ACCESSION NUMBER RANGES

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

STAR (N-10000 Series) N83-10001 - N83-16274
IAA (A-10000 Series) A83-10001 - A83-19623

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EARTH RESOURCES

A CONTINUING BIBLIOGRAPHY
WITH INDEXES

Issue 37

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between January 1 and March 31, 1983 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA)*.
This supplement is available as NTISUB/038/093 from the National Technical Information Service (NTIS), Springfield, Virginia 22161 at the price of $12.50 domestic; $25.00 foreign for standing orders. Please note: Standing orders are subscriptions which do not terminate at the end of a year, as do regular subscriptions, but continue indefinitely unless specifically terminated by the subscriber.
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 512 reports, articles, and other documents announced between January 1 and March 31, 1983 in Scientific and Technical Aerospace Reports (STAR), and International Aerospace Abstracts (IAA).

The coverage includes documents related to the identification and evaluation by means of sensors in spacecraft and aircraft of vegetation, minerals, and other natural resources, and the techniques and potentialities of surveying and keeping up-to-date inventories of such riches. It encompasses studies of such natural phenomena as earthquakes, volcanoes, ocean currents, and magnetic fields; and such cultural phenomena as cities, transportation networks, and irrigation systems. Descriptions of the components and use of remote sensing and geophysical instrumentation, their subsystems, observational procedures, signature and analyses and interpretive techniques for gathering data are also included. All reports generated under NASA's Earth Resources Survey Program for the time period covered in this bibliography will also be included. The bibliography does not contain citations to documents dealing mainly with satellites or satellite equipment used in navigation or communication systems, nor with instrumentation not used aboard aerospace vehicles.

The selected items are grouped in nine categories. These are listed in the Table of Contents with notes regarding the scope of each category. These categories were especially chosen for this publication, and differ from those found in STAR and IAA.

Each entry consists of a standard bibliographic citation accompanied by an abstract. The citations and abstracts are reproduced exactly as they appeared originally in STAR, or IAA, including 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 A83-10,000 in ascending accession number order;
- STAR entries identified by accession number series N83-10,000 in ascending accession number order.

After the abstract section, there are six indexes:
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# TABLE OF CONTENTS

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| 01       | Agriculture and Forestry  
Includes crop forecasts, crop signature analysis, soil identification, disease detection, harvest estimates, range resources, timber inventory, forest fire detection, and wildlife migration patterns. | 1    |
| 02       | Environmental Changes and Cultural Resources  
Includes land use analysis, urban and metropolitan studies, environmental impact, air and water pollution, geographic information systems, and geographic analysis. | 18   |
| 03       | Geodesy and Cartography  
Includes mapping and topography. | 23   |
| 04       | Geology and Mineral Resources  
Includes mineral deposits, petroleum deposits, spectral properties of rocks, geological exploration, and lithology. | 30   |
| 05       | Oceanography and Marine Resources  
Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location | 38   |
| 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. | 49   |
| 07       | Data Processing and Distribution Systems  
Includes film processing, computer technology, satellite and aircraft hardware, and imagery. | 54   |
| 08       | Instrumentation and Sensors  
Includes data acquisition and camera systems and remote sensors. | 67   |
| 09       | General  
Includes economic analysis. | 72   |

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### TYPICAL CITATION AND ABSTRACT FROM STAR

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<td>AUTHOR</td>
<td>R. FECSO, W. GARDNER, B. HALE, V. JOHNSON, and S. PAVLASEK</td>
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A remotely sensed area sampling frame was constructed for selected areas in Southern Brazil. The sampling unit information was stored in digital form in a latitudinal/longitudinal characterized population. Computerized sampling procedures were developed which allow for flexibility in sample unit specifications and sampling designs.

### TYPICAL CITATION AND ABSTRACT FROM IAA

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Ocean Color Experiment (OCE) on the OSTA-1 mission acquired ocean images at several widely separated locations on the earth. Digital computer enhancement and band ratioing techniques were used to emphasize patterns of chlorophyll and sediment distribution in the Yellow Sea and, in one case, of bottom topography in the Great Bahama Bank. Two scenes in the Gulf of Cadiz from orbits 30 and 32 were geometrically corrected to show the movement of plankton patches. This technique enabled ocean current velocities to be deduced. A duplicate of the OCE instrument mounted on a DFVLR aircraft was flown over an area of the Atlantic Ocean off the coast of Portugal during the Shuttle mission.
Agriculture and Forestry

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


SEASAT L-BAND RADAR RESPONSE TO FOREST VEGETATION IN EASTERN VIRGINIA

A83-10065* Purdue Univ., Lafayette, Ind.

APPLICATION OF COMPUTER AXIAL TOMOGRAPHY /CAT/ TO MEASURING CROP CANOPY GEOMETRY

A83-10067* National Aeronautics and Space Administration.

