperature increasing with depth to a maximum of about 0.5 C near 500 m then decreasing down to 1500 m. The temperature maximum region within the Warm Deep Water decreased in depth eastward, toward the center of the gyre, within the core. The baroclinic circulation, expressed as dynamic topography of the surface relative to the 1500 db level, was insignificant throughout the region. GRA

N88-24032# Silsoe Coll., Bedford (England).
SATELLITE REMOTE SENSING OF TURBIDITY AND SEDIMENT CONCENTRATION IN LAGOA DOS PATOS Abstract Only
JOHN TAYLOR, VIPUL PATEL, ALAN BELWARD, LAWSON BELTRAME, and MARLEY GONCALVES (Rio Grande do Sul Univ., Porto Alegre, Brazil) *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 279 1986
Avail: NTIS HC A99/MF E03

The use of LANDSAT Multispectral Scanner (MSS) digital imagery for mapping water turbidity and suspended sediment in Lagoa dos Patos, Rio Grande do Sul was investigated. Field measurements were taken form vessels in a test area, Saco De Tapes when there was a satellite overpass. Sample site locations were determined from shore-based fixes on the boats at the time of each reading. The satellite image was geometrically corrected and the sampling sites were located on it. Regression models were developed between LANDSAT digital data and field measurements. The results indicated that turbidity was linearly related to the spectral responses in MSS bands 1 and 2. The best relationship for the available data was with band 2. Suspended sediment concentration and turbidity were also linearly related using data from additional sampling data. Land and water features on the image were separated by masking. Band 2 of the satellite image of water surfaces was digitally smoothed to remove noise and then interactively density sliced. The regression equations were applied to determine the turbidity and suspended sediment levels for each slice. The results encourage the belief that satellite images can be used to quantatively map the spatial distribution of turbidity and suspended sediment in Lagoa dos Patos. It was possible to identify as sources of clear or tubid water all of the streams flowing into the test area. Author

N88-24033# *Indian Association for the Cultivation of Science*, Calcutta.
LANDUSE AND LANDFORM STUDIES OF THE MAHANADI RIVER DELTA WITH THE HELP OF SATELLITE MSS BAND Abstract Only
RANJIT KUMAR BANERJEE *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 291 1986
Avail: NTIS HC A99/MF E03

The present study is confined to the lower course of the Mahanadi River after the Satkosia Gorge. The Mahanadi River is on of the major rivers of the northern peninsular India which drains into the Bay of Bengal. Four major landforms are identified: residual hill termed highlands; intermediate lands; lowlands; and flood plains. The area is under the influence of deltaic environment and coastal vegetation is confined to the swampy areas with a big lake nearby known as Chilka Lake. Transport facility is meager in comparison with the industrial region near Cuttackand Bhubaneshwar. Author

N88-24076# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF RESERVOIR WATER QUALITY UTILIZING REMOTE SENSING TECHNIQUES: METHODOLOGICAL CONCEPTS [ESTUDO DE QUALIDADE DAGUA DE RESERVATORIOS, UTILIZANDO TECNICAS DE SENSORIAMENTO REMOTO: CONCEITOS METODOLOGICOS]
TANIA MARIA SAUSEN and MARISA DANTASBITEN-COURTPEREIRA (Sao Paulo Univ., Brazil) *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 638-644 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The objective is to inform the public and the scientific community about the importance of an efficient methodology for monitoring artificially acumulated water and the uselessness of the remote sensing techniques as a practical and economic alternative to minimize the field trip work wherever water quality parameters are to be investigated. In order to achieve these aims, a bibliographic study of this subject was done through the main papers for the last two decades. Methodological topics are shown taking into account the spectral response of water (with and without sediments) and techniques to analyze remote sensing data. Author

N88-24077# THEMAG Egenharia Ltda., Sao Paulo (Brazil).
UTILIZATION OF LANDSAT-TM IMAGERY IN THE HYDROENERGETIC INVENTORY OF THE PARAIBA DE SUL RIVER BASIN [UTILIZACAO DE IMAGENS LANDSAT TM NO INVENTARIO HIDROENERGETICO DA BASIA DO RIO PARAIBA DO SUL]
AUGUSTO PAIVA FILHO, CARLOS BIANCO, and TANIA MARIA SAUSEN (Instituto de Pesquisas Espaciais, Sao Jose dos Campos, Brazil) *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 645-653 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The THEMAG Engenharia Ltda developed a power study in an inventory level in the Paraiba Basin, Sub-basin 2. The aim of this study was to establish in the Paraiba do Sul River and its affluentes (mainly the Sao Manoel, Sopoto, and Novo Rivers) alternatives for power plant schemes in a suitable profile. The TM digital products of the land use studies performed over the planned reservoirs and the surrounding areas were used. The CCT TM Quadrant Digital Products with the desired spectral band selected for this purpose were useful in identifying and surveying land use categories: urban areas, agricultural ideas, forest areas, grazing areas, and drainage. Author

N88-24078# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EVALUATION OF THE FLOODABLE AREA OF THE CANAL OF SAO GONCALO THROUGH TM-LANDSAT 5 IMAGERY [AVALIACAO DA AREA DE INUNDACAO DO CANAL DE SAO GONCALO ATRAVES IMAGENS TM-LANDSAT 5]
C. HARTMANN, R. A. C. LAMPARELLI, R. ROSA, and E. E. SANO *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 654-659 1986 In PORTUGUESE; ENGLISH summary Prepared in cooperation with Fundacao Univ. do Rio Grande (Brazil).
Avail: NTIS HC A99/MF E03

Two LANDSAT TM images were digitally processed on the I-100 Image Analyzer of INPE Sao Jose dos Campos, Sao Paulo). The floodable area of the canal de Sao Goncalo was studied. One image associated with exceptional high inundation (June 11, 1984) and one image associated with normal water level (December 4, 1984) were compared. The digital classification (1:50,000 scale) led to a map (1:100,000 scale) showing the limits of the flooding. This work demonstrated the usefulness of remote sensing techniques to demilitate and identify floodable areas. Author

N88-25018# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
ICE CONDITIONS ALONG THE OHIO RIVER AS OBSERVED ON LANDSAT IMAGES, 1972-1985
LAWRENCE W. GATTO Jan. 1988 168 p
(AD-A191172; CRREL-SR-88-1) Avail: NTIS HC A08/MF A01 CSCL 08L

Lansat images were used to map ice distributions along the Ohio River. Ice conditions were inferred based on image grey tones interpreted using conventional photointerpretation techniques. Portions of the river that appeared black were considered ice-free. Grey tones were interpreted as ice that varied from patches of thin, snow-free solid or fragmented ice, sometimes with open areas, to floes, pans and slush. A white tone represented thick ice or snow-covered ice with few interspersed open areas. Ice that produced grey tones on the images occurred most frequently. Ice typically forms in late December or early January on the Ohio River and is gone by mid to late February. Ice was observed on the upstream section of the river from Pittsburgh to Greenup Dam during 7 of the 13 winters from 1972 to 1985, on the middle section from Greenup Dam to Cannelton Dam during 3 winters, and on the downstream section from Cannelton Dam to the Mississippi River during 4 winters. The most severe and long-lasting ice conditions occurred during the 1976-77 winter when ice covered 65 percent of the upstream section, 56 percent of the middle section, and 78 percent of the downstream section. GRA

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A88-32932#
COLOR SPACE MAPPING USING TERNARY/CHROMATICITY DIAGRAMS - A TECHNIQUE FOR COMPOSITE IMAGE INTERPRETATION
VINCENT J. REALMUTO (Arizona, University, Tucson) and THOMAS A. KING IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 491-500. Research supported by the University of Arizona.

A method has been developed to map spectral signatures of lithologic units into color space for rapid composite image interpretation. The method requires use of in situ spectral reflectance data, ratios, normalized ratio values, ternary diagrams and chromaticity diagrams. The analyst can design an analysis program to optimize spectral separability of materials by plotting normalized ratio values in the feature space of a ternary diagram. Then, through a color space mapping process, involving the transformation of a ternary diagram into a chromaticity diagram, one can determine the color of each lithologic field sample as it will appear in a color composite image. The project consisted of combining multiscanner, multispectral data sets for detection of hydrothermal alteration zones in the Silver Bell mining district. Five three-ratio combinations were analyzed, and the best combination correlated to the ternary diagram that showed the best data spread in the feature space. Also, color designations for lithologies, as plotted in the color space of a chromaticity diagram, matched the colors for each unit in the composite image. Author

A88-32933#
RESTORATION TECHNIQUES FOR SIR-B DIGITAL RADAR IMAGES
PAT S. CHAVEZ, JR. (USGS, Flagstaff, AZ) and GRAYDON L. BERLIN (Northern Arizona University, Flagstaff, AZ; King Abdulaziz University, Riyah, Saudi Arabia) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 501-511. refs

The performance of special algorithms designed to suppress SIR-B radiometric and speckle noise is evaluated. The following geological environments in Saudi Arabia served as test areas: (1) the Tihamat coastal plain and Hijaz mountainous zone bordering the Red Sea, and (2) the sedimentary terrane of the Arabian shelf near the oasis city of Buraydah. A special algorithm incorporating nine across-track multiplicative coefficients proved capable of suppressing the radiometric noise component in images representing different geologic terrains and SIR-B system parameters. In an attempt to reduce speckle contrast, five different spatial-filter operations were implemented on the radiometrically corrected images; the best results were obtained with 3- by 3-pixel median and 2- by 2-pixel mean filter operations. K.K.

A88-32943#
QUANTITATIVE PROCEDURE FOR PRODUCING COLOR-CALIBRATED THEMATIC MAPPER NATURAL-COLOR IMAGES
GRAYDON L. BERLIN (Northern Arizona University, Flagstaff, AZ) and PAT S. CHAVEZ, JR. (USGS, Flagstaff, AZ) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 2. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 639-648.

A two-staged quantitative correction procedure for Thematic Mapper bands 1-3 effectively suppresses atmospheric haze and increases scene brightness or contrast while maintaining band-to-band color balance. The procedure computes MIN/MAX contrast-stretch parameters, with gain, offset, and atmospheric-scattering normalization, for each of the three bands. To date, Thematic Mapper natural-color images have been produced of three different geologic environments (Arizona, California, and Saudi Arabia) wherein the image colors closely match those of the terrain. Author

A88-33377
THE PRODUCTION OF DISTORTION FREE SAR IMAGERY
J. W. WOOD (Royal Signals and Radar Establishment, Malvern, England) IN: Radar - 87; Proceedings of the International Conference, London, England, Oct. 19-21, 1987. London and New York, Institution of Electrical Engineers, 1987, p. 471-473.

A method of removing geometric errors in SAR imagery has been developed and is shown to remove distortions to the theoretical limit. The procedure enables azimuth distortion-free SAR imagery to be produced routinely and automatically. The restrictions on the SAR system for the method to be applied are that all motion errors should be restricted to the across-track direction. The measurement accuracy requirements for this motion are described, showing that autofocus measurements satisfy them. The update time between autofocus measurements and the maximum length of flight that can be processed for given aircraft dynamics are derived. C.D.

A88-33774
THE USE OF MULTISPECTRAL SPACE PHOTOGRAPHS TO DRAW UP A MAP OF LAND USE IN WESTERN SLOVAKIA
J. FERANEC, J. OTAHEL (Slovenska Akademia Vied, Geograficky Ustav, Bratislava, Czechoslovakia), M. HAJEK (Slovenska Vysoka Skola Technicka, Bratislava, Czechoslovakia), S. SLOBODA (Geodesy and Cartography Research Institute, Bratislava, Czechoslovakia), and J. SAFAR (Slovenska Kartografia, Bratislava, Czechoslovakia) Photogrammetria (ISSN 0031-8663), vol. 42, March 1988, p. 157-162. refs

A88-36171
NEW ASPECTS OF THE INTERPRETATION OF SPACE RADAR IMAGES [O NOVYKH ASPEKTAKH INTERPRETATSII RADIOLOKATSIONNYKH KOSMICHESKIKH IZOBRAZHENII]
T. KH. GEOKHLANIAN and G. V. BUGAEVA (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR) Isseldovanie Zemli iz Kosmosa (ISSN 0205-9614), Jan.-Feb. 1988, p. 104-110. In Russian.

High-level radar echoes were measured over land regions with a dense network of synoptic and aerological stations as well as over inland bodies of water. Particular emphasis is placed on Cosmos-1500 sidelooking-radar data. It is shown that such high-level radar signals are observed in regions of high atmospheric activity throughout the troposphere and lower stratosphere. B.J.

A88-37128
FACTORS AFFECTING FEATURE DIFFERENTIATION - THE IMPACT AND SOURCE OF VARIANCE IN THE UPWELLING RADIANCE FIELD
M. J. DUGGIN (New York, State University, Syracuse) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 19-31. refs

Problems in discriminating ground features or cloud formations in satellite remote-sensing images are examined in an analytical review, with a focus on the principal IR bands at 0.4-2.0, 3.5-4.2, and 8-12 microns. The sources of systematic and random error are listed in extensive flow charts, and their effects on discrimination are quantified in empirical formulas. Techniques for reducing and comparing multichannel image data obtained with different sensors on different dates are briefly considered. T.K.

A88-37131
DATA RECEPTION, ARCHIVING AND DISTRIBUTION
P. E. BAYLIS (Dundee, University, Scotland) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 69-86.

Technological aspects of the transmission, reception, and storage of satellite remote-sensing data are summarized in a series of diagrams and briefly reviewed, with an emphasis on the NOAA AVHRR system. Particular attention is given to the instrument parameters influencing the data rate, data encoding and modulation, antenna characteristics and performance, the optimization of the (receiver gain)/(system noise temperature) ratio, receiver antenna mounting, tracking control, the principal receiver components, magnetic-tape storage systems, error-detection techniques, and optical disk storage. T.K.

A88-37147
SURFACE ENERGY BUDGET, SURFACE TEMPERATURE AND THERMAL INERTIA
H. MANNSTEIN (DFVLR, Institut fuer Physik der Atmosphaere, Wessling, Federal Republic of Germany) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 391-410. refs

A technique for thermal-inertia (TI) mapping of land surfaces on the basis of satellite remote-sensing data is described and demonstrated. The derivation of the method from surface energy budgets and an atmospheric radiative-transfer model is explained in detail; the empirical data used in constructing practical models are characterized; the mapping of apparent TI on dry surfaces, heat capacity, and soil moisture is discussed; and sample results from studies of alpine thermally induced circulation are presented graphically. It was found that direct atmospheric warming by sensible heat flux on a cloudless late-summer day was due mainly to the sun-exposed slopes at elevation 2000-3000 m. T.K.

A88-37287#
IMAGE PROCESSING FOR EARTH REMOTE SENSING
RUDOLPH FIEDLER Dornier-Post (English Edition) (ISSN 0012-5563), no. 1, 1988, p. 19-23.

An account is given of the specialized and complex signal processing procedures required by imaging radars in such earth sensing applications as the ERS-1 satellite. The ERS-1 SAR is capable of a 30-m geometrical resolution, comparable to those of Landsat and SPOT and fruitfully applicable to oceanography, snow hydrology, and glacial geology. Attention is presently given to the DIPIDOS modular interactive image processing system, which has been designed in order to furnish both monospectral and multispectral data formats with high radiometric resolution, and geometrical resolution and/or image sizes from one image point to several thousand lines and columns. The software used allows interactive display handling as well as image filtering and scenery analysis. O.C.

A88-37417
INTERANNUAL LANDSAT-MSS REFLECTANCE VARIATION IN AN URBANIZED TEMPERATE ZONE
ALAIN ROYER, LISE CHARBONNEAU (Sherbrooke, Universite, Canada), and PHILIPPE M. TEILLET (Canada Centre for Remote Sensing, Ottawa, Canada) Remote Sensing of Environment (ISSN 0034-4257), vol. 24, April 1988, p. 423-446. Research supported by the Ministere de l'Education du Quebec. refs
(Contract NSERC-A-8643; NSERC-A-5252)

Short-term and long-term variations in land-surface parameters are studied based on a chronological time series of 40 Landsat-MSS images over southeastern Canada for the 1972-1984 period. The data were processed for radiometric correction and atmospheric correction, and background contamination effects were taken into account. The results indicate that for the Montreal area the yearly mean albedo showed a decreasing trend of -0.05 since 1972 due to urbanization, deforestation, and decreasing farmland. The year-to-year normalized vegetation index fluctuations are found to correlate with the cumulative amount of summer precipitation, which in turn is related to the mean summer evapotranspiration and global solar radiation. R.R.