LANDSAT MONITORING OF DESERT LOCUST BREEDING GROUNDS IN AFRICA, THE NEAR EAST AND SOUTHWEST ASIA
(Contract F19628-80-C-0052; NSF ENG-78-23145)

A method is developed to study the scattering of electromagnetic waves from periodic rough surfaces of dielectric media in order to improve the theory of the microwave remote sensing of plowed vegetation fields with row structures. The results of the theoretical investigation are also compared with experimental data obtained at optical frequencies, and they are found to be in excellent agreement. It is concluded that these results explain the serious discrepancies that existed in previous examinations of theory and experiment where only a perfect conductor model was used.

A83-10106 REMOTE SENSING OF DIELECTRIC MEDIA WITH PERIODIC ROUGH SURFACES
(Contract F19628-80-C-0052; NSF ENG-78-23145)

A backscatter model for a randomly perturbed periodic surface has been developed to explain backscatter measurements from a bare soil surface with row structure. It is assumed that the row-direction effect can be included by integrating the scattering coefficient due to the random roughness component over the underlying periodic component of the soil surface. It is found that the row-direction effect is strongly dependent upon the rate of change of this scattering coefficient with the local angle, and that the maximum difference between looking parallel and perpendicular to the row direction occurs around an incidence angle whose tangent is equal to the slope of the periodic surface at the inflection point.


A BACKSCATTER MODEL FOR A RANDOMLY PERTURBED PERIODIC SURFACE
(Contract NAG5-30)

A backscatter model for a randomly perturbed periodic surface has been developed to explain backscatter measurements from a bare soil surface with row structure. It is assumed that the row-direction effect can be included by integrating the scattering coefficient due to the random roughness component over the underlying periodic component of the soil surface. It is found that the row-direction effect is strongly dependent upon the rate of change of this scattering coefficient with the local angle, and that the maximum difference between looking parallel and perpendicular to the row direction occurs around an incidence angle whose tangent is equal to the slope of the periodic surface at the inflection point.

(Author)
A method currently used to derive agrophysical units (APUs), i.e., geographical areas having definable/comparable agronomic characteristics, and the NOAA series (especially the instrument imager (e.g., Multispectral Scanner of Landsat) on an early remote sensing system. V.L.

COMBINING LAND USE DATA ACQUIRED FROM LANDSAT WITH SOIL MAP DATA


A method currently used to derive agrophysical units (APUs), i.e., geographical areas having definable/comparable agronomic and physical parameters which reflect a range in agricultural use and management, is discussed with reference to results obtained for South Dakota and an area in China. The method consists of combining agricultural land use data acquired from Landsat with soil map data. The resulting map units are soil associations characterized by cropland use intensity, and they can be used to identify major cropland areas and to develop a rating reflecting the relative potential of the soils in the delineated area for crop production, as well as to update small-scale soil maps. V.L.

ANALYZING AND MAPPING REGIONAL LAND USE TRENDS BY COMBINING LANDSAT AND TOPOGRAPHIC DATA


Digital Landsat data and U-2 aerial photography for the Columbia Plateau region of eastern Washington and Oregon have been analyzed in order to estimate the amount of growth in irrigated cropland between 1975 and 1979. The classified scenes were registered with a stereographic map projection using USGS digital terrain data files and merged into one file. Irrigated cropland, water, and other land cover classes within this file were edited to conform with U-2 aerial photographs and Landsat color composite prints from 1975 and 1979. Land use data derived from 1975 Landsat imagery were registered to the same map projection and, in a map displaying irrigated cropland in 1979 and growth of irrigated cropland between 1975 and 1979 was produced using the discrete table lookup method. The total irrigated cropland for 1979 was found to be 4281 square miles, which represents a 20% increase over 1975 with an accuracy of 90%. The amount and location of the new irrigated cropland provides essential input into ongoing ground water studies for this region. (Author)

SATELLITE ORBITAL DYNAMICS AND OBSERVATION STRATEGIES IN SUPPORT OF AGRICULTURAL APPLICATIONS


The operational satellites (GOES, NOAA) and the proto-operational satellite (Landsat) acquire data suitable for agricultural applications representing a wide range of coverage frequencies and spatial resolution. The geosynchronous (GOES) satellites provide highly repetitive low spatial resolution data appropriate for monitoring atmospheric variability, the Landsats provide infrequent (80 m) spatially resolved data appropriate for detailed study of vegetation and surface characteristics, and the NOAA series (especially the instrument Advanced Very High Resolution Radiometer - AVHRR) represent an intermediate observing regime. A discussion of satellite orbital characteristics in the context of agricultural applications suggests advantages to placing both the AVHRR and a high resolution imager (e.g., Multispectral Scanner of Landsat) on an early
A modified vegetation reflectance model based on the Adding Method is presented as a means to measure the interaction of shortwave radiation within a vegetation canopy. The canopy is conceptualized with reflecting and transmitting leaf facets, with the leaf orientations described by a leaf slope distribution, thereby yielding scattering matrices for canopy layers. The model predictions, when compared with ground-truth measurements, show good agreement except at visible wavelengths, where overestimations are observed. Conditions under which the model satisfies the reciprocity theorem are defined. Extension of the model by including azimuth is indicated.

A radiative transfer model for heterogeneous 3-D scenes is designed and coded for application to radiative transfers in vegetative scenes. The model is unique in that it predicts (1) the directional spectral reflectance factors as a function of the sensor's azimuth and zenith angles and the sensor's position above the canopy, (2) the spectral absorption as a function of location within the scene, and (3) the directional spectral radiance as a function of the sensor's location within the scene. The model was shown to follow known physical principles of radiative transfer. Initial verification of the model as applied to a soybean row crop showed that the simulated directional reflectance data corresponded relatively well in gross trends to the measured data. However, the model can be greatly improved by incorporating more sophisticated and realistic anisotropic scattering algorithms.
A83-14236#

VEGETATION CHANGE DETECTION IN AN AGRICULTURAL AREA - A SIMPLE APPROACH FOR USE WITH GEO-DATA BASE


A simple method was developed for monitoring changes in vegetation cover conditions and for classifying crop cover types into three classes: potatoes, grain and hay. Vegetation indices (VI) are computed for two key dates during the growing season according to the formula: VI = (MSS7 - MSS5)/(MSS7 + MSS5) + K, where the MSS numbers designate Landsat MSS bands and K is a scale factor. Differences between VI values for the two dates provide a Multi-Temporal Vegetation Index (MTVI), which is a good indicator of changes in the vegetation vigour. All computations can be performed in a general purpose computer. The method was successfully tested, using June and August, 1979 Landsat-2 MSS data, acquired over Grand Falls, NB. (Author)

A83-14240#

POTENTIALS OF LANDSAT-D AND SPOT-1 FOR CROP IDENTIFICATION IN THE MARITIMES


An experiment was recently completed at U.N.B. to ascertain what improvements will the next generation of earth observation satellite sensors provide for the identification of agricultural crops and the delineation of farm fields in the Maritimes. Airborne MSS digital data, covering Grand Falls, NB and vicinity, was resampled to simulate Landsat-D TM and SPOT-1 HRV data for this purpose. Landsat-2 MSS data was also available. Each digital data set was geometrically corrected and registered to the U.T.M. grid. Supervised classification was then carried out on the CIAS for potato and grain fields. The region vigour. All computations could not be distinguished and therefore were not classified. The time of the Landsat overpass were consistently and accurately classified and were rarely confused with upland classes. However, wetlands that had gone dry because of drainage or evaporation could not be distinguished and therefore were not classified. The problem of dry wetlands was most pronounced in lowlands, mainly those imaged in August.

A83-14241#

LAND USE/LAND COVER MAPPING FROM ENHANCED LANDSAT IMAGERY OF THE EASTERN PROVINCES OF THE PEOPLE'S REPUBLIC OF CHINA

S. HATHOUT (Winnipeg, University, Winnipeg, Canada) and V. SMIL (Manitoba, University, Winnipeg, Canada) In: Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 126-134. refs

The three eastern provinces, Jiangsu, Anhui and Zhejiang, are among the world's most intensively farmed areas, where field multicropping is augmented by animal production, cultivation of water plants and tree crops, and fish breeding. The objective of this study is to compile a Land use/Land cover map of east China with particular emphasis on the agricultural land from enhanced Landsat imagery by using the diazo and density slicing techniques. Because of the lack of ground truth, the authors depend on various other sources of published and unpublished information on these provinces. Area measurement results from constructed Landsat mosaic of the major land use; irrigated cropland and total farmland are very close to the published figures. This study has revealed the usefulness of Landsat imagery for detecting and plotting recently reclaimed land, irrigated cropland with two patterns of multicropping, non-irrigated land, hilly cropland, valley cropland, swamp cropland, and mixed range cropland. (Author)

A83-14244#

WATERFOWL HABITAT INVENTORY OF ALBERTA, SASKATCHEWAN AND MANITOBA BY REMOTE SENSING

T. BARNARD, R. J. MACFARLANE, T. NERASEN (Ducks Unlimited /Canada/, Winnipeg, Canada), R. P. MROCZYNSKI (Purdue University, West Lafayette, IN), J. JACOBSSEN, and R. SCHMIDT (Interdisciplinary Systems, Ltd., Winnipeg, Canada) In: Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 150-158. refs

A waterfowl habitat inventory is described which reflects an attempt to map and describe wetlands across prairie, parkland and forest-edge regions of Manitoba, Saskatchewan, and Alberta using Landsat data. It is noted that wetlands that held water at the time of the Landsat overpass were consistently and accurately classified and were rarely confused with upland classes. However, wetlands that had gone dry because of drainage or evaporation could not be distinguished and therefore were not classified. The problem of dry wetlands was most pronounced in late season, mainly those imaged in August.

A83-14245#

OPTICAL CHARACTERISTICS OF ALBERTA RANGELAND AS RELATED TO REMOTE SENSING

F. J. AHERN, R. J. BROWN, K. P. B. THOMSON (Canada Centre for Remote Sensing, Ottawa, Canada), C. M. PEARCE (Calgary, University, Calgary, Alberta, Canada), G. FEDOSEJEVS (Intera Environmental Consultants, Ltd., Ottawa, Canada), and K. STAENZ (Zurich, Universitaet, Zurich, Switzerland) In: Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 159-173. Research supported by Alberta Environment.