A88-37421
THE SEMIVARIOGRAM IN REMOTE SENSING - AN INTRODUCTION
PAUL J. CURRAN (Sheffield, University, England) Remote Sensing of Environment (ISSN 0034-4257), vol. 24, April 1988, p. 493-507. refs
(Contract NERC-GR/3/5096)

The earth's surface and remotely sensed imagery contain spatial information that, if quantified, could be used to optimize many sampling procedures in remote sensing. Until recently a suitable and simple technique for the spatial characterization of surfaces was not readily available. Now, thanks to the development of regionalized variable theory there is a near-ideal tool, the semivariogram. The semivariogram is a function that relates semivariance to sampling lag. This function can be estimated using remotely sensed data or ground data and represented as a plot that gives a picture of the spatial dependence of each point on its neighbor. This paper provides an introduction to the semivariogram and indicates how it could be employed in remote sensing research. Author

A88-39095
TRANSFORMATION OF GLOBAL VEGETATION INDEX (GVI) DATA FROM THE POLAR STEREOGRAPHIC PROJECTION TO AN EQUATORIAL CYLINDRICAL PROJECTION
J. R. HARDY, S. M. SINGH, and A. S. NARRACOTT (Reading, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, March 1988, p. 583-589. refs
(Contract NERC-F60/G6/12)

A88-39097
USING SPATIAL AUTOCORRELATION ANALYSIS TO EXPLORE THE ERRORS IN MAPS GENERATED FROM REMOTELY SENSED DATA

RUSSELL G. CONGALTON (California, University, Berkeley) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, May 1988, p. 587-592. Research supported by the Nationwide Forestry Applications Program and McIntire-Stennis Project. refs

Three data sets of varying spatial complexity, including an agricultural area, a range area, and a forest area, were chosen for investigation in this study. A difference image was generated for each data set by comparing a Landsat classification with an assumed correct reference classification and noting the agreement and disagreement. Visual inspection and spatial autocorrelation analysis were used to identify and quantify the patterns of error within each difference image. This information is very important when land cover maps generated from remotely sensed data are sampled for accuracy assessment. Author

A88-39098
A COMPARISON OF SAMPLING SCHEMES USED IN GENERATING ERROR MATRICES FOR ASSESSING THE ACCURACY OF MAPS GENERATED FROM REMOTELY SENSED DATA
RUSSELL G. CONGALTON (California, University, Berkeley) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, May 1988, p. 593-600. Research supported by the Nationwide Forestry Applications Program and McIntire-Stennis Project. refs

A88-39099
DIFFERENTIATION OF ECOLOGICAL ZONES IN THE OKAVANGO DELTA, BOTSWANA BY CLASSIFICATION AND CONTEXTURAL ANALYSES OF LANDSAT MSS DATA
SUSAN RINGROSE (University of Botswana, Gaborone), WILMA MATHESON (Gaborone Secondary School, Botswana), and TIMOTHY BOYLE (Satellite Remote Sensing Centre, Johannesburg, Republic of South Africa) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, May 1988, p. 601-608. Research supported by the Ministry of Mineral Resources and Water Affairs of Botswana. refs

A88-41298
ALTERNATIVES FOR MAPPING FROM SATELLITE IMAGERY
G. KONECNY (Hannover, Universitaet, Hanover, Federal Republic of Germany) (IAF, International Astronautical Congress, 37th, Innsbruck, Austria, Oct. 4-11, 1986) Acta Astronautica (ISSN 0094-5765), vol. 17, March 1988, p. 355-358.
(IAF PAPER 86-76)

The paper discusses the alternatives for mapping the earth surface using remote-sensing satellite imagery by Landsat- MSS and-TM and by sensors of cartographic satellites, such as the European Spacelab-1' and SPOT sensors. The quality of these images are compared with images obtained by the MKF-6 camera system aboard Soyuz-Salyut missions and by the KATE 140,200 and the KFT 1000. Special attention is given to the question of cost of satellite imagery, with comparisons presented for the price per image and per million pixel for various sensors. I.S.

A88-41944
A COMPARISON BETWEEN CLASSIFICATION DIFFERENCING AND IMAGE DIFFERENCING FOR LAND COVER TYPE CHANGE DETECTION
KUO-MU CHIAO, YEONG-KUAN CHEN, and CHAO-FU CHOW (National Taiwan University, Taipei, Republic of China) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 1-12. Research supported by the Council of Agriculture of the Republic of China.

The effectiveness of two differencing methods in identifying changes in land use (from agricultural or forest to urban) is investigated in trial analyses of a region near Taipei, Taiwan. The techniques evaluated are described in detail, and the results are presented in extensive tables. An image-differencing scheme, in which the Landsat MSS band 5 values for each pixel of an image are subtracted from those obtained on a different date and the pixels with nonzero differences are marked as areas of land-use change, is found to be more accurate than a classification-differencing scheme, in which independent classifications (to five ground-cover types) for each date are compared. T.K.

A88-41958
ENHANCEMENT OF SPOT IMAGE RESOLUTION USING AN INTENSITY-HUE-SATURATION TRANSFORMATION
W. JOSEPH CARPER, RALPH W. KIEFER, and THOMAS M. LILLESAND (Wisconsin, University, Madison) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 348-361. refs

Techniques for merging SPOT 10 m resolution panchromatic and 20 m resolution multispectral data for enhanced image interpretability have recently been developed. The effectively 10 m resolution multispectral images produced using these procedures contain the high resolution information of the panchromatic image while maintaining the basic color content of the multispectral data. A method for merging the two data sets, which utilizes an intensity, hue and saturation transformation, is described. The effects of this merger on the spectral characteristics of the data are analyzed, along with those of two other techniques. Author

A88-41962
STRUCTURAL INFORMATION OF THE LANDSCAPE AS GROUND TRUTH FOR THE INTERPRETATION OF SATELLITE IMAGERY
M. ANTROP (Gent, Rijksuniversiteit, Ghent, Belgium) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 3-8. refs

The possibilities for a detailed and accurate land use interpretation using satellite imagery, depend for a great part upon the landscape structure. The selection of the training sites for image classification should follow a stratified scheme based upon a landscape classification which uses structural indicators. An analysis is made of the landscapes of Flanders based upon such indicators. An estimation of the occurrence of pure pixels (TM size) for different landscape components and types is given, as well as the compactness of the field shapes and their orientation in relation to the pixel size and scan direction. Author

A88-41964
IMAGE OPTIMIZATION VERSUS CLASSIFICATION - AN APPLICATION ORIENTED COMPARISON OF DIFFERENT METHODS BY USE OF THEMATIC MAPPER DATA
HERMANN KAUFMANN and BERTHOLD PFEIFFER (Karlsruhe, Universita¢'|t, Federal Republic of Germany) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 31-35. refs

A88-41965
COMPARISON OF CLASSIFICATION RESULTS OF ORIGINAL AND PREPROCESSED SATELLITE DATA
BARBARA KUGLER and RUEDIGER TAUCH (Berlin, Technische Universitaet, Federal Republic of Germany) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 41-45.

The production of satellite image maps is one of various objectives of image processing. Satellite image maps are very important tools as orientation maps in regions, where other topographic maps are either not available or out of date. They may also serve as basic information for thematic maps for landuse, geological and ecological purposes. The methods of multispectral

classification are applied to obtain landuse maps from satellite image data. These methods are based on the characteristic spectral reflectance of objects that enables to extract feature sets for different classes. By means of the feature sets it is possible to assign every picture element (pixel) to one of the various classes. For digital image classification the spectral signatures are the substantial source of information. Therefore usually roughly preprocessed data are used. The classification of preprocessed data offers advantages if the concerned area is covered by several satellite image scenes. In this case the data undergo radiometrical and geometrical processing before classification takes place. The purpose of this paper is to investigate digitally classified original and preprocessed data. The classification results of the two data types are compared. Author

A88-41966
AIRPHOTO MAP CONTROL WITH LANDSAT - AN ALTERNATIVE TO THE SLOTTED TEMPLET METHOD
W. D. LANGERAAR (Euroconsult, Arnhem, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 47-50.

The use of Landsat imagery for cartographic control in the production of geographic basemaps produced by assembling tilted airphotos with varying scales is discussed. Use of this method to map southeastern Irian Java produced basemaps with a mean accuracy of 1.5 mm on a photo scale of 1/20,000. Airphoto map control using Landsat is compared to the slotted templet method, showing that the method using Landsat has several advantages. With this method, photo tilt and scale variations do not alter map accuracy and no ground control is required prior to flying. It is found that Landsat control allows for production of more accurate maps in a shorter amount of time. R.B.

A88-41967
SPACE PHOTOMAPS - THEIR COMPILATION AND PECULIARITIES OF GEOGRAPHICAL APPLICATION
B. A. NOVAKOVSKII (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 59-62. refs

The use of satellite images in cartography is discussed, focusing on the creation of photomaps by converting space photographs into orthophotoimages through opticomechanical analog or electronic-digital orthophotographic equipment. The method used to process stereoscopic photographs is presented, using a 1:500,000 photomap made from images of the Pamiro-Alay region of the Soviet Union taken by the Soyuz-22 multispectral MKF-6 camera as an example. The use of hypsometric pictures to compile maps of morphoisoline, horizontal, and vertical relief dissection, erosion networks, and lineaments is discussed. Also, the combination of cartometry, morphometry, quantitative interpretation, and mathematical-cartographical modeling is examined. R.B.

A88-41968
PROCESSING OF RAW DIGITAL NOAA-AVHRR DATA FOR SEA- AND LAND APPLICATIONS
G. J. PRANGSMA and J. N. ROOZEKRANS (Koninklijk Nederlands Meteorologisch Instituut, De Bilt, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 63-66. refs

A project has been started at the KNMI to develop algorithms for digital processing of data of the Advanced Very High Resolution Radiometer (AVHRR) in an automatic way. Digital processing gives the opportunity to obtain quantitative data of the Earth-surface. For the conversion of the raw AVHRR-data into true parameters of the Earth-surface many steps have to be taken. The processing scheme is presented and the results of verification studies are discussed. Author

A88-41970
PER-FIELD CLASSIFICATION OF A SEGMENTED SPOT SIMULATED IMAGE
J. H. T. STAKENBORG (CEC, Joint Research Centre, Ispra, Italy) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 73-78. refs

A per-field classification has been applied to a SPOT simulated image of an area in southern France with mainly agricultural landuse. Using edge preserving smoothing, edge extraction, and edge tracking techniques the field boundaries are derived from the panchromatic channel. The segmented image is replaced by a property table in which the spectral signatures, position, and simple form describing factors of all segments are stored. Author

A88-41973
THEMATIC MAPPING BY SATELLITE - A NEW TOOL FOR PLANNING AND MANAGEMENT
J. W. VAN DEN BRINK, R. BECK (DHV Consulting Engineers, Amersfoort, Netherlands), and H. RIJKS (Delft, Technische Hogeschool, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 93-95. refs

The new generation of 'high-resolution' remote sensing satellites will increase the number of applications drastically. It is believed that the imagery of these new satellite systems will play a substantial role in the planning and management practices of land and water. Even in countries where a well-developed structure for geo-data processing exists such as the Netherlands, satellite remote sensing forms an important additional source of information in planning and management. This latter statement is also supported by the encouraging results of the case study presented in this article. The objective of the study was to evaluate the possibilities of the new satellite imagery and to present the obtained information in a way accessible to planners, etc. Therefore the concept of the 'Satellite Thematic Map' was adopted as a user-friendly endproduct useful for a large user community. In the article, characteristics of the Satellite Thematic Map for the 'Kromme Rijn' Area in the Netherlands are discussed. Author

A88-41974
SPATIAL FEATURE EXTRACTION FROM RADAR IMAGERY
G. BELLAVIA and J. ELGY (Aston, University, Birmingham, England) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 99-102. refs

It is accepted that the major role of remote sensing as an information source will be in its contribution to geographical information systems. With the advances in remote sensing, images are being created at an increasing rate. The extraction of information from such data is traditionally done manually and is thus costly in both time and money. Therefore techniques need to be developed which automatically extract information from remotely sensed images. This paper considers the extraction of thin line features such as forest rides, dykes and streams from active microwave imagery. Because radar images are coherently created speckle is produced which renders traditional feature extraction methods virtually useless. It is assumed that global techniques such as generalized rough transforms or intelligent graph searching will be more successful than simple local methods. Author

A88-41981
DIGITAL ELEVATION MODELING WITH STEREO SIR-B IMAGE DATA
R. SIMARD (Canada Centre for Remote Sensing, Ottawa), F. PLOURDE, and T. TOUTIN (DIGIM /1983/, Inc., Montreal,

Canada) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 161-166. refs

A stereo SIR-B image data set has been used to produce a digital elevaton model (DEM) for a test site located in the Mount Shasta area in California. The stereo pair was formed with images acquired at 53 and 29 degree incidence angles, both on the same side. A digital method has been developed for the extraction of differential parallaxes which relies mainly on a hierarchical nested zoomed correlation procedure. The efficiency of the proposed method for automatic producton of DEM is investigated in relation to terrain and SAR parameters. Author

A88-41982
EARTHSCAN - A RANGE OF REMOTE SENSING SYSTEMS
D. R. SLOGGETT and C. MCGEACHY (Software Sciences, Ltd., Environmental and Space Systems Group, Farnborough, England) IN: *Remote sensing for resources development and environmental* management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 167-171. Research supported by the National Remote Sensing Centre of England. refs

The Earthscan range of remote sensing systems designed around a core set of image processing and image manipulation routines to provide a building block on which operational remote sensing and research work may be carried out is discussed. The system design is modular, making it portable between host computer systems. The system displays images on an associated workstation and incorporates Geographic Information System capability. The architecture of the systems and their associated baseline image processing functions and the adaptation of the system in order to generate new products, enhance the catalogue, and add new image processing routines are examined. The range of systems may be applied to hydrology, agriculture, geology, environmental monitoring, oceanography, and land use surveys. R.B.

A88-42001
VISUAL INTERPRETATION OF MSS-FCC MANUAL CARTOGRAPHIC INTEGRATION OF DATA
E. AMAMOO-OTCHERE (ECA, Regional Centre for Training in Aerial Surveys, Ile-Ife, Nigeria) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 359-369. refs

The objective was to use the holistic and synoptic qualities of Landsat 2 MSS-FCC taken in 1975 to reorganize from an existing stock of scattered data, a relevant description of aspects of renewable resources development situation in which the fiscal decision makers and development planners have shown keen interest. The cartographic projection from the FCC interpretation was to illustrate the kind of information obtainable with simple techniques, but which data has so much been in short supply in the African resources development arena. The study purposefully selected 'frontier development' problem because it is an important development issue in Ghana. The themes chosen and visually interpreted from the FCC, and the manual cartographic integration of the information illustrate some aspects of the ways for closing the cooperation gap between mapping authorities and the national fiscal authorities. The latter, because of partly tight money situation and partly for lack of appreciation of the role of mapping, usually accord low priority to the former's needs. The study area was in northern Ghana. Author

A88-42016
ASSESSMENT OF TM THERMAL INFRARED BAND CONTRIBUTION IN LAND COVER/LAND USE MULTISPECTRAL CLASSIFICATION
JOSE A. VALDES ALATAMIRA (ICI, Mexico), MARION F. BAUMGARDNER (Purdue University, West Lafayette, IN), and CARLOS R. VALENZUELA (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 533-539. refs

Thermal data from Landsat 4 TM were used in conjunction with the six reflective TM bands to assess the contribution of the thermal band in eight multispectral classifications using four different data sets. Despite its coarse resolution and differences in radiometric measurements, the thermal data provided an additional informational plane in the generation principal components. This informational plane did not appear when the thermal band was excluded from the linear transformation. The use of all seven TM bands for cluster statistics generation provided greater statistically separability between pairs of spectral classes than when only reflective bands were used. Classification with subsets of selected bands gave better results than classification performed without the use of the thermal band for statistics generation. Classifications with principal components reduced the number of spectrally separable classes, but with a significant reduction in computer time. Author

A88-42025
ASSESSMENT OF DESERTIFICATION IN THE LOWER NILE VALLEY (EGYPT) BY AN INTERPRETATION OF LANDSAT MSS COLOUR COMPOSITES AND AERIAL PHOTOGRAPHS
A. GAD and L. DAELS (Gent, Rijksuniversiteit, Ghent, Belgium) IN: *Remote sensing for resources development and environmental* management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 599-605. refs

A88-42037
DIGITAL ANALYSIS OF STEREO PAIRS FOR THE DETECTION OF ANOMALOUS SIGNATURES IN GEOTHERMAL FIELDS
E. ZILIOLI, P. A. BRIVIO, M. A. GOMARASCA, and R. TOMASONI (CNR, Istituto per la Geofisica della Litosfera, Milan, Italy) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 685-690. refs

A88-42052
SATELLITE REMOTE SENSING OF THE COASTAL ENIVRONMENT OF BOMBAY
V. SUBRAMANYAN (Indian Institute of Technology, Bombay, India) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 779-781. refs

Landsat imagery is used to trace the development and evolution of the Bombay coast. Geological and geomorphological field traverses and maps, including topographical maps on the scale of 1:63,360 are used with black and white MSS band 6 Landsat imagery on the scale of 1:250,000 and false-color MSS bands 4,5, and 7 imagery on the scale of 1:500,000. An attempt is made to reconstruct the initial configuration of the region, where specific geological and geomorphological features of the region are indicated and discussed, and future changes in the coastal area are predicted. R.B.

A88-42054
A SIMPLE ATMOSPHERIC CORRECTION ALGORITHM FOR LANDSAT THEMATIC MAPPER SATELLITE IMAGES
P. I. G. M. VANOUPLINES (Musee Royal de l'Afrique Centrale, Tervuren, Belgium) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 787-791. refs

An atmospheric correction algorithm for Landsat Thematic

Mapping which uses the horizontal visibility or meteorological range as its only meteorological variable is presented. The algorithm is based on Sturm's (1981) correction for oceanographic applications using the Nimbus-7 CZCS. Because the horizontal visibility can be retrieved from meteorological time series, the algorithm can be applied to images months or even years after they were taken. The algorithm is tested with a sensitivity analysis and is shown to be applicable in regions where atmospheric conditions are stable and well measured. For water quality applications it may be necessary to cluster 4 X 4 pixels to increase the signal to noise ratios, allowing for a resolution of 120 m. R.B.

A88-42055
EVALUATION OF COMBINED MULTIPLE INCIDENT ANGLE SIR-B DIGITAL DATA AND LANDSAT MSS DATA OVER AN URBAN COMPLEX
B. C. FORSTER (New South Wales, University, Sydney, Australia) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 2. Rotterdam, A. A. Balkema, 1986, p. 813-816.

As part of the NASA sponsored SIR-B experiment, digital data with incident angles of 17, 36 and 43 deg were recorded over Sydney, Australia, and have been used in a study of radar imagery for urban purposes. The effect on radar backscatter of the multifaceted and oriented features found in urban regions has been examined as a means for improving urban discrimination when combined with Landsat multispectral data. Imagery at different incidence angles were registered to each other and to Landsat data and analyzed using an image analysis computer system. While systematic interpretation of the radar imagery is complicated by the high response from urban features aligned at right angles to the incident radiation, the combined radar and Landsat images are shown to give good discrimination between sites cleared for development and those heavily urbanized. These areas show a similar Landsat response but are markedly different in radar. Moreover in older residential areas, with significant tree cover, the Landsat response is dominated by the vegetation signature, while radar is shown to provide an increased response from the underlying buildings. Author

A88-42771
A STATISTICAL MODEL FOR PREDICTION OF PRECISION AND ACCURACIES OF RADAR SCATTERING COEFFICIENT MEASUREMENTS DERIVED FROM SAR DATA
ERIC S. KASISCHKE, GARY W. FOWLER, and CHRISTOPHER C. WACKERMAN (Michigan, Environmental Research Institute, Ann Arbor) IN: IEEE National Radar Conference, 3rd, Ann Arbor, MI, Apr. 20, 21, 1988, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1988, p. 111-117. refs

A model is presented to estimate a relative error-bound associated with radiometric calibration of the scattering coefficient derived from synthetic-aperture radar (SAR) data. This error bound is based on a statistical coefficient-of-variation error model. The error model was exercised parametrically to determine what factors most significantly influence radiometric errors from SAR systems. It was found that errors in the measurement of the antenna elevation gain-pattern resulted in the most dramatic increases in the statistical error bound. The results from this analysis can be utilized in both the design of SAR systems and measurements programs needed to calibrate SAR systems to minimize the error bounds associated with radiometric calibration. I.E.

A88-43223
RADIOMETRIC CORRECTION FOR ATMOSPHERIC AND TOPOGRAPHIC EFFECTS ON LANDSAT MSS IMAGES
YOSHIYUKI KAWATA, SUEO UENO, and TAKASHI KUSAKA (Kanazawa Institute of Technology, Nonoichi, Japan) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 729-748. refs
(Contract MOESC-60129032)

Raw radiance data measured by a Landsat satellite includes undesirable atmospheric and topographic effects. The correction to allow for these effects is important in order to increase the accuracy of classification. In this paper it is shown how these effects on the Landsat MSS data are estimated, allowing for the transfer theory of radiation in the atmosphere-ground system. First, the theoretical basis of the atmospheric effect correction system (AECS), which corrects for atmospheric effects on the Landsat MSS data over a flat terrain, is presented. Then a simple radiometric correction method which can remove both the atmospheric and topographic effects from the Landsat MSS data over a rugged terrain is proposed. It is applied to a mountainous test area with known digital terrain data, and satisfactory results are obtained. In the present analyses, the values of relevant atmospheric parameters such as the optical thickness, the single scattering albedo, and the turbidity factor of the atmosphere were adopted from either an Elterman's (1968) model atmosphere or a model atmosphere given by the Lowtran 5 code in the evaluation of scattering and transmission functions. Lambert's law was assumed as a bidirectional reflection at the ground surface. Author

A88-43224* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
DIRECTED BAND RATIOING FOR THE RETENTION OF PERCEPTUALLY-INDEPENDENT TOPOGRAPHIC EXPRESSION IN CHROMATICITY-ENHANCED IMAGERY
ROBERT E. CRIPPEN, RONALD G. BLOM, and JAN R. HEYADA (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 749-765. refs

A band ratioing method is developed which directs the retention of topographic expression and albedo information so that they remain depicted as prominent variations in image intensity. Band data are adjusted so that ratio values for each surface material coherently increase with increasing pixel bispectral radiance for all three ratios of the color composite. The retained topographic expression and albedo information do not significantly distort the ratio-enhanced band-variant reflectance information, and the resultant images are similar to chromaticity-enhanced band composite images, but require only simple arithmetic processing steps. R.R.

A88-43225* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE DANGERS OF UNDERESTIMATING THE IMPORTANCE OF DATA ADJUSTMENTS IN BAND RATIOING
ROBERT E. CRIPPEN (California Institute of Technology, Jet Propulsion Laboratory, Pasadena; California, University, Santa Barbara) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 767-776. refs
(Contract NAG5-177; NAGW-455)

The practical importance of simple data adjustments for path (atmospheric) radiance and sensor calibration offsets prior to band ratioing has often been overlooked or misjudged. This paper describes and demonstrates the critical nature of data adjustments for the production of useful ratio images, including ratio images derived solely from long wavelength bands. A simple bispectral graphic model is used for illustrating and evaluating the impact of data offsets upon ratio images. Orthogonal indices, used as alternatives to band ratios, are shown to be sometimes less sensitive to topographic influences than ratios of unadjusted data but not less sensitive than ratios of properly adjusted data. Author

A88-43672
CORRECTION OF SPATIAL AND TEMPORAL DISTORTIONS IN THE PHOTOGRAPHIC IMAGE INPUT INTO AN INTERACTIVE PROCESSING SYSTEM [KORREKTSIIA PROSTRANSTVENNO-VREMENNYKH ISKAZHENII VVODA FOTOIZOBRAZHENII V SISTEMU INTERAKTIVNOI OBRABOTKI]
S. A. BARTALEV and M. D. BREIDO (Vsesoiuznoe Aerofotolesoustroitel'noe Ob'edinenie Lesproekt, Moscow, USSR) Issledovanie Zemli iz Kosmosa (ISSN 0205-9614), Mar.-Apr. 1988, p. 83-89. In Russian.

This paper describes a method for correcting spatial and temporal distortions in photographic images, which makes it possible to generate digital imagery invariant to the input conditions in an interactive processing system. The efficiency of the method was evaluated using real black-and-white images of an area covered with saxaul bushes for the determination of crown diameters and of the number of bushes. I.S.

A88-44517
OBJECT-SPACE LEAST-SQUARES CORRELATION
U. V. HELAVA (Helava Associates, Inc., Southfield, MI) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, June 1988, p. 711-714. refs

A variation of the least-squares correlation, called least-squares groundel correlation (LSGC), which is performed in object space by matching densities assigned to ground elements (groundels) is presented. LSGC is used for refining results obtained using conventional methods, processing each groundel individually, accommodating multiple images, and employing mathematical processing to sharpen automatic measurements. The application of LSCS to the measurement of point elevations and tie points for aerial triangulation are discussed. It is expected that LSCS may be a means of eventually merging automatic correlation and feature extraction into one integrated process. R.B.

A88-44532
THEORETICAL BASIS FOR MULTISPECTRAL IMAGING SIMULATION
K. Q. LAO and G. R. LOEFER (Lockheed-Georgia Co., Marietta, GA) IN: Infrared image processing and enhancement; Proceedings of the Meeting, Orlando, FL, May 20, 21, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 33-39. refs

Layered weather models are presently used to compute the spectral irradiance and attenuation experienced by simulated multispectral imagers due to atmospheric constituents along the propagation path. In the case of FLIR imagery, the IR spectral band is divided into subbands; for each of these, a set of effective temperatures must be computed in order to supplant the physical temperature of the emission sources. A common algorithm can be used to simulate both IR and mm-wave passive imagery. O.C.

A88-44534
THERMAL MODELING AND IR SCENE GENERATION
RANDY K. SCOGGINS (U.S. Army, Engineer Waterways Experiment Station, Vicksburg, MS) IN: Infrared image processing and enhancement; Proceedings of the Meeting, Orlando, FL, May 20, 21, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 50-57. Army-supported research. refs

Numerical models have been developed for the simulation of terrain surface temperatures for such geographic constituents as grasslands, deserts, and forested regions, using semiempirical techniques and local surface meteorology and material thermal properties as inputs. Attention is presently given to the termperature modeling approach used, the structuring of the codes in the requisite form for scene generation, and the data required by the models. Approaches to accounting for the effects of atmospheric contaminants are noted. O.C.

A88-44540
INTEGRATION OF LANDSAT, DTED, AND DFAD
NICKOLAS L. FAUST (Georgia Institute of Technology, Atlanta) IN: Infrared image processing and enhancement; Proceedings of the Meeting, Orlando, FL, May 20, 21, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 106-115.

Procedures for the integration of Landsat Thematic Mapper digital data with DMA provided DTED and DFAD data sets are presented. Geometric correction issues in the merging of the data sets are addressed and examples are given. Presentation of the results of a data merge are displayed using a licensed perspective sceneration program GTVISIT. Author

A88-44641* Georgia Univ., Athens.
CARTOGRAPHIC FEATURE EXTRACTION WITH INTEGRATED SIR-B AND LANDSAT TM IMAGES
R. WELCH and MANFRED EHLERS (Georgia, University, Athens) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, May 1988, p. 873-889. refs
(Contract JPL-957516)

A digital cartographic multisensor image database of excellent geometry and improved resolution was created by registering SIR-B images to a rectified Landsat TM reference image and applying intensity-hue-saturation enhancement techniques. When evaluated against geodetic control, RMSE(XY) values of approximately + or - 20 m were noted for the composite SIR-B/TM images. The completeness of cartographic features extracted from the composite images exceeded those obtained from separate SIR-B and TM image data sets by approximately 10 and 25 percent, respectively, indicating that the composite images may prove suitable for planimetric mapping at a scale of 1:100,000 or smaller. At present, the most effective method for extracting cartographic information involves digitizing features directly from the image processing display screen. Author

A88-44648* Vexcell Corp., Boulder, Colo.
SIR-B STEREO-RADARGRAMMETRY OF AUSTRALIA
F. LEBERL, W. MAYR, G. DOMIK (Vexcel Corp., Boulder, CO), and M. KOBRICK (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, May 1988, p. 997-1011. refs
(Contract JPL-957549)

Results are reported from an ongoing program of radargrammetric experimentation with SIR-B data. Six stereo models of orbits over Australia were processed in an analytical stereo plotter. Height accuracies were up to + or - 25 m or 1.8 times the range resolution. This is better than in previous SIR-B stereo work, probably due to better image quality. Some inconsistencies were encountered between look angle geometries and height measurement accuracies. While general observations about earlier SIR-B stereo results were confirmed, inconsistencies with theoretical expectations could not be fully explained. Author

A88-44649* Vexcell Corp., Boulder, Colo.
DEPENDENCE OF IMAGE GREY VALUES ON TOPOGRAPHY IN SIR-B IMAGES
G. DOMIK, F. LEBERL (Vexcel Corp., Boulder, CO), and J. CIMINO (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, May 1988, p. 1013-1022. refs
(Contract JPL-957549)

This paper focuses on the use of a high resolution digital elevation model (DEM) to aid in rectifying and enhancing synthetic aperture radar images. Using a synthetic backscatter image, the SIR-B images are manually rectified and resampled to remove geometric distortions caused by topography. In a second step, an improved reflectance function of incidence angle is derived from the DEM and the rectified image and this function is used to reduce radiometric effects of topography yielding an albedo image which clearly shows the thematic, as opposed to topographic content of the image. The procedure is tested on four SIR-B images of a scene in Argentina (crossover point) that is imaged under different azimuth and incidence angles. The similarity of the resulting images indicates that the procedure effectively reduces artefacts from the images that are dependent on topography. Author

A88-44650* Cornell Univ., Ithaca, N.Y.
A DEMONSTRATION OF STEREOPHOTOGRAMMETRY WITH COMBINED SIR-B AND LANDSAT TM IMAGES
ARTHUR L. BLOOM, ERIC J. FIELDING, and XIU-YEN FU (Cornell University, Ithaca, NY) International Journal of Remote Sensing

(ISSN 0143-1161), vol. 9, May 1988, p. 1023-1038. refs
(Contract JPL-956926; NAS5-28767; NGT-33-010-801)

Shuttle Imaging Radar-B (SIR-B) and Landsat Thematic Mapper (TM) images can be viewed stereoscopically if the illumination geometries are compatible. To create the stereoscopic effect points must be coregistered. Simplified stereophotogrammetric equations permit the height of an object above a reference plane to be crudely calculated from the target offset toward the SIR-B radar antenna with reference to its position on a TM image. Precision is limited by pixel resolution and target correlation. Future spaceborne imaging radar missions will offer the potential for topographic mapping in many areas where TM coverage is available. Author

A88-44651
AN EFFECT OF COHERENT SCATTERING IN SPACEBORNE AND AIRBORNE SAR IMAGES
R. K. RANEY (Radarsat Project Office, Ottawa, Canada), A. L. GRAY, and J. G. PRINCZ (Canada Centre for Remote Sensing, Ottawa) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, May 1988, p. 1039-1049. refs

Radar imagery obtained by the Shuttle Imaging Radar-B (SIR-B) is compared to high resolution aircraft imagery of the same urban and agricultural areas close to the city of Montreal, Canada. It is clear that the SIR-B radar is more sensitive than the aircraft radar to reflections from extended, along-track radar targets. The effect is evident for both urban and agricultural areas in which the street or field orientation is near parallel to the radar azimuth direction. It is likely that such reflectivity enhancement is due to coherent combination of the scattered field from appropriate scattering centers. The paper considers the observed phenomena and probes potential scattering models to explain the results. Author

A88-45116
EVALUATIONS OF UNSUPERVISED METHODS FOR LAND-COVER/USE CLASSIFICATIONS OF LANDSAT TM DATA
KIYONARI FUKUE, HARUHISA SHIMODA, YOSHIAKI MATUMAE, RYOUJI YAMAGUCHI, and TOSHIBUMI SAKATA (Tokai University, Japan) Geocarto International (ISSN 1010-6049), vol. 3, June 1988, p. 37-44.

Classification accuracies of unsupervised classification methods for Landsat TM data are estimated using land-cover/use test site data, evaluated, and compared to a conventional supervised maximum likelihood classification. The unsupervised classification methods are six kinds of hierarchical clustering and a minimum residual clustering. The nearest neighbor, farthest neighbor, and median methods show classification accuracies lower than the maximum likelihood method because the distance measures used are not weighted by numbers of elements within clusters. The Ward method, group average method, and minimal residual group clustering show accuracies 6 to 7 percent higher than the maximum likelihood method. R.B.

A88-45639
APPLICATION OF SPATIAL STATISTICS TO ANALYZING MULTIPLE REMOTE SENSING DATA SETS
CHARLES E. GLASS, HSIEN-MIN YANG, DONALD E. MYERS (Arizona, University, Tucson), and JAMES R. CARR (Nevada, University, Reno) IN: Geotechnical applications of remote sensing and remote data transmission; Proceedings of the Symposium, Cocoa Beach, FL, Jan. 31-Feb. 1, 1986. Philadelphia, PA, American Society for Testing and Materials, 1988, p. 138-150. refs

The results of research using image spatial statistics to improve the resolution of low-resolution digital images are presented. Two digital images in adjacent spectral bands are degraded to simulate a low-resolution image. New samples within the sparse, low-resolution images are estimated using the spatial characteristics displayed in a variogram function and an estimation process known as cokriging. The resulting high-resolution estimation is compared with the original undegraded image to check accuracy. Accuracy improves from a mean square error of 826 for sample replication to 56 for cokriging. It is concluded that cokriging is an accurate and flexible estimation technique, which could possibly be used for future automated image interpretation and feature extraction algorithms. R.B.

A88-45640* Geological Survey, Baton Rouge, La.
A COMPARISON OF AIRBORNE GEMS/SAR WITH SATELLITE-BORNE SEASAT/SAR RADAR IMAGERY - THE VALUE OF ARCHIVED MULTIPLE DATA SETS
BRADFORD C. HANSON (Louisiana Geological Survey, Baton Rouge) and LOUIS F. DELLWIG (Kansas, University, Lawrence) IN: Geotechnical applications of remote sensing and remote data transmission; Proceedings of the Symposium, Cocoa Beach, FL, Jan. 31-Feb. 1, 1986. Philadelphia, PA, American Society for Testing and Materials, 1988, p. 163-179; Discussion, p. 179-182. Research supported by the Phillips Petroleum Co. refs
(Contract JPL-954946)

In a study concerning the value of using radar imagery from systems with diverse parameters, X-band images of the Northern Louisiana Salt dome area generated by the airborne Goodyear electronic mapping system (GEMS) are analyzed in conjunction with imagery generated by the satelliteborne Seasat/SAR. The GEMS operated with an incidence angle of 75 to 85 deg and a resolution of 12 m, whereas the Seasat/SAR operated with an incidence angle of 23 deg and a resolution of 25 m. It is found that otherwise unattainable data on land management activities, improved delineation of the drainage net, better definition of surface roughness in cleared areas, and swamp identification, became accessible when adjustments for the time lapse between the two missions were made and supporting ground data concerning the physical and vegetative characteristics of the terrain were acquired. R.B.

N88-20712# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RESTORATION TECHNIQUES FOR REDISPLAY OF LANDSAT-5 SATELLITE IMAGERY [TECNICAS DE RESTAURACAO PARA REAMOSTRAGEM DE IMAGENS DO SATELITE LANDSAT-5]
LEILA MARIA GARCIA FONSECA, NELSON DELFINO DAVIL MASCARENHAS, and GERALD JEAN FRANCIS BANON Jun. 1987 14 p In PORTUGESE Presented at the 5th Brazilian Symposium of Telecommunication Campinas, Brazil, 8-10 Sep. 1987
(INPE-4189-PRE/1076) Avail: NTIS HC A03/MF A01

Some results are shown of restoration for redisplayed images of the Thematic Mapper, utilizing Fourier domain techniques. A restored image is compared to the redisplayed image with cubic convolution interpolation. The comparison is done visually and through radiometric profile of the line imagery. Author

N88-22450# Northwest Research Associates, Inc., Bellevue, Wash.
GEOMETRIC RESTORATION OF SATELLITE IMAGE DATA
Scientific Report No. 3, 20 Feb. - 30 Sep. 1987
R. D. LUCAS and ROBERT E. ROBINS 15 Oct. 1987 31 p
(Contract F19628-87-C-0003)
(AD-A190462; NWRA-CR-R019; AFGL-TR-87-0270) Avail: NTIS HC A03/MF A01 CSCL 08B

We describe an approach for projecting satellite image data onto arbitrary map coordinates. This transformation removes distortions caused by the basic geometry of cross-track scanners and by spacecraft pitch, roll, and yaw. Geometrically restored images are useful for morphological analyses and correlative studies involving concurrent data from multiple sensors. It is possible, for example, to present AIRS passes from distinct receivers, all-sky camera images, radar data, and other relevant spatial measurements on one map in geographic coordinates. Out approach is rigorous in that arbitrary satellite motions are accounted for and exact principles of geometry are used throughout. The floating-point intensive geometry calculations are performed on an arbitrary (adjustable) reference grid, which can be coarse for quick-look purposes, or fine for highest accuracy. Concurrent images for distinct wavelengths can be efficiently projected without

redundant geometry calculations. An IBM PC/AT compatible implementation for Polar BEAR AIRS image data is described. Results are presented for two data sets representing moderate and severe platform motions. GRA

N88-22451# Northwest Research Associates, Inc., Bellevue, Wash.
SATELLITE UV IMAGE PROCESSING Scientific Report No. 4, 1 Jul. - 10 Sep. 1987
NORMAN ROSENBERG 9 Oct. 1987 56 p
(Contract F19628-87-C-0003)
(AD-A190466; NWRA-CR-87-R016; AFGL-TR-87-0271) Avail: NTIS HC A04/MF A01 CSCL 17E