Attention is given to interband correlations, to the role of grass, forbs, shrubs, litter, carryover, and soil in determining the spectral reflectance of two rangeland types, and to the optical manifestation of soil moisture and plant moisture. Simulated thematic mapper imagery is also investigated. It is noted that the investigation has led to a greater understanding of the optical behavior of individual rangeland vegetation components throughout the growing season and has led to the development of Landsat images for a qualitative assessment of range conditions. It is found that a qualitative assessment of range conditions is difficult in the rough fescue prairie with green-red-infrared composite color imagery but shows promise with imagery that includes the mid-infrared region to be provided with the thematic mapper.

A83-14246#

THE USE OF R.B.V., COLOUR ADDITIVE VIEWER AND M.S.S. PRODUCTS IN THE BRITISH COLUMBIA FOREST INVENTORY DEPLETION MONITORING PROGRAM


Since 1981, the British Columbia Ministry of Forests has engaged in complete annual updates of the provincial forest inventory to determine the extent and location of all logged areas and areas significantly disturbed by fire, insects, disease, windthrow, or other causes since the last inventory. The present paper considers the potential contributions of data sources other than conventional medium and small-scale photography to the annual forest depletion updates. Operational procedures and results obtained are discussed for a field study conducted with satellite-borne return beam vidicon (RBV) imagery, temporarily classified MSS imagery, and color additive viewer (CAV) imagery. It is concluded that both RBV and MSS data are well suited to the identification and delineation of forest depletion boundaries,
while CAV products are a useful and effective means for the quality control of depletion monitoring programs. A.L.W.

**A83-14248#**

ASSESSMENT OF SPRUCE BUDWORM DEPOLITION USING DIGITAL AIRBORNE MSS DATA


**A83-14249#**

DIGITAL COLOUR ENHANCEMENT OF LANDSAT DATA FOR APPRAISING VEGETATION OF BARRENGROUND CARIBOU WINTER RANGE IN NORTHERN MANITOBA

R. J. DIXON (Manitoba Remote Sensing Center, Winnipeg, Canada) and L. HORN (Department of Natural Resources, Wildlife Branch, Thompson, Manitoba, Canada) In: Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 197-205. refs

**A83-14252#**

INTEGRATION OF LANDSAT IMAGERY INTO A PROGRAM FOR AERIAL SURVEYING OF DEER POPULATIONS IN ALBERTA


**A83-14253#**

LANDSAT-BASED FOREST MAPPING IN ONTARIO NORTH OF LATITUDE 52 DEG NORTH


The Ontario Centre for Remote Sensing (OCRS) has initiated an operational forest cover mapping program in Ontario north of latitude 52 deg N, based on the digital analysis of Landsat data and an innovative computerized map production technique. At present, only a reconnaissance inventory is required for this 400,000-sq km region. The OCRS program provides statistics on and maps of several major forest types and non-productive classes. The classification accuracy is highest for homogeneous areas, such as the dense, uniform forest cover types which represent most of the timber volume in this region. Although the Landsat-based method has inherent limitations, it can provide a reliable, low-cost inventory to serve as the basis for future detailed resource surveys. (Author)

**A83-14254#**

MULTITEMPORAL ANALYSIS OF LANDSAT DATA FOR FOREST CUTOVER MAPPING - A TRIAL OF TWO PROCEDURES


A trial was conducted to evaluate two procedures to map forest cutovers using Landsat data; a multitemporal band 5 overlay and a multitemporal vegetation index difference. The satellite data had been geometrically corrected using the Digital Image Correction System (DICS). Both techniques were applied using the Canada Centre for Remote Sensing Image Analysis System (CCAS). Results of this study indicate that the 'multitemporal band 5 overlay' technique shows great potential as a cutover monitoring technique. The procedure is effective for cutovers with a grass or regeneration cover as well as for those with bare soil. According to this trial, the 'multitemporal vegetation index difference' is impractical for delineation of cutover boundaries. The vegetation index indicates the presence of grass or other vegetation within cutovers. Clear-cuts with an ingrowth of vegetation appear uncut using this procedure. The two methods are discussed using Landsat data, photography taken concurrently with the second Landsat pass, and ground reference data. (Author)

**A83-14255#**

AERIAL SURVEY OF CROP LOSSES DUE TO GRASSHOPPERS /ORTHOPTERA - ACRIDIDAE/ IN SASKATCHEWAN

O. OLFERT (Department of Agriculture, Research Station, Saskatoon, Saskatchewan, Canada) In: Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 241-246. refs

**A83-14257#**

THE APPLICATION OF REMOTE SENSING IN SOUTHERN ALBERTA'S MOUNTAIN PINE BEETLE MANAGEMENT


**A83-14259#**

PREDICTING FOREST LAND ATTRIBUTES FROM AERIAL PHOTO INTERPRETATION VARIABLES


High-altitude panchromatic photography has been applied to the prediction of forest and land attributes in two areas of Montana. The technique utilizes photointerpretation variables consisting of five landform characteristics, five vegetation characteristics, and one combination variable: a land and overstory modifier. Each unit was then classified according to eleven photointerpretation variables. Prediction equations were formulated using multiple linear regression and dummy variables. Discriminant analysis predicted habitat and forest types. The mapping system utilized the digital terrain information system and the RID-POLY technique developed by Russell et al., 1975. S.C.S.