The overall objective of the computer program is the photometric and geometric processing of UV satellite images. The data source is the AIRS scanning UV spectrometer aboard the POLAR BEAR satellite. The processing is designed to provide geographic-mapped images which describe the spatial and temporal variability of airglow and aurora of emitting species. The AIRS data stream provided simultaneous records from 3 detectors received at several ground stations from several passes per day. These total about 1500 useful images from launch to Feb. 1987. The major progress during the report period has been development of programs to accomplish the following: (1) Statistical filtering of low-count images to provide meaningful brightness estimates; (2) Use of observed limb locations to provide attitude correction in daylit images and attitude estimation in night images to provide accurate ground positions; (3) Normalization of airglow based on column path length and solar flux which allows separation of aurora from airglow portions of the images; (4) Multi-band presentation of auroral features which clearly define differences between the location of emitting species. GRA

N88-22454# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
METHOD FOR RESTORATION AND RESAMPLING OF TM SENSOR IMAGERY [METODO PARA RESTAURACAO E REAMOSTRAGEM DE IMAGENS DO SENSOR TM]
LEILA MARIA GARCIAFONSECA and NELSON DELFINODA-VILAMASCARENHAS Mar. 1988 16 p In PORTUGUESE; ENGLISH summary Presented at the 2nd Latin American Symposium on Remote Sensing, Bogota, Colombia, Nov. 1987
(INPE-4491-PRE/1255) Avail: NTIS HC A03/MF A01

Some results obtained with the restoration for resampling TM images using techniques designed in the Fourier domain and implemented in the spatial domain are presented. The main idea is to obtain a good approximation for the original image over a finer grid, by substituting conventional interpolation techniques by the restoration technique. Therefore, image data with slightly better spatial and radiometric quality than the raw data can be synthesized with the resampling process. The work involves the design of a linear restoration filter with input and output defined on different sampling grids. The filter is designed in the Fourier domain by using the technique of compensation of the transfer function. Subsequently, a linear operator in the spatial domain is derived to be applied in the image restoration process. The restoration filter is applied to resample images from the TM sensor of the LANDSAT-5 on a 15 m sampling grid. These restored images are compared to the images that were resampled with the parametric cubic convolution. The comparison is made in visual terms, through the radiometric profile along on image line, through the difference between the images and through statistical measures, indicating better results with the proposed method. Author

N88-22485# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
CALIBRATION AND PROCESSING OF AVHRR DATA FOR TEMPERATURE ESTIMATION [CALIBRACAO E PROCESSAMENTO DOS DADOS DE AVHRR PARA ESTIMATIVA DE TEMPERATURA]
KEIKO TANAKA, CARLOS HO SHIH NING, YOSHIHIRO YAMAZAKI, and VALDER MATOSDEMEDEIROS Mar. 1988 25 p In PORTUGUESE; ENGLISH summary Presented at the SELPER/86, Gramado/RS, Brazil, 10-15 Aug. 1986
(INPE-4493-PRE/1257) Avail: NTIS HC A03/MF A01

The results of a quantitative analysis of the thermal channels of the NOAA-9 satellite Advanced Very High Resolution Radiometer (AVHRR) scanning radiometer digital data, recorded on a CCT magnetic tape, are presented. The calibration coefficients derived from the reference parameters contain information on the following telemetry data: the energy levels detected by the AVHRR sensor during space view and the internal calibration target for each thermal channel and each scanning. The linearization functions are found by taking, for each channel, the radiometric mean of 10 samples of space view and internal target data. The linear radiance was produced by taking the average of 50 scan data. These linear functions give the sensor radiance variations for each target scanned, and were used to convert the digital image data into radiance, and consequently, into temperature values using the inverse Planck function. The main results of the April 18th, 1986 image processed, applying the navigation system, for an area of 256 x 256 pixels are presented. Author

N88-23300# Begeleidingscommissie Remote Sensing, Delft (Netherlands).
PROPOSALS FOR THE PRE-OPERATIONAL USE OF DATA FROM THE EUROPEAN REMOTE SENSING SATELLITE ERS-1 [VOORSTEL VOOR HET PRE-OPERATIONELE GEBRUIK VAN ERS-1 GEGEVENS]
J. REIFF (Royal Netherlands Meteorological Inst., De Bilt.) 1986 57 p In DUTCH
(BCRS-86-02; ETN-88-91549) Avail: NTIS HC A04/MF A01

Payload and time planning of ERS-1, and comparable satellites are discussed. The deduction of geophysical parameters from ERS-1 data is explained. The international data flow and data management, data management in the Netherlands, and mission operations plan are outlined. Finance, national and international cooperation, and commercialization possibilities are discussed. ESA

N88-23302# Begeleidingscommissie Remote Sensing, Delft (Netherlands).
INVESTIGATION OF THE USEFULNESS OF SPECKLE ANALYSIS IN IMAGING RADAR SYSTEMS [ONDERZOEK NAAR DE BRUIKBAARHEID VAN SPECKLE-ANALYSIS IN BEELDVORMENDE RADARSYSTEMEN]
A. H. J. M. PELLEMANS (Technische Hogeschool, Delft, Netherlands) Oct. 1986 72 p In DUTCH
(BCRS-86-05; ETN-88-91552) Avail: NTIS HC A04/MF A01

The usefulness of speckle analysis in imaging side looking airborne radar systems was investigated. The speckle-analysis model, and the programs developed for simulations are explained. The imaging of periodic objects is presented. If the object consists of a grid of equidistant point targets, it is possible to determine periodicities in the object with repetition distances smaller than the resolution using the power density spectrum in the azimuthal direction. The model cannot be applied for sea wave observation. Decorrelation calculations give a decorrelation distance of 0.5 to 0.6 m above sea, which is smaller than half the antenna length (1.25 m). ESA

N88-23304# Begeleidingscommissie Remote Sensing, Delft (Netherlands).
RESULTS OF THE TESTING OF THE SEGMENTATION PROGRAM ON RESEDA [RESULTATEN VAN DE BEPROEVING VAN HET SEGMENTATIEPROGRAMMA OP RESEDA]
G. J. L. NOOREN (National Aerospace Lab., Amsterdam, Netherlands) and D. H. HOEKMAN 1987 38 p In DUTCH
(BCRS-87-01; NLR-TR-86104-L; ETN-88-91554) Avail: NTIS HC A03/MF A01

A segmentation program was tested using images of agriculture and forestry areas from side looking airborne radar as well as from Seasat synthetic aperture radar. Segmentation following the method of Gerbrands, and the implementation of the segmentation

algorithm in the Remote Sensing Data processing system RESEDA are explained. The experiments show that the accuracy of surface determination and field average estimate is determined by the segmentation without postprocessing. The (positive) effect of the segmentation on the classification is determined. ESA

N88-23309# Begeleidingscommissie Remote Sensing, Delft (Netherlands).
STUDY OF THE PLAN FOR A NATIONAL DATA CENTER FOR THE EUROPEAN REMOTE SENSING SATELLITE ERS-1 [STUDIE NAAR DE OPZET VAN EEN NATIONAAL ERS-1 DATACENTRUM]
R. W. VANSWOL (National Aerospace Lab., Amsterdam, Netherlands) Jul. 1987 80 p In DUTCH
(BCRS-87-11; NLR-TR-87055-L; ETN-88-91560) Avail: NTIS HC A05/MF A01

The way to receive and distribute in the Netherlands the data of ERS-1 was studied. It was investigated which data will come from ERS-1, which data products will be deduced by ESA, how ESA will distribute these products, and who will be the Dutch users. The investigation shows that for the Netherlands the real-time use of ERS-1 data in regional weather and wave prediction models will be the most important operational application of the data. In that respect, proposals for the practical use of the data are given. ESA

N88-24017# Societe Europeenne de Propulsion, Bordeaux (France). Image Processing Div.
THE GEOMETRIC WORKSTATION, A NEW APPROACH FOR GEOMETRIC CORRECTIONS OF REMOTELY SENSED DATA Abstract Only
P. N. PASCAUD and PH. REBILLARD *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 69 1986
Avail: NTIS HC A99/MF E03

Accurate registration of image data to maps or image-to-image is mandatory for both cartographic and multitemporal or multisensor studies. The auxiliary data provide with the images do not allow a satisfactory precision level in the image production. The magnitude of the errors vary with the sensors and can be greater than a hundred pixels. If a better precision is needed, additional information such as pairs of ground control points (GCP) must be introduced. Acquisition of such sets of control points is usually a difficult and tiresome repetitive task. The geometric workstation overpasses some typical limitations of existing methods. An interactive software was designed in order to improve efficiency of the operators. The systematic access to the map sheet was suppressed by digitally storing the maps and retrieving them using a cartographic data base service. An automatic recognition of the GCP is provided by the data base. A sophisticated signal processing was implemented in order to improve the quality of the auxiliary data. The combination of all these features allows the geometric workstation to perform quick and efficient geometric corrections. This improved precision is fully exploited by the accurate algorithm used for geometric precision modeling. Author

N88-24018# MacDonald, Dettwiler and Associates Ltd., Richmond (British Columbia).
MAPPING FROM LANDSAT AND SPOT SATELLITE IMAGERY Abstract Only
IAN LAVERTY *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 70 1986
Avail: NTIS HC A99/MF E03

Recent advances in the resolution and stereo capability of earth imaging satellites have made it practical to produce true cartographic maps from satellite imagery. Preliminary tests with LANDSAT TM have shown that: satellite imagery can be corrected to planimetric accuracy suitable for 1:50,000 scale maps with very few control points. Elevation can be derived accurately from stereo satellite imagery by automatic computer processing. Natural planimetric features can be interpreted accurately enough for 1:50,000 scale mapping at 30 meter resolution. The results from SPOT imagery, particularly in the areas of elevation accuracy and the interpretation of cultural features where LANDSAT TM does not meet 1:50,000 scale mapping standards are updated. An operational method of producing and updating topographic base maps digitally from satellite imagery will be presented. The costs and benefits of satellite mapping, particularly for developing nations, will be discussed in detail. Author

N88-24019# Toulouse Univ. (France). Langages et Systemes Informatiques.
THE SYSTEME D'ANALYSE GEOGRAPHIQUE (SAGE) GEOGRAPHIC ANALYSIS SYSTEM Abstract Only
M. R. CAUBET and M. A. HAMEURLAIN *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 86 1986
Avail: NTIS HC A99/MF E03

The design and implementation of a geographic analysis system, SAGE, is described. A classification of geographic analysis data base queries and two geographic data manipulation models are presented. Then, after establishing a data base model for geographic objects, a series of integrity constraints on the time and space elements of the geographic data base are specified and a means of ensuring the structural coherence of geographic objects is discussed. Author

N88-24020# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
SPECTRAL MEASUREMENTS FOR CORRECTING LANDSAT DATA FOR ATMOSPHERIC EFFECTS Abstract Only
A. BRIZUELA, M. A. RAED, G. HERREN, and C. MARINEZ CASADO *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 92 1986
Avail: NTIS HC A99/MF E03

Target reflectance data are needed by all man and machine systems to obtain the unambiguous interpretation of LANDSAT data. In response to the need for correcting target reflectance spectral data, the capabilities of a wide range of techniques for determining and removing atmospheric parameters and effects from LANDSAT data are being evaluated. Evaluated techniques include: experimental method that includes transferring known ground reflectance to spacecraft measurements, and three empirical methods computerizing image processing techniques. The approach that was performed was the conversion of radiance data from the satellite into reflectance values from a measurement technique based on ground measurements with an Exotech Model 100 A radiometer. Two Chavez' techniques are used to correct ERTS digital data for atmospheric scattering and other associated haze effects. Another empirical method is an extension of Chavez' Regression Technique: the covariance matrix method (CMM) for estimating additive path radiance in remote sensing data. All the methods were applied to each LANDSAT image of Buenos Aires and its environment. It was concluded that in all cases, there is a big influence of path radiance with different high levels and with time. Another important conclusion was obtained: there is a high correlation between histogram minimum load and CMM empirical methods with ground data. Empirical methods are of the same order as the ground truth haze effects. Author

N88-24027# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
TEXTURAL FEATURES FOR IMAGE CLASSIFICATION IN REMOTE SENSING Abstract Only
VITOR HAERTEL (Rio Grande do Sul Univ., Porto Alegre, Brazil) and YOSIO E. SHIMABUKURO *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 181 1986
Previously announced as N88-16181
Avail: NTIS HC A99/MF E03

Texture is an important characteristic in identifying regions of interest in an image. Several methods to quantify image texture

were reported in the literature. Experiments are described which are aimed at extracting textural features from digital images by calculating statistical properties in and around each pixel. The moving window concept is implemented and tests using LANDSAT MSS and TM imagery are presented. Author

N88-24028# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
SHAPE DETECTION IN REMOTE SENSING THROUGH GRAPH ISOMORPHISM Abstract Only
SEVERINO FERNANDEZ *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 183 1986
Avail: NTIS HC A99/MF E03

Experiments on shape detection in remote sensing were performed using graph homeomorphism as the match criteria. The first step involved is to extract a graph from a monochromatic image, being the first approach the extraction of linear features as graph edges and intersections and points of local maximum curvature as graph nodes. This first step was performed through three consecutive algorithms: detection of edge strength and thresholding with the Vero-Massy algorithm, edge thinning and finally edge following with simultaneous graph destruction generation. This provides a description of the considered image as a set of graphs. The description is completed with the computation of the angle between graph edges incident at a common node. A candidate graph is now generated and the same description is computed. The graph matching procedure is carried out with a simplified version of a forward checking with backtracking algorithm from Haralick and Shapiro with the sum of differences between corresponding edges of prototype and candidate as a measure of graph similarity. Finally, a couple of experiments with LANDSAT images is shown. Author

N88-24064# Universidade Estadual de Paulista, Guaratingueta (Brazil). Dept. de Planejamento Regional.
IMPLANTATION OF A GEO-CARTOGRAPHICAL INFORMATION SYSTEM THROUGH MICROCOMPUTERS [IMPLANTACAO DE UM SISTEMA DE INFORMACAO GEO-CARTOGRAFICA ATRAVES DE MICROCOMPUTADOR]
A. L. A. TEIXEIRA and L. H. O. GERARDI *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 548-553 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The introduction of quantitative methods as a tool for data analysis, has caused impact changes in the scientific approach to geographic problems. The growing automation of the cartographic process has changed cartography in a very significant way. Common to both cases is the problem of the enormous amount of data to be manipulated and analyzed. This volume can not be efficiently treated if more modern techniques are not used. All this considered, a geo-cartographical information system was idealized, planned, and implemented using database techniques and the microcomputer as a basic tool. Author

N88-24067# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STUDY OF METHODS OF POST-PROCESSING APPLIED TO A PROBLEM OF STANDARD CLASSIFICATION [ESTUDO DE METODOS DE POS-PROCESSAMENTO APLICADO A PROBLEMA DE CLASSIFICACAO DE PADROES]
LUCIANO VIEIRA DUTRA and JOSE CARLOS MOREIRA *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 562-568 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

In order to identify the various objects within a multispectral image, per point classification methods are normally used. This kind of method does not use the spatial information among the pixels of the images, thereby producing a higher classification error. The spatial information can be added before, within and after the classification stage. Two methods of post-processing which take account of the spatial relationship between pixels are presented. The first one is based on a local histogram of the pixel's class. The central pixel is reclassified to the most occurring class, provided the frequency is higher than a selected threshold. The results show a fairly better classification performance and a good improvement of the visual appearance. The second method is based on a generalization of the expansion-striking concept of binary images applied to the individual classes. This method did not lead to a better performance in terms of classification precision but allowed the identification of pixels of mixed classes, which occur mainly in the border between classes, allowing a better localization of these frontiers. Author

N88-24070# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANALYSIS OF THE PARAMETERS RESPONSIBLE FOR THE VARIATIONS OF THE ILLUMINATION CONDITIONS IN THE LANSAT DATA [ANALISE DOS PARAMETROS RESPONSAVEIS PELAS VARIACOES DAS CONDICOES DE ILUMINACAO NOS DADOS LANDSAT]
R. ROSA and E. E. SANO *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 583-588 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The variations in the tonality (photographic paper products) or in the digital values (computer compatible tapes (CCT) of LANDSAT data are associated with the spectral signatures of objects, atmospheric conditions, geometric measurement, and illuminations, this last is analyzed in the presented work. The parameters that influence the illumination conditions are the geometric relationships between the sensor system, the sun (solar angle of elevation and azimuth), and the surface (orientation and inclination). These parameters are defined and discussed, as well as, their implications on the LANDSAT data. B.G.

N88-24080# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
AUTOMATIC REGISTRATION OF SATELLITE IMAGERY [REGISTRO AUTOMATICO DE IMAGENS DE SATELITE]
GILBERTO CAMARA NETO *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 669-671 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

Registration of satellite imagery is an important need in various application areas in remote sensing. A method is presented for registration which reduces use work to a minimum, the control points being automatically chosen. The method near tests in LANDSAT TM imagery with good results. Author

N88-24081# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
VISUALIZATION OF DIGITAL TERRAIN MODELS [VISUALIZACAO DE MODELOS DIGITAIS DE TERRENO]
GUARACI JOSE ERTHAL, CARLOS ALBERT FELGUEIRAS, and JOAO ARGEMIRODECARVALHOPAIVA *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 672-674 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

The fundamental problem in displaying digital terrain models (DTM) that are tri-dimensional data, is representing them in a bi-dimensional space. Traditional approaches represent DTM data by: contour lines, grey level indexes, and perspective view of a regular grid. First results of a method for rendering tri-dimensional surfaces are presented. This method allows visualization of DTM combined with other spatial information like satellite imagery. Author

N88-24082# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
APPLICATION OF ITS TRANSFORMATION IN COLOR ENHANCEMENT OF LANDSAT IMAGERY [APLICADAO DA TRANSFORMACAO IHS PARA REALCE DE CORES EM IMAGENS LANDSAT]
LUCIANO VIEIRA DUTRA and PAULO ROBERTO MENESES *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 675-681 1986 In PORTUGUESE: ENGLISH summary
Avail: NTIS HC A99/MF E03

The multispectral color composite imagery, obtained by digital processing and displayed on video monitors through the combination of the fundamental colors (red, green, and blue) consists in an efficient form of presentation. The visual or psychophysiologic perception of the brain to the stimulus of particular colors, tends to combine independently the quantitative components of the fundamental colors, the intensity, (I), hue (H), and saturation (S). So it is possible to perceive each one of these attributes of color, separately. A method is presented to increase the contrast of the colors, using a transformation to the IHS coordinator which permits individual manipulation in each of these components, in order to obtain a better control about the color composite generated in the video display. The basic procedure is a manipulation of the histograms of the components (I, H, and S), in order to increase, decrease, or offset the range of possible values of the components, by linear transformations. The test of this procedure using LANDSAT-TM scene of Serra de Ramalho (BA) showed that different component manipulations resulted in different enhancements of lithologic units, formerly not distinguished in the original color composition, allowed an easier photogeologic interpretation. Author

N88-24102# Research Inst. of National Defence, Stockholm (Sweden).
TERRAIN CLASSIFICATION USING SPOT IMAGES AND THE COMPUTER SYSTEM GOP-300
MATTI SVANTESSON Sep. 1987 50 p In SWEDISH; ENGLISH summary
(FOA-C-20677-2.7; ISSN-0347-3694; ETN-88-92201) Avail: NTIS HC A03/MF A01

For the classification of multispectral images from the SPOT satellite a maximum likelihood algorithm was used. Different contextual analyses were utilized as extra features in the classification, the results of which, with only spectral information as features, was compared with the results when contextual information was used as extra features. Edge-effect is important for fixing the margins. Examples are presented. ESA

N88-25030# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
TESTS FOR THE AUTOMATIC PATTERN RECOGNITION OF BUILDING SURFACES BY THE TK 50 [VERSUCHE ZUR AUTOMATISCHEN MUSTERERKENNUNG VON GEBAEUDEFLAECHEN DER TK 50]
JUERGEN BRENNECKE *In its* Reports on Cartography and Geodesy. Series 1, No. 99 p 57-77 1987 In GERMAN; ENGLISH summary
Avail: NTIS HC A08/MF A01

An essentially automatic procedure to separate features of built-up areas from the other planimetric features of the TK 50 map is presented. The features are classified by means of the object features width and area in a feature space, here two-dimensional. The procedure is based on simple raster operations: thinning, thickening, extending, and counting of pixels. The rate of wrong classifications amounts to only 3 percent. The total processing time required for 1/4 map sheet is 12 hr. The automatic vectorization of building outlines is described. ESA

N88-25038# Institut fuer Angewandte Geodaesie, Frankfurt am Main (West Germany).
RECENT DEVELOPMENTS IN SOFTWARE AND HARDWARE BY SCITEX CO. [NEUENTWICKLUNGEN IM HARD- UND SOFTWAREBEREICH BEI FIRMA SCITEX]
FERDINAND SALOMON *In its* Reports on Cartography and Geodesy. Series 1, No. 99 p 157-165 1987 In GERMAN; ENGLISH summary
Avail: NTIS HC A08/MF A01

The raster data processing applications offered by the Response 280 system of Scitex Company are being expanded in the field of user software by more sophisticated raster and vector processing modes, as interactive text positioning, DIANA (Digital Analysis) and DTM (Digital Terrain Modelling). Improved possibilities of communication achieved via direct connection of IBM/PC and or Microvax 2 of DEC are substantial hardware extensions. ESA

08

INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A88-29286
THE ACQUISITION OF SPOT-1 HRV IMAGERY OVER SOUTHERN BRITAIN AND NORTHERN FRANCE, MAY 1986-MAY 1987
JANIS CUSHNIE (Reading, University, England) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, Jan. 1988, p. 159-167.

The number and spatial distribution of SPOT-1 HRV images acquired over southern Britain and northern France during the first commercial year of the SPOT system have been assessed in response to concern about the lack of cloud-free imagery. It is confirmed that, despite large numbers of images being acquired per scene (1 panchromatic and 12 multispectral on average over northern France; 8 panchromatic and 12 multispectral over southern Britian), most are of limited use because of cloud cover. Only 30 percent of the images collected have at least one quadrant with less than 25 percent cloud cover and 10 percent have less than 10 percent cloud cover in each quadrant. Recommendations on what can be done are presented. B.J.

A88-32850
A PC-BASED INTERACTIVE GRAPHICS SYSTEM TO PERFORM SATELLITE-DERIVED OCEANOGRAPHIC THERMAL ANALYSIS
MARCIA WEAKS, KIM BUTTLEMAN, and W. B. CAMPBELL (NOAA, National Environmental Satellite, Data and Information Service, Camp Springs, MD) IN: American Meteorological Society, International Conference on Interactive and Information Processing Systems for Meteorology, Oceanography and Hydrology, 4th, and Conference on Satellite Meteorology and Oceanography, 3rd, Anaheim, CA, Feb. 1-5, 1988, Preprints. Boston, MA, American Meteorological Society, 1988, p. J1-J8.

A project aimed at improving upon the present manual methods of satellite-based oceanographic analysis is described which is based on a combination of interactive and automated computer techniques. A suitable system configuration contains a mainframe computer to perform preprocessing functions and a PC-class microprocessor to perform image analysis and product generation. These components are described and the main outstanding development issues are discussed. C.D.

A88-33150
SPARSE-APERTURE MICROWAVE RADIOMETERS FOR EARTH REMOTE SENSING
ANDREW S. MILMAN (Michigan, Environmental Research Institute,

Ann Arbor) Radio Science (ISSN 0048-6604), vol. 23, Mar.-Apr. 1988, p. 193-205. Research supported by the Environmental Research Institute of Michigan. refs

Passive microwave instruments for remote sensing of the Earth's surface from space can measure many meteorological parameters in the absence of daylight and in the presence of clouds. Because of the large apertures that are required to achieve good spatial resolution (1-5 km) at microwave frequencies, these radiometers should be arrays of small antenna elements that are arranged so that the collecting area of the radiometer is much smaller than that of a conventional, solid scanning antenna with the same spatial resolution. Despite the various methods that might be used for combining the signals from the different array elements and the different ways the elements might be arranged, the sensitivity depends almost exclusively on the collecting area, integration time, RF bandwidth, and the system temperature. Interferometers and phased arrays have limitations on their bandwidths that depend on the size of the array; beam-forming arrays are not so limited. A cross antenna is considered in some detail as an example of a sparse-aperture radiometer. It has 5-km resolution from an 800-km orbit and significantly better sensitivity than the equivalent conically scanning parabolic antenna, while it has only 10 percent of the collecting area and no moving parts.
Author

A88-33416* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SATELLITE INFRARED TECHNIQUE TO ESTIMATE TROPICAL CONVECTIVE AND STRATIFORM RAINFALL
ROBERT F. ADLER and ANDREW J. NEGRI (NASA, Goddard Space Flight Center, Greenbelt, MD) Journal of Applied Meteorology (ISSN 0733-3021), vol. 27, Jan. 1988, p. 30-51. refs

A new method of estimating both convective and stratiform precipitation from satellite infrared data is described. This technique defines convective cores and assigns rain rate and rain area to these features based on the infrared brightness temperature and the cloud model approach of Adler and Mack (1984). The method was tested for four south Florida cases during the second Florida Area Cumulus Experiment, and the results are presented and compared with three other satellite rain estimation schemes.
C.D.

A88-33429* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TROPICAL RAINFALL MEASURING MISSION (TRMM)
THOMAS KEATING (NASA, Goddard Space Flight Center, Greenbelt, MD) IN: EASCON '87; Proceedings of the Twentieth Annual Electronics and Aerospace Systems Conference, Washington, DC, Oct. 14-16, 1987. New York, Institute of Electrical and Electronics Engineers, Inc., 1987, p. 21-32.

By measuring rainfall in the tropics, the Tropical Rainfall Measuring Mission (TRMM) will make possible the understanding of the heat engine that drives the global weather. The TRMM mission parameters are given, and the spacecraft is described. The instruments are examined, including the precipitation radar, TRMM microwave radiometer, and Advanced Very High Frequency Radiometer. The mission life is addressed, including atmospheric data, fuel consumption, and life extension methods. The spacecraft interfaces, payload configuration, and deployment sequence are considered. The subsystems are described, including propulsion, power, command, data handling, and tracking. A Japanese Experimental Data Relay Tracking Satellite experimental package working with TRMM is briefly addressed. C.D.

A88-33742* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A PROPOSED TROPICAL RAINFALL MEASURING MISSION (TRMM) SATELLITE
JOANNE SIMPSON, ROBERT F. ADLER (NASA, Goddard Space Flight Center, Greenbelt, MD), and GERALD R. NORTH (Texas A & M University, College Station) American Meteorological Society, Bulletin (ISSN 0003-0007), vol. 69, March 1988, p. 278-295. refs

The proposed Tropical Rainfall Measuring Mission (TRMM) satellite (presently in its third year of planning), is described. The TRMM satellite, planned for an operational duration of at least three years beginning in the mid-1990s, is intended to obtain high-quality measurements of tropical precipitation by means of information derived from a quantitative spaceborne radar, a multichannel passive microwave radiometer, and an AVHRR. The satellite's orbit will be low-altitude (320 km), for high resolution, and low-inclination (30 to 35 deg), for making it possible to visit each sampling area twice a day. Radar and passive microwave algorithms and rain-retrieval algorithms to be used in precipitation measurements are discussed together with cloud dynamical models designed to test these algorithms. I.S.

A88-33832
TECHNIQUE FOR THE INSTRUMENTED INTERPRETATION OF SPACE SCANNER IMAGERY OF THE EARTH'S CLOUD COVER [METODIKA INSTRUMENTAL'NOGO DESHIFRIROVANIIA MATERIALOV KOSMICHESKOI SKANERNOI S'EMKI OBLACHNOGO POKROVA ZEMLI]
A. I. SHAROV Geodeziia i Aerofotos'emka (ISSN 0536-101X), no. 5, 1987, p. 95-98. In Russian.

Results of the instrumented interpretation of scanner images obtained with meteorological satellites are presented. The MSP-4 synthesizing device is used to process bispectral imagery of the earth's cloud cover, and a masking technique is used to identify the structural features of cloud formations. The proposed technique is verified using data from the NOAA 6, 9, and 10 satellites. B.J.

A88-33872
CLIMATOLOGICAL INTERPRETATION OF TIME SERIES OF SATELLITE OBSERVATIONS OF THE EARTH'S RADIATION BALANCE [KLIMATOLOGICHESKAIA INTERPRETATSIIA VREMENNYKH RIADOV SPUTNIKOVYKH NABLIUDENII RADIATSIONNOGO BALANSA ZEMLI]
G. I. MARCHUK, K. IA. KONDRAT'EV, and V. V. KOZODEROV Akademiia Nauk SSSR, Doklady (ISSN 0002-3264), vol. 299, no. 1, 1988, p. 88-94. In Russian. refs

A method for the reliable determination of climatic-effect regions of energy active ocean zones is developed. The method involves a principal-components analysis of mean-monthly field anomalies of the outgoing long-wavelength radiation with a step of 5 deg for the whole globe. The data used include time series for observations made with NOAA (1974-1977) and Nimbus-7 (1978-1983) satellites. B.J.

A88-35154
ERS-1, EARTH RESOURCES SATELLITE-1 AND FUTURE EARTH OBSERVATION PROGRAM IN JAPAN
YUJI MIYACHI, YASUSHI HORIKAWA (National Space Development Agency of Japan, Tokyo), and YOSHIKAZU KAMIYA (National Space Development Agency of Japan, Los Angeles, CA) IN: Aerospace century XXI: Space sciences, applications, and commercial developments; Proceedings of the Thirty-third Annual AAS International Conference, Boulder, CO, Oct. 26-29, 1986. San Diego, CA, Univelt, Inc., 1987, p. 1623-1630.
(AAS PAPER 86-289)

The development of the Earth Resources Satellite-1, the follow-on to the MOS-1 satellite, is discussed. The mission objectives of the ERS-1 are summarized and its sensors and spacecraft characteristics are described. The satellite orbital elements are listed. The functions of the ERS-1 sensors are stated and the developmental status is described. NASDA activities in data reception and processing relevant to the ERS-1 project and the role of NASDA in the international earth observation effort are discussed. C.D.

A88-35155
SPOT 1 - INTERNATIONAL COMMERCIALIZATION OF REMOTE SENSING
PIERRE BESCOND (Spotimage, Reston, VA) IN: Aerospace century XXI: Space sciences, applications, and commercial developments; Proceedings of the Thirty-third Annual AAS

International Conference, Boulder, CO, Oct. 26-29, 1986. San Diego, CA, Univelt, Inc., 1987, p. 1631-1636.
(AAS PAPER 86-299)

The role of the Spot satellite in the French and in the international remote sensing effort is considered. The Spot satellite system and its ground segment are described, showing the functioning of the satellite as a remote sensor and the role of the ground segment in market distribution. Further innovations being made on Spot are addressed, and Spot's impact on the remote sensing industry is assessed. C.D.

A88-35159* Jet Propulsion Lab., California Inst. of Tech., Pasadena.
PRECISION POSITIONING OF EARTH ORBITING REMOTE SENSING SYSTEMS
WILLIAM G. MELBOURNE, T. P. YUNCK, and S. C. WU (California Institute of Technology, Jet Propulsion Laboratory, Pasadena) IN: Aerospace century XXI: Space sciences, applications, and commercial developments; Proceedings of the Thirty-third Annual AAS International Conference, Boulder, CO, Oct. 26-29, 1986. San Diego, CA, Univelt, Inc., 1987, p. 1677-1694. refs
(AAS PAPER 86-398)

Decimeter tracking accuracy is sought for a number of precise earth sensing satellites to be flown in the 1990's. This accuracy can be achieved with techniques which use the Global Positioning System (GPS) in a differential mode. A precisely located global network of GPS ground receivers and a receiver aboard the user satellite are needed, and all techniques simultaneously estimate the user and GPS satellite states. Three basic navigation approaches include classical dynamic, wholly nondynamic, and reduced dynamic or hybrid formulations. The first two are simply special cases of the third, which promises to deliver subdecimeter accuracy for dynamically unpredictable vehicles down to the lowest orbit altitudes. The potential of these techniques for tracking and gravity field recovery will be demonstrated on NASA's Topex satellite beginning in 1991. Applications to the Shuttle, Space Station, and dedicated remote sensing platforms are being pursued. Author

A88-35162
POTENTIAL FOR EARTH OBSERVATIONS FROM THE MANNED SPACE STATION
JAMES V. TARANIK (Nevada, University, Reno) IN: Aerospace century XXI: Space sciences, applications, and commercial developments; Proceedings of the Thirty-third Annual AAS International Conference, Boulder, CO, Oct. 26-29, 1986. San Diego, CA, Univelt, Inc., 1987, p. 1725-1729.
(AAS PAPER 86-426)

This paper outlines a few potential uses of the Manned Space Station for earth observations and sensor development in support of earth observations. The way the Space Station can assist in earth-based observations is briefly considered. The advantages of the Space Station for instrument development and for calibrating free-flying instruments are addressed. C.D.

A88-35395
CANADIAN LARGE-SCALE AERIAL PHOTOGRAPHIC SYSTEMS (LSP)
RAY D. SPENCER (Melbourne, University, Creswick, Australia) and R. J. HALL (Canadian Forestry Service, Edmonton, Canada) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, April 1988, p. 475-482. Research supported by the Canadian Forestry Service, University of Melbourne, and University of British Columbia. refs

This paper reviews Canadian approaches for acquiring and processing large scale aerial photographs (LSP). Developments in Canada show that large scale aerial photographs (LSP) can be used as a sampling tool and so reduce the need for expensive and slow ground surveys in forest inventories. The use of LSP is a two-step process involving photo acquisition and analysis, with both steps requiring specialized equipment and techniques to ensure efficient recording, extraction, and processing of data. Canadians have pioneered two different photographic approaches and tested various measurement-interpretation systems. One photographic approach uses twin-vertical 70-mm cameras mounted on a fixed air base; the other uses single-camera, timed-interval photography with a radar or laser altimeter and in-flight recording of tilt. The major systems for photo analysis use analytical stereo digitizers and computers to extract and process data. Author

A88-35396
DIFFERENCES IN VISIBLE AND NEAR-IR RESPONSES, AND DERIVED VEGETATION INDICES, FOR THE NOAA-9 AND NOAA-10 AVHRRS - A CASE STUDY
K. P. GALLO (NOAA, Satellite Research Laboratory, Washington, DC) and J. C. EIDENSHINK (TGS Technology, Inc., Sioux Falls, SD) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, April 1988, p. 485-490. refs

This study evaluates the differences in the visible and near-IR responses of the Advanced Very High Resolution Radiometers (AVHRR) of the National Oceanic and Atmospheric Administration (NOAA)-9 and -10 satellites for coincident sample locations. The study also evaluates the differences in vegetation indices computed from those data. Data were acquired of the southeast portion of the United States for the 6 December 1986 daylight orbits of NOAA-9 and NOAA-10 satellites. The data sets were registered and 38 coincident sample locations were selected that included land and water surfaces. The data were calibrated to reflectance values with coefficients supplied by NOAA. The visible and near-IR reflectance values and the derived vegetation index values of the NOAA-9 AVHRR were usually greater than those of the NOAA-10. Visible and near-IR reflectance values exhibited trends that appeared to be related to the satellite scan angles at the examined sample locations. Linear relationships were developed between the vegetation indices of the two systems. The vegetation index values for the NOAA-9 and NOAA-10 AVHRR displayed nearly constant differences for a variety of surface features. The results suggest that, with appropriate gain and offset, the vegetation indices of the two sensor systems may be interchangeable for assessment of land surfaces. Author

A88-35968
IMAGING INSTRUMENT OF THE VEGETATION PAYLOAD (SPOT 4)
R. KRAWCZYK and G. CERUTTI-MAORI (Aerospatiale, Cannes, France) IN: Optical systems for space applications; Proceedings of the Meeting, The Hague, Netherlands, Mar. 30-Apr. 1, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1987, p. 125-131.

The SPOT-4 Vegetation Payload is designed for an operational global-scale survey of earth vegetation as well as for the observation of ocean areas. The push-broom imaging instrument is intended to measure ground albedo simultaneously in five spectral bands from 0.43 to 1.70 microns. A general description is given of the imaging instrument, followed by an examination of the performance of the instrument component parts. The calibration device is described, and some radiometric results are presented. B.J.