**A83-14261#**

LANDSAT FOR DELINEATION AND MAPPING OF SALINE SOILS IN DRYLAND AREAS IN SOUTHERN ALBERTA

M. D. THOMPSON (Interia Environmental Consultants, Ltd., Calgary, Alberta, Canada), N. A. PROUT (Interia Environmental Consultants Ltd., Ottawa, Canada), and T. G. SOMMERFELDT (Department of Agriculture, Lethbridge, Alberta, Canada) In: Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 294-303. Department of Supply and Services refs (Contract DSS-052-00-00026)
A83-14264#
PREICTING PERMAFROST CONDITIONS WITH INFRARED SENSING TECHNIQUES
H. SCHREIER (British Columbia, University, Vancouver, Canada) and C. SELBY (Department of Agriculture, Land Resource Research Institute, Vancouver, Canada) In: Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 323-330. Department of Supply and Services refs (Contract DSS-OSU-323-8050)

In order to investigate how the conditions and depth of the active layer can be predicted with IR remote sensing technology, the relationships between terrain, vegetation, permafrost, and surface temperature regimes were investigated using thermal IR imagery and color IR air photos in a 50 x 50 km test area in the Richardson Mountains of the Yukon Territory. Three out of five identified plant communities were found to indicate permafrost conditions which were significantly different from one another in terms of depth of active layer, moisture content in the active layer, and temperature at 20 cm depth. The vegetation distribution thus reflected the spatial pattern of the active layer. While the thermal data was found to be less reliable than the color IR data, when processed it was found to be of considerable use where nonindicator plants were present. C.D.

A83-14269#
OFFICE AUTOMATION IN RESOURCE-MANAGEMENT - THE FUTURE IS NOW

During the summer of 1981, the Canada Center for Remote Sensing participated in a commercial Telidon project in southwestern Manitoba. In this project (called 'GRASSROOTS') CCRS provided thematic images showing agricultural land use derived from Landsat data for distribution in a network that included terminals installed in ag rep offices, crop insurance offices, grain elevator offices and in the homes of private farmers. Remote sensing information on estimated acreages of rapeseed and fallow fields were transmitted along with current weather maps and commodity prices. Early user experiences indicate that low cost Canadian videotex technology may be a feasible tool for disseminating text and graphic information to improve decision-making and productivity in the primary and resource industry sectors. (Author)

A83-14301
A SYSTEM FOR THE COMPLEX PROCESSING OF AERIAL AND SPACE DATA FOR AGRICULTURE [O SISTEME KOMPLEKSONOI OBRABOTKI AEROKOSMIKESKOI INFORMATSIYI Dlia SELSKOGO KHOZIAISTVA]

The hardware and software requirements for a typical aerial and space-data reduction system for agricultural applications are briefly discussed. Some practical results obtained during the use of such a system for processing images generated by the Fragment satellite-borne multispectral scanning system are reviewed. V.L.

A83-14306
REMOTE MEASUREMENT OF BIOMASS [DISTANCSIONNOE OPREDELENIIE GUMUSA V POCHVAKH PO DANNYM SPECTRAL'NYKH IZMERENII]

Generalized functions are presented for determining grass and shrub biomass on the basis of the luminance factor and optical density of photographic negatives in the red (0.6-0.7 micron) and near infrared (0.7-1.3 micron) spectral regions. The exponential nature of the remote indicators of biomass is discussed. A two-parameter method is developed for measuring the biomass on the basis of its optical characteristics with an accuracy to within 10%.

V.L.

A83-14307
DETEMINATION OF FOREST FIRE SPREAD RATES FROM INFRARED PHOTOGRAPHS [IDENTIFIKATSIIA SKOROSTEI RASPROSTRANENIIIA LESNYKH POZHAROV PO IKH INFRAKRASNYM SNIMKAM]

Methods for estimating the spread rates of forest fires from a series of remote infrared images taken at given intervals of time are examined. Algorithms are presented which have been proven useful in interpreting infrared photographs of forest fires and which might be also useful in designing airborne instrumentation for similar applications. V.L.

A83-14310
DETERMINATION OF HUMUS IN SOIL ON THE BASIS OF SPECTRAL MEASUREMENTS [VOZMOZHNOSTI OPREDELENIIA GUMUSA V POCHVAKH PO DANNYM SPEKTRAL'NYKH IZMERENII]

A study has been carried out with a view to establishing a quantitative relationship between the color coordinates and the humus content of soils. With reference to comprehensive experimental data, it is demonstrated that remote monitoring of soil humus from aircraft is possible in principle. A regional map showing humus contents which has been derived from airborne spectral measurements is presented. V.L.