A88-36378
SPACE SHUTTLE LARGE FORMAT CAMERA PHOTOGRAPHY AND RESOURCE MANAGEMENT
JERRY D. GREER (USDA, Forest Service, Salt Lake City, UT) IN: Airborne reconnaissance XI; Proceedings of the Meeting, San Diego, CA, Aug. 17, 18, 1987. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1988, p. 11-21. refs

In October 1984 the Space Shuttle Challenger carrying the Large Format Camera (LFC) took 2134 photographs of the earth's land, oceans, and clouds. In this experiment, the precision cartographic LFC was used to take vertical aerial photographs on a strip of film made up of four different emulsions. An exceptionally cloudy weather system in North America and Europe caused most of primary photography sites to be obscured. Many photographs were therefore taken of secondary sites. The U.S. Department of Agriculture Forest Service participated in this experiment by

identifying many photographic test sites in the U.S. When the mission was flown, most of the National Forests selected were obscured by clouds. Author

A88-37126
REMOTE SENSING APPLICATIONS IN METEOROLOGY AND CLIMATOLOGY; PROCEEDINGS OF THE NATO ADVANCED STUDY INSTITUTE, DUNDEE, SCOTLAND, AUG. 17-SEPT. 6, 1986
ROBIN A. VAUGHAN, ED. (Dundee, University, Scotland) Institute sponsored by NATO. Dordrecht, D. Reidel Publishing Co. (NATO ASI Series. Volume C201), 1987, 492 p. For individual items see A88-37127 to A88-37150.

The theoretical principles of remote sensing and its operational and experimental application to meteorology and climatology are examined in reviews and reports. Topics addressed include cloud formations seen by satellite; sources of variance in the upwelling radiance field; data reception, archiving, and distribution; image processing, pattern recognition, and AI; vertical sounding from satellites; the impact of satellite data on global numerical weather prediction; and satellite studies of synoptic and mesoscale atmospheric features. Consideration is given to cloud-motion analysis of cyclones within cold air masses, multispectral classification of clouds and fog, remote sensing of sea-surface winds, surface energy budgets and temperatures, and thermal inertia. Also discussed are advanced instruments being developed for ERS-1 and the Columbus polar platform of the International Space Station. T.K.

A88-37127
CLOUD FORMATIONS SEEN BY SATELLITE
R. S. SCORER (Imperial College of Science and Technology, London, England) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 1-18. refs

The remote sensing of cloud formations by NOAA AVHRR and CZCS satellite instruments is surveyed. The instruments and their observing channels are listed and briefly described, with particular attention to day and night observations; intensity, absorption, and directional scattering; cloud brightness; shadows and haze; sun glint; and hot spots. Cloud formations characterized include lee waves, billows, orographic and Foehn cirrus, jet streams, warm-front instability, streets and cells, anvil and other plumes, and isolated lines such as rope clouds and ship trails. The use of archived remote-sensing images in climatological studies is illustrated for the cases of the Greenland barrier and ship trails. T.K.

A88-37129
THE PHYSICAL PRINCIPLES CONTROLLING THE REMOTE SENSING PROCESS
M. J. DUGGIN (New York, State University, Syracuse) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 33-50. refs

The physical principles controlling the reflection and emission of radiation from natural and man-made surfaces are considered. Topics addressed include the interaction of the downwelling radiance field with the atmosphere, the interaction of the global irradiance field with the anisotropic reflectance, the absorbtance and emissivity characteristics of clouds and of terrestrial surfaces, and the interaction of the upwelling radiance field with the sensor. The impact of these features and their interactions is examined for the bands 0.4-2.0, 3.5-4.1, and 8-12 microns. The need for sensors capable of recording radiance with high S/N in several different portions of the spectrum to discriminate cloud and land cover types is indicated. Author

A88-37130
SENSORS TO RECORD ATMOSPHERIC AND TERRESTRIAL INFORMATION - PRINCIPLES OF COLLECTION AND ANALYSIS
M. J. DUGGIN (New York, State University, Syracuse) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 51-68. refs

The general principles and current status of staring and scanning sensors for satellite remote sensing of land and sea surfaces and atmospheric parameters are reviewed. The types of information obtainable in the different spectral bands are indicated; the common characteristics and specific features of sensors are listed in extensive tables and discussed; and a chronological diagram of U.S. meteorological and earth-resources satellites is provided. T.K.

A88-37132
MICROWAVE INSTRUMENTS AND METHODS
G. E. PECKHAM (Heriot-Watt University, Edinburgh, Scotland) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 87-106. refs

The basic principles and current status of satellite remote sensing of the earth surface and atmosphere using active and passive microwave sensors are reviewed. Consideration is given to nadir and limb sounding of the atmosphere; radiometry of surface properties, liquid water, and integrated water vapor; scatterometry for ocean wind estimation; sea-surface altimetry; and high-resolution SAR imaging of surface features. Technological aspects examined include antennas, power sources, receivers, radiometers and calibration, spectrum analysis, and radar instrumentation. T.K.

A88-37145
CLOUD CLIMATOLOGIES FROM SPACE AND APPLICATIONS TO CLIMATE MODELLING
A. HENDERSON-SELLERS and K. MCGUFFIE (Liverpool, University, England) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 359-373. refs
(Contract AF-AFOSR-86-0118)

Global satellite-derived cloud climatologies are considered, and the results of an automated cloud-analysis model are presented. The zonal distribution of cloud is applied to the radiative fluxes as predicted by an energy balance model. Special-channel cloud discrimination is discussed with reference to the Landsat Thematic Mapper. Author

A88-37150
REMOTE SENSING IN THE SPACE STATION AND COLUMBUS PROGRAMMES
D. D. HARDY (British National Space Centre, London, England) IN: Remote sensing applications in meteorology and climatology; Proceedings of the NATO Advanced Study Institute, Dundee, Scotland, Aug. 17-Sept. 6, 1986. Dordrecht, D. Reidel Publishing Co., 1987, p. 441-450.

Plans for terrestrial remote sensing from the International Space Station are reviewed, with an emphasis on ESA activities (the Columbus program). The advantages of large, long-duration (servicable) multiple-instrument platforms for remote sensing are indicated; the history of the Space Station and Columbus is briefly traced; and relevant results from the UK Space Station Utilization Study (1986) are summarized in tables. It is concluded that the two unmanned polar platforms planned for the Space Station will meet most, but not all, of the remote-sensing objectives identified in the study. It is pointed out, however, that two such platforms will overload the data-relay capacity of TDRSS and the proposed ESA DRS systems. T.K.

A88-37279#
NON-TRACKING ANTENNA SYSTEMS FOR THE ACQUISITION OF NOAA HRPT DATA
M. WEGENER, G. LENNON, D. BOWERS, J. BRANDWYK, G. WILKINS (South Australia, Flinders University, Bedford Park, Australia) et al. IN: National Space Engineering Symposium, 3rd, Canberra, Australia, June 30-July 2, 1987, Preprints of Papers. Barton, Australia/Brookfield, VT, Institution of Engineers/Brookfield Publishing Co., 1987, p. 238-240.

A concept for a NOAA HRPT receiving station using an array of yagi-type antennae instead of a tracking dish is described. It has been shown that a pointing array of antennae can provide a sufficient signal level for the reliable acquisition of NOAA HRPT data from a spatially limited area of interest. Author

A88-37286#
SPACEBORNE RADAR X-SAR FOR CIVIL APPLICATIONS
HANS MARTIN BRAUN and HELMUT KAPPEL Dornier-Post (English Edition) (ISSN 0012-5563), no. 1, 1988, p. 16-18.

The X-band SAR that is scheduled to fly in a joint mission with NASA's two-frequency Shuttle Imaging Radar SIR-C in 1991 is designed for simultaneous earth measurements at 1.3, 5.3, and 9.6 GHz frequencies, in order to furnish investigators with radar images having different signatures from a given target scene. In conjunction with SIR-C, X-SAR will furnish enhanced multispectral/dual-polarization data pertinent to biogeochemical cycles, hydrologic cycles, and global climate changes. Attention is given to real-time SAR signal processing capabilities. O.C.

A88-37336#
RETRIEVAL OF ATMOSPHERIC TEMPERATURE STRUCTURE FROM THE NOAA-9 SATELLITE
CHAOHUA DONG and FENGYING ZHANG (Satellite Meteorological Center, People's Republic of China) Chinese Journal of Infrared Research (ISSN 0258-7114), vol. 7A, no. 2, 1988, p. 125-130. In Chinese, with abstract in English.

In this paper, a statistical regression with a matching algorithm has been described to retrieve the atmospheric temperature structure from the NOAA-9 satellite. The calculated temperatures are verified by comparison with radiosondes over the China region. The study shows that the root-mean-square (rms) difference is about 2.3 C over the middle and low latitude area and about 3.0 C over the higher latitude area. The largest differences are near the ground and in the tropopause region, particularly over land with complicated topography. Author

A88-37383#
G.P.S. SURVEYING IN THE NETHERLANDS
H. J. W. VAN DER VEGT (Rijkswaterstaat, Delft, Netherlands) IN: Institute of Navigation, Technical Meeting, 1st, Colorado Springs, CO, Sept. 21-25, 1987, Proceedings. Washington, DC, Institute of Navigation, 1987, p. 49-56.

The Global Positioning System (G.P.S.) shows very promising results, which will cause enormous changes in the survey community in the next decade. Those changes will affect both the landsurveying and marine surveying activities. Some results, recently obtained at the Survey Department will be discussed, showing the possibility of integrating G.P.S. measurements in local geodetic networks. Concerning highly accurate dynamic applications, results obtained with two Sercel TR5SB receivers in a differential mode are compared with the results from an optical tracking system. The analysis shows the possibility to achieve accuracies at the decimeter level under dynamic conditions. The first preliminary results of a project aimed at the use of GPS in an airplane for photogrammetric mapping also shows accuracies at the few decimeter level. Author

A88-37384#
DEVELOPMENTS IN USE OF GPS AS RANGE TSPI
DARWIN G. ABBY (General Dynamics Services Co., Yuma, AZ) IN: Institute of Navigation, Technical Meeting, 1st, Colorado Springs, CO, Sept. 21-25, 1987, Proceedings. Washington, DC, Institute of Navigation, 1987, p. 57-61.

Techniques developed at US Army Yuma Proving Ground to evaluate GPS receiver designs and performance have been applied to demonstrate a capability to generate Time and Space Position Information (TSPI) using GPS. Flight test data collected on developmental GPS receivers is post-processed using differential GPS concepts to produce GPS based TSPI. The UPG laser tracking system is used to evaluate GPS TSPI performance. The differences between the two systems show that the accuracies of each are comparable and in the 3-5 m area. Existing capabilities and resources are described and results are presented. A concept is proven which proposes that every GPS equipped vehicle is a mobile test range. Author

A88-37391#
THE MAGNAVOX CIVIL AND MILITARY LINE OF GPS RECEIVERS - A TECHNOLOGY AND APPLICATIONS OVERVIEW
THOMAS A. STANSELL, JR. (Magnavox Advanced Products and Systems Co., Torrance, CA) IN: Institute of Navigation, Technical Meeting, 1st, Colorado Springs, CO, Sept. 21-25, 1987, Proceedings. Washington, DC, Institute of Navigation, 1987, p. 109-118. refs

Eleven different GPS receivers are described, including both military and commercial versions for land, sea, and air navigation. The receivers cover applications including geodetic land surveying, differential navigation with and without pseudolites, parachute descent navigation, and GPS integrated with an inertial navigation system. The receiver configurations range from complete packages to original equipment manufacturer modules. R.R.

A88-37416
AN UPDATE ON VISIBLE AND NEAR INFRARED CALIBRATION OF SATELLITE INSTRUMENTS
JOHN C. PRICE (USDA, Remote Sensing Research Laboratory, Beltsville, MD) Remote Sensing of Environment (ISSN 0034-4257), vol. 24, April 1988, p. 419-422. refs

Additions and corrections are given to the calibration of visible/near-infrared satellite instruments provided by Price (1987). The impact of the change of presentation of Channel 4 data from the Landsat multispectral scanner from six bits to seven bits is considered. It is noted that the SPOT instruments in orbit have different characteristics, particularly band central wavelength, than those previously considered by Price based on preliminary information. Instrument calibration for the Landsat Thematic Mapper and NOAA AVHRR instruments is also discussed. R.R.

A88-38411
EARTH OBSERVATION: CAPTURING THE IMAGERY - REMOTE SENSING DEPENDS ON ADVANCED RECORDING TECHNOLOGY
Space Markets (ISSN 0258-4212), Spring 1988, p. 40-43.

Problems involved in capturing earth-observation data aboard satellites and receiving and storing it on the ground are addressed, in addition to the means adopted to overcome them. Longitudinal rather than rotary-head recording are used by the SPOT data recorders, providing the benefits of fixed heads and the elimination of rapidly rotating scanners. Recent recording technologies discussed include active tape tracking, application specific integrated circuits, and high-speed word generators and error rate counters. The use of fully-automatic bit synchronization, error elimination techniques, and high density rates in ground-segment data storage is also considered. R.R.

A88-39919
COMPARATIVE ANALYSIS OF RESULTS OF PHOTOGRAPHIC OBSERVATIONS OF NATURAL OBJECTS FROM SALYUT-7 [SRAVNITEL'NYI ANALIZ REZUL'TATOV FOTOS'EMKI PRIRODNYKH OB'EKTOV SO STANTSII 'SALIUT-7']
L. A. RONZHIN and IU. L. RESHTOGA Geodeziia i Kartografiia (ISSN 0016-7126), April 1988, p. 45-47. In Russian. refs

Photographs taken from space in spectral bands 10 and 40 nm wide are compared. It is shown that, in the 10-nm case, it is possible to satisfactorily identify a significant number of natural

objects, as well as to substantially enhance the contrast of objects on the background. Here, a positive effect is achieved for various natural objects, including soils, rocks, vegetation, and water bodies. B.J.

A88-40351#
SIR-B EXPERIMENTS IN JAPAN. I - SENSOR CALIBRATION EXPERIMENT
MASARU ICHINOSE, YOSHIMATSU ECHIZENYA, MITSUHIRO KAMATA, EIJI KAWAI, NORIHISA HIROMOTO et al. Radio Research Laboratory, Journal (ISSN 0033-8001), vol. 35, March 1988, p. 3-27. refs

A sensor calibration experiment was proposed as part of SIR-B experiments in Japan, together with the rice crop experiment and the ocean oil-pollution detection experiment. This sensor calibration experiment was intended (1) to establish a transfer function from image data to radar backscattering characteristics, (2) to evaluate 3-dB resolutions, (3) to verify the ability to resolve two closely-spaced targets, and (4) to clarify sidelobe structures due to range and azimuth compressions. The disused Akita Airport was chosen as the main test site for the calibration experiment on the first three objectives. This paper describes the test site, the design of the corner reflectors, and briefly predicts the results. Author

A88-40785*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
USING THE THERMAL INFRARED MULTISPECTRAL SCANNER (TIMS) TO ESTIMATE SURFACE THERMAL RESPONSES
J. C. LUVALL (NASA, National Space Technology Laboratories, Bay Saint Louis, MS) and H. R. HOLBO (Oregon State University, Corvallis) International Conference on Measurement of Soil and Plant Water Status, Utah State University, Logan, July 6-10, 1987, Paper. 7 p. refs
(Contract NAGW-924; NAS13-268)

A series of measurements was conducted over the H.J. Andrews, Oregon, experimental coniferous forest, using airborne thermal infrared multispectral scanner (TIMS). Flight lines overlapped, with a 28-min time difference between flight lines. Concurrent radiosonde measurements of atmospheric profiles of air temperature and moisture were used for atmospheric radiance corrections of the TIMS data. Surface temperature differences over time between flight lines were used to develop thermal response numbers (TRNs) which characterized the thermal response (in KJ/sq m/C, where K is the measured incoming solar radiation) of the different surface types. The surface types included a mature forest (canopy dominated by dense crowns of Pseudosuga menziesii, with a secondary canopy of dense Tsuga heterophylla, and also a tall shrub layer of Acer circinatum) and a two-year-old clear-cut. The temperature distribution, within TIMS thermal images was found to reflect the surface type examined. The clear-cut surface had the lowest TRN, while mature Douglas fir the highest. I.S.

A88-41093
GEOGRAPHIC STUDY OF THE NORTH COAST OF SENEGAL USING MOMS-1 SATELLITE DATA [ETUDE GEOGRAPHIQUE DE LA COTE NORD DU SENEGAL A PARTIR DES DONNEES SATELLITAIRES MOMS-1]
A. T. DIAW (Institut Fondamental d'Afrique Noire, Dakar, Senegal) and G. JOLY (Institut de Geographie, Paris, France) Societe Francaise de Photogrammetrie et de Teledetection, Bulletin (ISSN 0244-6014), no. 108, 1987, p. 5-23. In French. refs

The MOMS-1 (Modular Optoelectronic Multispectral Scanner) remote sensing system was used to obtain images of the Senegal River delta and the Atlantic coast in the Lompoul region. The MOMS images have a ground resolution of 20 x 20 m. Products such as digital data stored on tape, 1:800,000 images on film, and quick-looks are produced by the MOMS system. Data processing techiques described include histogram production, mathematical transformations for smoothing, the automatic detection of landscape boundaries based on luminance values obtained by Sobel nonlinear filtering, and the determination of ground irradiance and classification indexes. The kinematics of aeolian formations is also considered. R.R.

A88-41943
AMERICAN SOCIETY FOR PHOTOGRAMMETRY AND REMOTE SENSING AND ACSM, FALL CONVENTION, RENO, NV, OCT. 4-9, 1987, ASPRS TECHNICAL PAPERS
Convention sponsored by the American Society for Photogrammetry and Remote Sensing and ACSM. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, 423 p. For individual items see A88-41944 to A88-41958.

Recent advances in remote-sensing technology and applications are examined in reviews and reports. Topics addressed include the use of Landsat TM data to assess suspended-sediment dispersion in a coastal lagoon, the use of sun incidence angle and IR reflectance levels in mapping old-growth coniferous forests, information-management systems, Large-Format-Camera soil mapping, and the economic potential of Landsat TM winter-wheat crop-condition assessment. Consideration is given to measurement of ephemeral gully erosion by airborne laser ranging, the creation of a multipurpose cadaster, high-resolution remote sensing and the news media, the role of vegetation in the global carbon cycle, PC applications in analytical photogrammetry, multispectral geological remote sensing of a suspected impact crater, fractional calculus in digital terrain modeling, and automated mapping using GP-based survey data. T.K.

A88-41956
AN APPROACH FOR EMULATING THE COLOR BALANCE OF LANDSAT MULTISPECTRAL SCANNER IMAGES WITH AVHRR DATA
BILL P. CLARK (Computer Sciences Corp., Silver Spring, MD), FRANK G. SADOWSKI (TGS Technology, Inc., Sioux Falls, SD), and A. J. JOHNSON (Central Intelligence Agency, Langley, VA) IN: American Society for Photogrammetry and Remote Sensing and ACSM, Fall Convention, Reno, NV, Oct. 4-9, 1987, ASPRS Technical Papers. Falls Church, VA, American Society for Photogrammetry and Remote Sensing, 1987, p. 331-341.
(Contract USGS-14-08-0001-22521)

A mathematical procedure was developed for transforming the red and near-infrared (NIR) spectral bands of Advanced Very High Resolution Radiometer (AVHRR) data (bands 1 and 2) into three-band data space that approximates the response of Landsat Multispectral Scanner System (MSS) bands 1, 2, and 4. Color images incorporating the transformed AVHRR data emulate much of the tone and color balance of Landsat MSS color-infrared composite images. Comparative vegetative index calculations using the transformed AVHRR data and MSS data are well suited for combined visual and digital applications and can be used in multi-level sampling approaches to large-area monitoring programs. Author

A88-41976
SLAR AS A RESEARCH TOOL
G. P. DE LOOR and P. HOOGEBOOM (Centrale Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek, The Hague, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 115, 116. refs

In the early seventies for some time an FMI real aperture X-band SLAR with imaging on film was flown in the Netherlands. It showed many new and unexpected phenomena, in particular over the sea. It soon became clear that for a closer investigation of these phenomena an absolute and digital system is necessary. Being simple and straightforward and still giving sufficient coverage and resolution for the research purposes under consideration, a real aperture system was chosen. Its final construction and implementation required the efforts of several institutes. Radiometric and geometric errors caused by unwanted aircraft motions can now be corrected during the data processing and

resampling, resulting in a presentation of the data in a map corrected format. The radiometric accuracy of the system and its internal and external calibration are discussed. Author

A88-41985
SHUTTLE IMAGING RADAR (SIR-A) INTERPRETATION OF THE KASHGAR REGION IN WESTERN XINJIANG, CHINA
DIRK WERLE (F. G. Bercha and Associates /Ontario/, Ltd., Ottawa, Canada) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 187-192. refs

A88-41990
INSERTION OF HYDROLOGICAL DECORRALATED DATA FROM PHOTOGRAPHIC SENSORS OF THE SHUTTLE IN A DIGITAL CARTOGRAPHY OF GEOPHYSICAL EXPLORATION (SPACELAB 1-METRIC CAMERA AND LARGE FORMAT CAMERA)
G. GALIBERT IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 251-255. refs

Microphotographic enlargements of space images from the Shuttle Metric Camera and Large Format Camera are combined with digital maps from airborne sensors to produce flight documents for different aerial geophysical surveys through various data transmission networks using the Telecom 1 and Inmarsat satellites. Two IR 2443 false-color images and one black and white XX positive first copy from the Metric Camera and two black and white 3414 positive first copies from the Large Format Camera are compared. The compression of data using a digitalization of colors and problems of storage and daily transmission from central offices to field bases are discussed. R.B.

A88-41995
SELECTION OF BANDS FOR A NEWLY DEVELOPED MULTISPECTAL AIRBORNE REFERENCE-AIDED CALIBRATED SCANNER (MARCS)
M. A. MULDERS (Landbouwhogeschool, Wageningen, Netherlands), K. SCHURER (Technisch-Fysische Dienst voor de Landbouw, Wageningen, Netherlands), A. N. DE JONG (Centrale Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek, The Hague, Netherlands), and D. DE HOOP (International Institute for Aerospace Survey and Earth Sciences, Enschede, Netherlands) IN: Remote sensing for resources development and environmental management; Proceedings of the Seventh International Symposium, Enschede, Netherlands, Aug. 25-29, 1986. Volume 1. Rotterdam, A. A. Balkema, 1986, p. 301-303. refs

The principles of design and operation of a newly developed multispectral airborne reference-aided calibrated scanner (MARCS) are described. The 16-band MARCS contains, besides an array of detectors for the measurement of radiation reflected and emitted from the land surface, a reference sensor which measures the flux of radiation coming from above (from the sun and the sky) and a device for internal calibration of the signals derived from below, i.e., the reflected and emitted radiation of the land surface. The bands have a width between 50 nm and 150 nm in the 0.3-3 micron range but become broader in the 3-10 micron range. By the choice of the wavelength bands, the MARCS is suited for the detection of features on the surface of the earth of both mineralogical and agricultural interest. Both the reference and the calibration data are recorded during the flight, while the data processing is performed off line on a ground-based system. I.S.

A88-43227
ARTIFICIAL GCPS IN AIRCRAFT AND SATELLITE SCANNER IMAGERY
N. W. T. CHISHOLM and R. L. COLLIN (University College of Wales, Aberystwyth) International Journal of Remote Sensing (ISSN 0143-1161), vol. 9, April 1988, p. 799-821. refs

Results are presented of an experiment to determine the feasibility of providing artificial ground control points (GCPs) for controlling geometrical rectification procedures which are necessary to correct airborne scanner data and satellite imagery. These tests suggest that if proper consideration is given to the various factors governing the detectability of targets, more accurate ground control may be provided. Author

A88-44231
COMPARISON OF RADAR AND MICROWAVE RADIOMETER TECHNIQUES FOR DETERMINING PERMITTIVITY [SRAVNENIE RADIOLOKATSIONNOGO I SVCH RADIOMETRICHESKOGO METODOV OPREDELENIIA DIELEKTRICHESKOI PRONITSAEMOSTI]
V. P. IAKOVLEV and I. P. VUZMAN (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izucheniia Prirodnykh Resursov, Moscow, USSR) Radiofizika (ISSN 0021-3462), vol. 31, no. 4, 1988, p. 421-425. In Russian. refs

Radar and microwave radiometer methods of permittivity measurement are examined for slightly rough surfaces. The accuracies of the two methods are compared, and attention is given to the areas where the application of the two techniques are advantageous. The results are pertinent to the remote sensing of the earth's surface. B.J.

A88-44306
CLOUD AND PRECIPITATION REMOTE SENSING AT 94 GHZ
ROGER M. LHERMITTE (Miami, University, FL) IEEE Transactions on Geoscience and Remote Sensing (ISSN 0196-2892), vol. 26, May 1988, p. 207-216. refs
(Contract DAAG29-84-K-0145)

The use of short millimeter-wave Doppler radars for the observation of clouds and precipitation is discussed. Attenuation and scattering (including Mie backscattering by raindrops) of this short-wavelength radiation by hydrometers is discussed as well as the sensitivity of such radars for the observation of clouds. I.E.

A88-44449
NEW FEATURES OF THE LMK AERIAL CAMERA SYSTEM
ULRICH ZETH Jena Review (ISSN 0448-9497), vol. 32, no. 4, 1987, p. 174-176.

Extended intrument functions of the LMK aerial camera system are presented. The new features include a lens cone of 210 mm focal length, the extension of the range of forward motion compensation, and the introduction of half stop increments to reduce the jumps in the shutter speed occuring in exposure control when changing the f-stop setting. The possibility of taking simultaneous photographs with several LMK systems, the optimization of the exposure of the fiducial marks and of the data margin images, and the additional exposure of alpha-numeric auxiliary data are also discussed. R.B.

A88-44450
KARTOFLEX - AN INSTRUMENT FOR COMPUTER-AIDED PHOTOINTERPRETATION AND MAP REVISION
WERNER MARCKWARDT and ARNOLD ZEMANN Jena Review (ISSN 0448-9497), vol. 32, no. 4, 1987, p. 183-185.

A computer-aided photointerpretation and map revision instrument is examined, giving a description of the instrument equipment and its applications. The viewing unit allows for continuous (between 2.4 and 12) magnification with pancratic systems. Another pancratic system allows for 0.8 to 4 magnification. The microcomputer system contains test, orientation, area calculation, and distance calculation programs. Uses of the system and its applications for map interpretation and verification are discussed. R.B.

A88-44519
COMPARATIVE EVALUATION OF THE LARGE FORMAT CAMERA, METRIC CAMERA, AND SHUTTLE IMAGING RADAR - A DATA CONTENT
C. P. LO (Georgia, University, Athens) Photogrammetric Engineering and Remote Sensing (ISSN 0099-1112), vol. 54, June 1988, p. 731-742. Research supported by the University of Georgia. refs

LFC photography, MC photography, and SIR-A data were evaluated on their thematic contents in satisfying the requirements for topographic mapping at 1:100,000 scale. The study area of Mobile, Alabama - Pensacola, Florida was selected because of the availability of these three types of images. USGS topographic maps at 1:24,000, 1:100,000, and 1:250,000 scales were used as a standard for comparison for the completeness of linear and areal features (LAFs). It was found that the LFC photography provided nearly complete areal features and a sufficient amount of linear features for topographic mapping. The MC photography was the worst of all in revealing LAFs, although planimetrically it was the most accurate. The SIR-A data revealed an adequate amount of LAFs to complement LFC and MC photography, especially in times of poor weather conditions. It was concluded that each type of space photograph alone could not provide sufficient details for 1:100,000-scale topographic mapping, and an approach to form stereopairs of different image types was suggested. Author

N88-20715# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANALYSIS FOR ARCHITECTURE FOR IMAGE PROCESSING [ANALISE DE ARQUITETURAS PARA PROCESSAMENTO DE IMAGENS]
CELSO LUIZ MENDES, GILBERTO GAMARANETO, JOSE CLAUDIO MURA, JUAN CARLOS PINTODEGARRIDO, and RICARDO CARTAXOMODESTODESOUZA Aug. 1987 18 p In PORTUGESE Presented at the 1st Brazilian Symposium Computer Architecture-Parallel Processing, Gramado, RS, 13-15 May 1987
(INPE-4294-PRE/1165) Avail: NTIS HC A03/MF A01

After a brief introduction on image processing activities at INPE, the principal characteristics of the system family SITIM are presented, followed by a presentation of procedure types most utilized in image processing. Discussed are some options already tested for augmentation on the system execution, through the use of accelerator plates and, lastly, the perspectives for future development are presented, some in the areas of accelerator plates, as systems based on parallel architecture, associated unity of advanced images. Author

N88-21584*# Arizona Univ., Tucson. Optical Sciences Center.
THE ABSOLUTE RADIOMETRIC CALIBRATION OF THE ADVANCED VERY HIGH RESOLUTION RADIOMETER
Semiannual Status Report
P. N. SLATER, P. M. TEILLET, and Y. DING Apr. 1988 17 p
(Contract NAG5-859)
(NASA-CR-182755; NAS 1.26:182755) Avail: NTIS HC A03/MF A01 CSCL 08B

The need for independent, redundant absolute radiometric calibration methods is discussed with reference to the Thematic Mapper. Uncertainty requirements for absolute calibration of between 0.5 and 4 percent are defined based on the accuracy of reflectance retrievals at an agricultural site. It is shown that even very approximate atmospheric corrections can reduce the error in reflectance retrieval to 0.02 over the reflectance range 0 to 0.4. Author

N88-22449# Massachusetts Inst. of Tech., Cambridge. Artificial Intelligence Lab.
RELATIVE ORIENTATION
BERTHOLD K. HORN Sep. 1987 32 p
(Contract N00014-85-K-0124; DACA76-85-C-0100)
(AD-A190385; AD-E801598; AI-M-994) Avail: NTIS HC A03/MF A01 CSCL 08B

Before corresponding points in images taken with two cameras can be used to recover distances to objects in a scene, one has to determine the position and orientation of one camera relative to the other. This is the classic photogrammetric problem of relative orientation, central to the interpretation of binocular stereo information. Iterative methods for determining relative orientation were developed long ago; without them we would not have most of the topographic maps we do today. Relative orientation is also of importance in the recovery of motion and shape from an image sequence when successive frames are widely separated in time. Workers in motion vision are rediscovering some of the methods of photogrammetry. Described here is a particularly simple iterative scheme of recovering relative orientation that, unlike existing methods, does not require a good initial guess for the baseline and the rotation. The data required is a set of pairs of corresponding rays from the two projection centers to points in the scene. It is well known that at least five pairs of rays are needed. Less appears to be known about the existence of multiple solutions and their interpretation. These issues are discussed here in detail. GRA

N88-23301# Begeleidingscommissie Remote Sensing, Delft (Netherlands).
THE RADIOMETRIC PROCESSING OF SLAR MEASURING VALUES USING THE PARES PROGRAM [DE RADIOMETRISCHE BEWERKINGEN OP SLAR MEETWAARDEN DOOR HET PARES PROGRAMMA]
H. POUWELS (National Aerospace Lab., Amsterdam, Netherlands) Aug. 1986 15 p In DUTCH
(BCRS-86-04; ETN-88-91551) Avail: NTIS HC A03/MF A01

The radiometric processing of calibration measurements using the Preprocessing Airborne Remote Sensing (PARES) program is described. The internal single-point calibration pulse with which the digital side-looking radar (SLAR) is equipped, is described. The demodulation and digitizing of the radar output are explained. The PARES program is described. The global effect of the different losses is determined using an external calibration. An absolute level can be assigned to the preprocessed images. ESA

N88-23932*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
THE SHUTTLE IMAGING RADAR B (SIR-B) EXPERIMENT REPORT
JO BEA CIMINO, BENJAMIN HOLT, and ANNIE RICHARDSON 15 Mar. 1988 223 p
(Contract NAS7-918)
(NASA-CR-182923; NAS 1.26:182923; JPL-PUBL-88-2) Avail: NTIS HC A10/MF A01 CSCL 17I

The primary objective of the SIR-B experiment was to acquire multiple-incidence-angle radar imagery of a variety of Earth's surfaces to better understand the effects of imaging geometry on radar backscatter. A complementary objective was to map extensive regions of particular interest. Under these broad objectives, many specific scientific experiments were defined by the 43 SIR-B Science Team members, including studies in the area of geology, vegetation, radar penetration, oceanography, image analysis, and calibration technique development. Approximately 20 percent of the planned digital data were collected, meeting 40 percent of the scientific objectives. This report is an overview of the SIR-B experiment and includes the science investigations, hardware design, mission scenario, mission operations, events of the actual missions, astronaut participation, data products (including auxiliary data), calibrations, and a summary of the actual coverage. Also included are several image samples. Author

N88-24013# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LATIN AMERICAN SYMPOSIUM ON REMOTE SENSING. 4TH BRAZILIAN REMOTE SENSING SYMPOSIUM AND 6TH SELPER PLENARY MEETING, VOLUME 1
1986 798 p In PORTUGUESE; ENGLISH summary Symposium held in Gramado, Brazil, 10-15 Aug. 1986 Prepared in cooperation with Sociedad de Especialistas Latinoamericanos en Percepcion

Remota, Chile, and Sociedade Brasileira de Cartografia, Geodesia, Fotogrametria e Sensoriamento Remoto
Avail: NTIS HC A99/MF E03

Topics addressed include: crop cover estimation; rain penetration; forest resources in Uruguay; geometric correction of data; satellite imagery; thematic mapping; surface morphology; spatial filtering; remote sensing problems; image classifications; remote sensing; geographical information systems; computer techniques; spectral behavior of crops; tectonics; data processing; cartography; image processing; archeology; aerial photography; geological structures.

N88-24029# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE MODELING OF ERROR BUDGET ANALYSIS AND TOLERANCE SPECIFICATIONS FOR BRESEX MULTIBAND LINEAR ARRAY CCD CAMERA Abstract Only
G. K. RAYALU *In its* Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 254 1986
Avail: NTIS HC A99/MF E03

In multispectral imaging, precise image-to-image registration is necessary to form a color composite. The accuracy to which images may be registered depends on many factors. Achieving a half-a-pixel registration error between corresponding elements of any two bands in an involved task and calls for stringent specifications on various sub-systems of a camera. An attempt is made to present what are the sources of error, how to distribute them on a RMS basis to achieve a given total registration error and derive tolerance specifications for the sub-system components and for the alignment of the BRESEX camera. The final error budget is checked for its practicability, considering various options and making full use of the available state-of-the-art technology. Author

N88-24035# United Nations, New York, N. Y. Outer Space Affairs Div.
THE USSR SPACE SYSTEMS FOR REMOTE SENSING OF EARTH RESOURCES AND THE ENVIRONMENT (SENSOR SYSTEMS, PROCESSING TECHNIQUES, APPLICATIONS) Abstract Only
ROLF-PETER OESBERG *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 317 1986
Avail: NTIS HC A99/MF E03

The two main techniques in present use of sensing multispectral information for different applications are photography or scanning with detector arrays from air- or space-borne platforms. The USSR remote sensing program has included manned missions on Soyuz spacecraft and Salyut orbital stations, and regular missions of Meteor and Meteor-Priroda (Meteor-Nature) operational satellites carrying multispectral sensor systems. Photography from space was acquired in the early and mid-1970s from the short-duration manned missions on Soyuz spacecraft using single-band and multiband cameras. The MKF-6 multiband camera was first flown on Soyuz-22 in 1976 and was subsequently developed further and flown on many missions, including Salyut-6 and 7. The design and technical parameters of this camera and other sensor systems that were flown on board the USSR spacecraft include the KATE-140 photographic camera on the Salyut-6 and 7 and the scanner systems MSU-M, MSU-S, MSU-SK, Fragment-2 and MSU-E on board the spacecraft Meteor and Meteor-Piroda, basic methodologies of image interpretation and processing techniques and examples of different applications. The technical parameters of these sensor systems are compared with those form other photographic and scanner systems launched or planned. Author

N88-24090# Universidade Estadual de Paulista, Guaratingueta (Brazil). Departamento de Planejamento Regional.
CURRENT STAGE OF REMOTE SENSING SYSTEM FOR CARTOGRAPHIC APPLICATION [ESTAGIO ATUAL DOS SISTEMAS DE SENSORIAMENTO REMOTO DE APLICACAO CARTOGRAFICA]
M. I. C. DEFREITAS *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 741-753 1986 In PORTUGUESE; ENGLISH summary
Avail: NTIS HC A99/MF E03