A83-14665* South Dakota State Univ., Brookings.
AERIAL THERMAL INFRARED CENSUS OF CANADA GEESE IN SOUTH DAKOTA
R. G. BEST, D. HAUSE, M. WEHDE (South Dakota State University, Brookings, SD), and R. FOWLER (South Dakota Department of Game, Fish and Parks, Pierre, SD) Photogrammetric Engineering and Remote Sensing, vol. 48, Dec. 1982, p. 1869-1877. Research supported by the South Dakota Department of Game, Fish and Parks refs (Contract NGL-42-003-007)

A83-14666
A MULTISPECTRAL APPROACH TO REMOTE DETECTION OF DEER

A83-14856
EFFECTS OF VEGETATION COVER ON THE RADIUS SENSITIVITY TO SOIL MOISTURE

Measurements of the backscattering coefficient, made for bare and vegetation-covered fields, are used in conjunction with a simple backscattering model to evaluate the effects of vegetation cover on the estimation accuracy of soil moisture when derived from radar observations. The results indicate that for soil moisture values...
below 50% of field capacity, the backscatter contribution of the vegetation cover limits the radar’s ability to predict soil moisture with an acceptable degree of accuracy. However, for moisture values in the range between 50 and 150% of field capacity, the measured backscatter coefficient is dominated by the soil contribution and the effects of vegetation cover become secondary in importance. It is estimated that in this upper soil moisture range, which is the primary range of interest in hydrology and agriculture, a radar soil moisture prediction algorithm would predict soil moisture with an error of less than 15% of field capacity in 90% of the cases.

(Author)

A83-14659
A BACKSCATTER MODEL FOR A RANDOMLY PERTURBED PERIODIC SURFACE

A backscatter model for a randomly perturbed periodic surface has been developed to explain backscatter measurements from a bare soil surface with row structure. It is assumed that the row-direction effect can be included by integrating the scattering coefficient due to the random roughness component over the underlying periodic component of the soil surface. It is found that the row-direction effect is strongly dependent upon the rate-of-change of the scattering coefficient with the local angle and that for sinusoidal surfaces, the maximum difference between looking parallel and perpendicular to the row direction occurs around an incidence angle whose tangent is usually smaller than the slope of the periodic surface at the inflection point. (Author)

A83-15889
REMOTE DETERMINATION OF HUMUS CONTENT IN SOILS [DISTANTSIONNOE OPREDELENIJE SODERZHANIIA GUMUSA Y POCHYVAKH]

A procedure for constructing a calibration curve for the determination of humus content in soils on the basis of aerial measurements is described. This procedure was used in compiling a 1:1,500,000 scale soil-humus maps of the Ukraine and Moldavia. A portion of this map for the Kiev region is presented here. It is assumed that the slope of the periodic surface at the inflection point. (Author)

A83-16909
REFLECTANCE DIFFERENCES BETWEEN UNTREATED AND MEPIQUAT CHLORIDE-TREATED, FIELD-GROWN COTTON THROUGH A GROWING SEASON

Large-area relations between satellite spectral data and end-of-season crop yield were investigated. Green Index Number (GIN) values from Landsat MSS data of sample segments throughout the U.S. Great Plains winter wheat belt in 1976 were correlated to county USDA-SRS reported yields. A linear relation between GIN and yield appeared to exist up to GIN values of 40 or 50, covering cases of severe to moderate stress. In a test on 1978 Texas winter wheat at the county level, GIN values for sample segments in the counties were used in conjunction with an agronomic-meteorological yield model. The combined fit explained significantly more of the observed yield variation at the county level than the agromet model alone. (Author)

INFLUENCE OF ENVIRONMENTAL FACTORS DURING SEED DEVELOPMENT AND AFTER FULL-RIPENESS ON PRE-HARVEST SPROUTING IN WHEAT

Pre-harvest sprouting of wheat are summarized. Other possible areas where additional research is needed is suggested. A.R.H.

A83-12483*# Missouri Univ., Columbia.
SECOND GENERATION CROP YIELD MODELS REVIEW

Second generation yield models, including crop growth simulation models and plant process models, may be suitable for large area crop yield forecasting in the yield model development project. Subjective and objective criteria for model selection are defined and models which might be selected are reviewed. Models may be selected to provide submodels as input to other models; for further development and testing; or for immediate testing as forecasting tools. A plant process model may range in complexity from several dozen submodels simulating (1) energy,
carbohydrates, and minerals; (2) change in biomass of various organs; and (3) initiation and development of plant organs, to a few submodels simulating key physiological processes. The most complex models cannot be used directly in large area forecasting but may provide submodels which can be simplified for inclusion into simpler plant process models. Both published and unpublished models which may be used for development or testing are reviewed. Several other models, currently under development, may become available at a later date.

Author

**R83-12484** # Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

PERFORMANCE COMPARISON FOR BARNES MODEL 12-1000, EXOTECH MODEL 100, AND IDEAS INC. BIOMETER MARK 2.