This work is based upon the need for a better and up-to-date knowledge of existing remote sensing systems or those ready to be activated. The objective is to discuss the principal sensors and cameras with regard to their applications on cartography and photointerpretation. Initially the spatial photogrammetry (LFC, metric camera) is presented followed by the passive imaging systems (LANDSAT, MOMS, TERS, MAPSAT). Next the active imaging systems (RADAR, SLAR, SEASAT, ERS-1, RADARSAT, SIR-A, SIR-B) are shown. A comparative panel of the sensors studied with their main characteristics is presented. Among these characteristics some are mentioned: imaging mode, satellite orbit, height, circle, width of the imaged strip, resolution, possibility for stereoscopic vision, available products, and mapping applications. As a conclusion, the evolution of such systems with respect to accuracy, imaging speed, and the increasing number of different products obtainable was noted. Author

N88-24105# Technische Hogeschool, Delft (Netherlands). Dept. of Geodesy.
ADJUSTMENT IN PHOTOGRAMMETRY: METHODS, PROGRAMS AND APPLICATIONS Thesis
[BLOKVEREFFENING IN DE FOTOGRAMMETRIE: METHODEN, PROGRAMMATUUR EN TOEPASSINGEN]
F. DETMAR Nov. 1987 115 p In DUTCH; ENGLISH summary
(B8735130; ETN-88-92419) Avail: NTIS HC A06/MF A01

Adjustment programs and the application of nonphotogrammetric information in photogrammetry are discussed. The nonphotogrammetric data are from control objects, the Global Positioning System, and auxiliary data from horizon camera, statoscope, and the airborne profile recorder. Aerotriangulation and adjustment procedures are described with regard to the method with independent models and the method with bundles. Test procedures and error search methods such as data snooping and robust estimation are considered. Precision of the method with bundles is better than the method with independent models. For both methods the reliability measures are in good agreement with each other. The application of additional parameters is easy to manage for the bundle method in contrast with the method with independent models. Additional parameters seem not to be necessary for the method with independent models, because this method is insensitive to systematic errors. Auxiliary data only seem sufficient for small scale projects. The Global Positioning System might be used to determine terrain control point coordinates as well as to determine the projection center coordinates which can also be used as control points. ESA

N88-24387*# New Mexico Univ., Albuquerque. Technology Application Center.
REVIEW OF POWER REQUIREMENTS FOR SATELLITE REMOTE SENSING SYSTEMS
STANLEY A. MORAIN *In its* Transactions of the Fifth Symposium on Space Nuclear Power Systems p 55-63 1988
(Contract NASW-4191)
Avail: NTIS HC A99/MF A01 CSCL 22B

The space environment offers a multitude of attributes and opportunities to be used to enhance human life styles and qualities of life for all future generations, worldwide. Among the prospects having immense social as well as economic benefits are earth-observing systems capable of providing near real-time data in such areas as food and fiber production, marine fisheries, ecosystem monitoring, disaster assessment, and global environmental exchanges. The era of Space Station, the Shuttle program, the planned unmanned satellites in both high and low Earth orbit will transfer to operational status what, until now, has been largely research and development proof of concept for remotely sensing Earth's natural and cultural resources. An

important aspect of this operational status focuses on the orbital designs and power requirements needed to optimally sense any of these important areas. Author

09

GENERAL

Includes economic analysis.

A88-32919*# Science Applications International Corp., Washington, D.C.
APPROACH AND STATUS FOR A UNIFIED NATIONAL PLAN FOR SATELLITE REMOTE SENSING RESEARCH AND DEVELOPMENT
KRISTINE BUTERA and DAVID J. OKERSON (Science Applications International Corp., Washington, DC) IN: Thematic Conference on Remote Sensing for Exploration Geology, 5th, Reno, NV, Sept. 29-Oct. 2, 1986, Proceedings. Volume 1. Ann Arbor, MI, Environmental Research Institute of Michigan, 1987, p. 325-331. NOAA-supported research.
(Contract NASW-4092)

Public Law 98-365, the Land Remote-Sensing Commercialization Act of 1984, requires that the Secretary of the Department of Commerce and the Administrator of the National Aeronautics and Space Administration 'shall, within one year after the date of the Law's enactment and biennially thereafter, jointly develop and transmit to the Congress a report that includes (1) a unified national plan for remote-sensing research and development applied to the earth and its atmosphere; (2) a compilation of progress in the relevant on-going research and development activities of Federal agencies; and (3) an assessment of the state of our knowledge of the Earth and its atmosphere, the needs for additional research (including research related to operational Federal remote-sensing space programs), and opportunities available for further progress'. NASA and NOAA have organized a series of public forums to encourage interest and discussion of the national plan. Author

A88-45110#
MISSION TO PLANET EARTH
D. JAMES BAKER (Joint Oceanographic Institution, Inc., Washington, DC) Aerospace America (ISSN 0740-722X), vol. 26, July 1988, p. 44-46.

Plans for environmental monitoring using remote-sensing satellites in the era of the International Space Station are reviewed. The role of international cooperation is stressed, considering the present Landsat, SPOT, and Marine Observation Satellite programs; ERS-1 and Topex/Poseidon; and plans for the Italian Lageos-2, the Indian Remote Sensing Satellite, and the Japanese Advanced Earth Observation Satellite. The NASA Mission to Planet Earth proposal calls for four polar-orbit and five GEO platforms (five NASA, two ESA, and two NASDA), to be in place by the year 2000, as well as dedicated spacecraft of the Earth System Explorer series in the 1990s. Payloads will monitor the geomagnetic field, atmospheric temperature and water vapor, O3 and aerosols, outgoing radiation, precipitation, sea-surface temperature, sea ice, ocean chlorophyll, surface winds, wave height, ocean circulation, snow cover, land use, vegetation, crops, volcanic activity, and the hydrologic cycle. T.K.

N88-21087# Executive Office of the President, Washington, D.C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT: 1986 ACTIVITIES
1986 141 p
Avail: NTIS HC A07/MF A01

The achievements of aeronautics and space programs in the United States for 1986 are summarized in the areas of communications: Earth atmosphere, environment, and resources; space science; space transportation; commercial use of space; space tracking and data systems, space station; and aeronautics and space research and technology. The achievements of each of the following organizations are described: NASA, the Departments of Defense, Commerce, Energy, Interior, Agriculture, Transportation and State, the Federal Communications Commission, Environmental Protection Agency, National Science Foundation, Smithsonian Institution, Arms Control and Disarmament Agency and USIA. Appendices provide historical information on launches, satellites, manned and ummanned spacecraft, and Federal budgets for aeronautical and astronautical activities.
Author

N88-24038# European Space Agency, Paris (France).
INTERNATIONAL COOPERATION IN REMOTE SENSING: THE ESA EXPERIENCE Abstract Only
VALERIE ANNE HOOD *In* INPE, Latin American Symposium on Remote Sensing. 4th Brazilian Remote Sensing Symposium and 6th SELPER Plenary Meeting, Volume 1 p 337 1986
Avail: NTIS HC A99/MF E03

The active involvement of the European Space Agency (ESA) with remote sensing began with the establishment of the Earthnet program in 1978. Earthnet acquires data from the American remote sensing satelites (LANDSAT, SEASAT, HCCM, and Nimbus) from its stations in Fulcino, Kiruna, Oakhanger, and Maspalomas. Earthnet acquires remote sensing data and preprocesses them. Each member state of ESA has established a focal point who is responsible for remote sensing data distribution in their country. Regular meetings are held among the national points of contact and the other users of the data in the Earthnet coverage zone. The European Space Agency also participates in the LANDSAT Station Operators' Working Group. At a bilateral level ESA has many projects with the European Community including airborne campaigns, pilot projects, and training programs. Close contact in remote sensing is also kept with Brazil, Canada, France, United States, Japan, India, and Australia on a bilateral basis. On the meteorological side, ESA has launched Meteosats 1 and 2 and will be launching Meteosat 3 this year. An extensive promotion campaign was carried out in Europe and Africa to encourage countries to use the satellite. Training programs in meteorology and agrometeorology are conducted both by ESA alone and in cooperation with other organizations. The European Space Agency is also preparing ERS-1 and is in the process of negotiating terms for direct access with several states. Author

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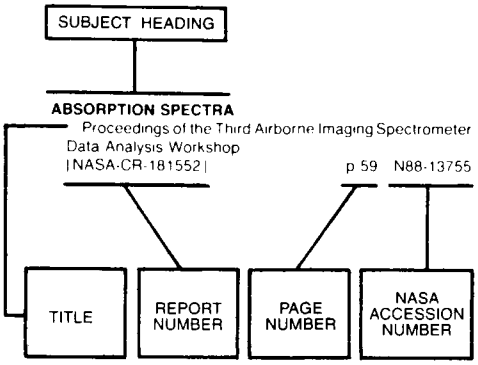

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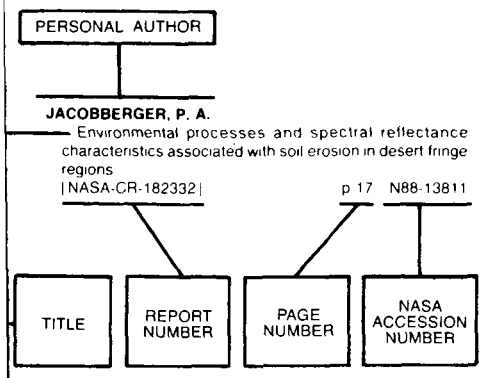

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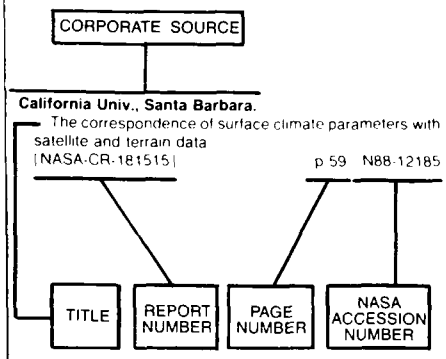

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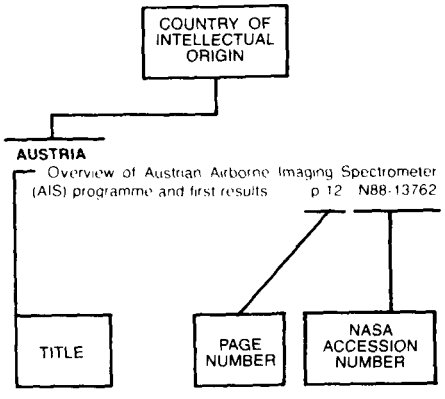

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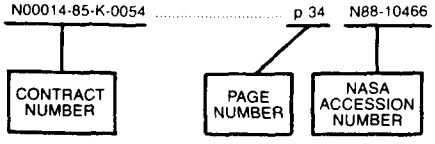

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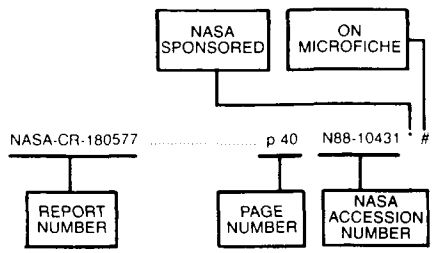

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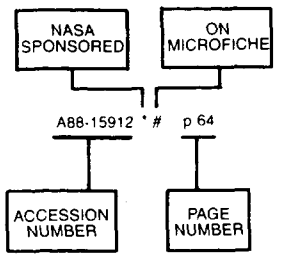

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(602) 255-4121

UNIVERSITY OF ARIZONA LIB.
Government Documents Dept.
Tucson, AZ 85721
(602) 621-6433

ARKANSAS

ARKANSAS STATE LIBRARY
One Capitol Mall
Little Rock, AR 72201
(501) 371-2326

CALIFORNIA

CALIFORNIA STATE LIBRARY
Govt. Publications Section
P.O. Box 2037
Sacramento, CA 95809
(916) 324-4863

COLORADO

UNIV OF COLORADO LIB.
Government Pub. Division
Campus Box 184
Boulder, CO 80309
(303) 492-8834

DENVER PUBLIC LIBRARY
Govt. Pub. Department
1357 Broadway
Denver, CO 80203
(303) 571-2131

CONNECTICUT

CONNECTICUT STATE LIBRARY
Government Documents Unit
231 Capitol Avenue
Hartford, CT 06106
(203) 566-7029

FLORIDA

UNIV. OF FLORIDA LIBRARIES
Library West
Documents Department
Gainesville, FL 32611
(904) 392-0367

GEORGIA

UNIV. OF GEORGIA LIBRARIES
Government Reference Dept.
Athens, GA 30602
(404) 542-8949

HAWAII

UNIV. OF HAWAII LIBRARY
Govt. Documents Collection
2550 The Mall
Honolulu, HI 96822
(808) 948-8230

IDAHO

UNIV. OF IDAHO LIBRARY
Documents Section
Moscow, ID 83843
(208) 885-6344

ILLINOIS

ILLINOIS STATE LIBRARY
Information Services Branch
Centennial Building
Springfield, IL 62756
(217) 782-5185

INDIANA

INDIANA STATE LIBRARY
Serials Documents Section
140 North Senate Avenue
Indianapolis, IN 46204
(317) 232-3686

IOWA

UNIV. OF IOWA LIBRARIES
Govt. Documents Department
Iowa City, IA 52242
(319) 353-3318

KANSAS

UNIVERSITY OF KANSAS
Doc. Collect—Spencer Lib.
Lawrence, KS 66045-2800
(913) 864-4662

KENTUCKY

UNIV. OF KENTUCKY LIBRARIES
Govt. Pub. Department
Lexington, KY 40506-0039
(606) 257-3139

LOUISIANA

LOUISIANA STATE UNIVERSITY
Middleton Library
Govt. Docs. Dept.
Baton Rouge, LA 70803
(504) 388-2570

LOUISIANA TECHNICAL UNIV. LIBRARY
Documents Department
Ruston, LA 71272-0046
(318) 257-4962

MAINE

UNIVERSITY OF MAINE
Raymond H. Fogler Library
Tri-State Regional Documents Depository
Orono, ME 04469
(207) 581-1680

MARYLAND

UNIVERSITY OF MARYLAND
McKeldin Lib.—Doc. Div.
College Park, MD 20742
(301) 454-3034

MASSACHUSETTS

BOSTON PUBLIC LIBRARY
Government Docs. Dept.
Boston, MA 02117
(617) 536-5400 ext.226

MICHIGAN

DETROIT PUBLIC LIBRARY
Sociology Department
5201 Woodward Avenue
Detroit, MI 48202-4093
(313) 833-1409

MICHIGAN STATE LIBRARY
P.O. Box 30007
Lansing, MI 48909
(517) 373-1593

MINNESOTA

UNIVERSITY OF MINNESOTA
Government Pubs. Division
409 Wilson Library
309 19th Avenue South
Minneapolis, MN 55455
(612) 373-7870

MISSISSIPPI

UNIV. OF MISSISSIPPI LIB.
Documents Department
University, MS 38677
(601) 232-5857

MONTANA

UNIV. OF MONTANA
Mansfield Library
Documents Division
Missoula, MT 59812
(406) 243-6700

NEBRASKA

UNIVERSITY OF NEBRASKA - LINCOLN
Love Library
Documents Department
Lincoln, NE 68588-0410
(402) 472-2562

NEVADA

UNIVERSITY OF NEVADA LIB.
Govt. Pub. Department
Reno, NV 89557-0044
(702) 784-6579

NEW JERSEY

NEWARK PUBLIC LIBRARY
5 Washington Street
Newark, NJ 07101-0630
(201) 733-7812

NEW MEXICO

UNIVERSITY OF NEW MEXICO
Zimmerman Library
Government Pub. Dept.
Albuquerque, NM 87131
(505) 277-5441

NEW MEXICO STATE LIBRARY
Reference Department
325 Don Gaspar Avenue
Santa Fe, NM 87503
(505) 827-3826

NEW YORK

NEW YORK STATE LIBRARY
Empire State Plaza
Albany, NY 12230
(518) 474-5563

NORTH CAROLINA

UNIVERSITY OF NORTH CAROLINA AT CHAPEL HILL
Davis Library
BA/SS Documents Division
Chapel Hill, NC 27515
(919) 962-1151

NORTH DAKOTA

UNIVERSITY OF NORTH DAKOTA
Chester Fritz Library
Documents Department
Grand Forks, ND 58202
(701) 777-4629
In cooperation with North Dakota State Univ. Library

OHIO

STATE LIBRARY OF OHIO
Documents Department
65 South Front Street
Columbus, OH 43266-0334
(614) 462-7051

OKLAHOMA

OKLAHOMA DEPT. OF LIB.
Government Documents
200 NE 18th Street
Oklahoma City, OK 73105
(405) 521-2502, ext. 252

OKLAHOMA STATE UNIV. LIB.
Documents Department
Stillwater, OK 74078
(405) 624-6546

OREGON

PORTLAND STATE UNIV. LIB.
Documents Department
P.O. Box 1151
Portland, OR 97207
(503) 229-3673

PENNSYLVANIA

STATE LIBRARY OF PENN.
Government Pub. Section
P.O. Box 1601
Harrisburg, PA 17105
(717) 787-3752

TEXAS

TEXAS STATE LIBRARY
Public Services Department
P.O. Box 12927—Cap. Sta.
Austin, TX 78711
(512) 475-2996

TEXAS TECH. UNIV. LIBRARY
Govt. Documents Department
Lubbock, TX 79409
(806) 742-2268

UTAH

UTAH STATE UNIVERSITY
Merrill Library, U.M.C. 30
Logan, UT 84322
(801) 750-2682

VIRGINIA

UNIVERSITY OF VIRGINIA
Alderman Lib.—Public Doc.
Charlottesville, VA 22903-2498
(804) 924-3133

WASHINGTON

WASHINGTON STATE LIBRARY
Documents Section
Olympia, WA 98504
(206) 753-4027

WEST VIRGINIA

WEST VIRGINIA UNIV. LIB.
Documents Department
Morgantown, WV 26506-6069
(304) 293-3640

WISCONSIN

MILWAUKEE PUBLIC LIBRARY
814 West Wisconsin Avenue
Milwaukee, WI 53233
(414) 278-3065

ST. HIST LIB. OF WISCONSIN
Government Pub. Section
816 State Street
Madison, WI 53706
(608) 262-4347

WYOMING

WYOMING STATE LIBRARY
Supreme Ct. & Library Bld.
Cheyenne, WY 82002
(307) 777-5919

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