B. ROBINSON, Principal Investigator

22 Apr. 1981 32 p

Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15466; PROJECT AGRISTARS)

(E83-1004; NASA-CR-167646; SR-P1-04090; NAS 1.26:167646)

Avail: NTIS HC A03/ MF A01 CSCL 02C

Results of tests show that all channels of all instruments, except channel 3 of the Biometer Mark 2, were stable in response to input signals were linear, and were adequately stable in response to temperature changes. The Biometer Mark 2 is labelled with an inappropriate description of the units measured and the dynamic range is a inappropriate for field measurements causing unnecessarily high fractional errors. This instrument is, therefore, quantization limited. The dynamic range and noise performance of the Model 12-1000 are appropriate for remote sensing field research. The field of view and performance of the Model 100A and the Model 12-1000 are satisfactory. The Biometer Mark 2 has not, as yet, been satisfactorily equipped with an acceptable field of view determining device. Neither the widely used aperture plate nor the 24 deg cone are acceptable.

A. R. H.


A THREE-PART GEOMETRIC MODEL TO PREDICT THE RADAR BACKSCATTER FROM WHEAT, CORN, AND SORGHUM

F. T. ULABY, Principal Investigator, G. W. EGER, III, and E. T. KANEMASU

Apr. 1982 211 p refs

Sponsored by NASA, USDA, Dep. of Commerce, Dep. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15421; PROJECT AGRISTARS)

(E83-1005; NASA-CR-167713; SR-K2-04313; RSL-TR-360-18)

Avail: NTIS HC A10/ MF A01 CSCL 02C

A model to predict the radar backscattering coefficient from crops must include the geometry of the canopy. Radar and ground-truth data taken on wheat in 1979 indicate that the model must include contributions from the leaves, from the wheat head, and from the soil moisture. For sorghum and corn, radar and ground-truth data obtained in 1979 and 1980 support the necessity of a soil moisture term and a leaf water term. The Leaf Area Index (LAI) is an appropriate input for the leaf contribution to the radar response for wheat and sorghum, however the LAI generates less accurate values for the backscattering coefficient for corn. Also, the data for corn and sorghum illustrate the importance of the water contained in the stalks in estimating the radar response.

Author

**R83-12486** # National Aeronautics and Space Administration.

Lyndon B. Johnson Space Center, Houston, Tex.

AGRI STARS. SEMIANNUAL PROGRAM REVIEW PRESENTATION TO LEVEL 1, INTERAGENCY COORDINATION COMMITTEE

15 Apr. 1982 104 p

Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract PROJ. AGRISTARS)

(E83-1006; NASA-TM-84878; IT-J2-04267; JSC-17830; NAS 1.15:84878)

Avail: NTIS HC A06/ MF A01 CSCL 02C

Results are presented for (1) spring small grains; (2) summer crops/corn and soybeans; and (3) crop signature characterization.

The development of an early season approach, profile and segment based change estimation, and future satellite and sensor system requirements are discussed. Documentation for the inventory technology development project is included.

A. R. H.

**R83-12487** # Lockheed Engineering and Management Services Co., Inc., Houston, Tex.


M. L. AMIS, M. V. MARTIN, W. G. MCGUIRE, and S. S. SHEN, Principal Investigators

Aug. 1982 146 p refs

Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract NAS9-15600)

(E83-1006; NASA-CR-167752; DC-L2-04264; JSC-17829; NAS 1.26:167752; LEMSCO-17597)

Avail: NTIS HC A07/ MF A01 CSCL 02C

Studies completed in fiscal year 1981 in support of the clustering/classification and preprocessing activities of the Domestic Crops and Land Cover project. The theme throughout the study was the improvement of subanalysis district (usually county level) crop area estimates, as reflected in the following three objectives: (1) to evaluate the current U.S. Department of Agriculture Statistical Reporting Service regression approach to crop area estimation as applied to the problem of obtaining subanalysis district estimates; (2) to develop and test alternative approaches to subanalysis district estimation; and (3) to develop and test preprocessing techniques for use in improving subanalysis district estimates.

A. R. H.


DISCRIMINATION OF GROWTH AND WATER STRESS IN WHEAT BY VARIOUS VEGETATION INDICES THROUGH A CLEAR A TURBID ATMOSPHERE

R. D. JACKSON, P. M. SLATER, and P. J. PINTER, Principal Investigators

May 1982 44 p refs

Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS

(Contract PROJ. AGRISTARS)

(E83-1009; NASA-CR-169491; EW-J2-04298; JSC-18241; NAS 1.26:169491)

Avail: NTIS HC A03/ MF A01 CSCL 02C

Reflectance data were obtained over a drought-stressed and a well-watered wheat plot with a hand-held radiometer having bands similar to the MSS bands of the LANDSAT satellites. Data for 48 clear days were interpolated to yield reflectance values for each day of the growing season, from planting until harvest. With an atmospheric path radiance model and LANDSAT-2 calibration data, the reflectance were used to simulate LANDSAT digital counts (not quantized) for the four LANDSAT bands for each day of the growing season, through a clear (approximately 100 km meteorological range) and a turbid (approximately 10 km meteorological range) atmosphere. Several ratios and linear combinations of bands were calculated using the simulated data, then assessed for their relative ability to discriminate vegetative growth and plant stress through the two atmospheres. The results show that water stress was not detected by any of the indices until after growth was retarded, and the sensitivity of the various indices to vegetation dependent on plant growth stage and atmospheric path radiance.

Author
N83-12499\* Department of Agriculture, Houston, Tex.

OPTICAL PARAMETERS OF LEAVES OF SEVEN WEED SPECIES

(E83-10010; NASA-CR-169440; EW-U2-04328; JSC-18250; NAS 1.26:00480) Avail: NTIS HC A02/MF A01 CSCL 02C

The absorption coefficient (k), infinite reflectance (R), and scattering coefficient (s) were tabulated for five wavelengths and analyzed for statistical differences for seven weed species. The wavelengths were: 0.55-micrometer, 0.65-micrometers, 0.85-micrometer, 1.65-micrometers, and 2.20-micrometer. The R of common lambsquarters (Chenopodium album L.), Johnsongrass (Sorghum halepense (L.) Pers.), and annual sowthistle (Sonchus oleraceus L.) leaves at the 0.65-micrometer wavelength were significantly (p=0.05) higher than for sunflower (Helianthus annus L.), ragweed parthenium (Parthenium hysterophorus L.), or London rocket (Silysmium ino L.). Annual sowthistle had the largest k value, and Palmer amaranth (Amaranthus palmeri S. Wats.) had the smallest k value at the 0.65-approximate chlorophyll absorption wavelength. In general, johnsongrass, ragweed parthenium, or London rocket had the largest s values among the five wavelengths, wereas annual sowthistle and Palmer amaranth were usually lowest. Author

N83-12491\* Arkansas Univ., Fayetteville. Dept. of Electrical Engineering

MEASUREMENT OF SOIL MOISTURE USING REMOTE SENSING MULTISENSOR RADIATION TECHNIQUES Final Report
W. P. WAITE, Principal Investigator May 1982 12 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract NAS9-14251; PROJ. AGRISTS)

(E83-10012; NASA-CR-167648; SM-A2-04322; NAS 1.26:167648) Avail: NTIS HC A02/MF A01 CSCL 02C

Theoretical modeling as well as laboratory and field measurement were coupled with analysis of aircraft data obtained from controlled sites in an effort to enhance understanding of the microwave response due to soil moisture so as to specify sensor parameters and develop inversion algorithms. Models to predict the complex dielectric constant were produced which led to the interpretation of the results in terms of a matrix potential rather than simply moisture content. Similar advances were made in the development of coherent and incoherent radiative transfer models and rough surface scattering models. A.R.H.

N83-12492\* Department of Agriculture, Sydney, Mont.

WINTER WHEAT STAND DENSITY DETERMINATION AND YIELD ESTIMATES FROM HANDHELD AND AIRBORNE SCANNERS

(E83-10013; NASA-CR-169469; EW-U2-04327; JSC-18258) Avail: NTIS HC A02/MF A01 CSCL 02C

Radiance measurements from handheld (Exotech 100-A) and air-borne (Daedalus DEI 1260) radiometers were related to wheat (Triticum aestivum L.) stand densities (simulated winter wheat winterkill) and to grain yield for a field located 11 km northwest of Sidney, Montana, on a Williams loam soil (fine-loamy, mixed Typic Argiborolls) where a semi-dwarf hard red spring wheat cultivar was newly sown to stand. Radiances were measured with the handheld radiometer on clear mornings throughout the growing season. Aircraft flight-line measurements were made at the end of tillering and during the early stem extension period, and the mid-heading period. The IR/red ratio and normalized difference vegetation index were used in the analysis. The aircraft measurements corroborated the ground measurements inasmuch as wheat stand densities were detected and could be evaluated at an early enough growth stage to make management decision. The aircraft measurements also corroborated handheld measurements when related to yield prediction. The IR/red ratio, although there was some growth stage dependency, related well to yield when measured from just past tillering until about the wetty-rripe stage. Author

N83-12493\* Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

DEVELOPMENT OF A CORN AND SOYBEAN LABELING PROCEDURE FOR USE WITH PROFILE PARAMETER CLASSIFICATION

(E83-10014; NASA-CR-167720; SR-L2-00750; JSC-18257; NAS 1.28:167720; LEMSICO-17765) Avail: NTIS HC A09/MF A01 CSCL 02C

Some essential processes for the development of a green-number-based logic for identifying (labeling) crops in LANDSAT imagery are documented. The supporting data and subsequent conclusions that resulted from development of a specific labeling logic for corn and soybean crops in the United States are recorded. Author

N83-12494\* Texas A&M Univ., College Station. Dept. of Mathematics.


(E83-10015; NASA-CR-167701; SR-L2-04371; NAS 1.26:167701) Avail: NTIS HC A12/MF A01 CSCL 05B

The development of an accurate and efficient algorithm for analyzing the structure of MSS data, the application of the Akaike information criterion to mixture models, and a research plan to delineate some of the technical issues and associated tasks in the area of rice scene radiation characterization are discussed. The AMOEBA clustering algorithm is refined and documented. Author

N83-12495\* Texas A&M Univ., College Station.

SYSTEM SUPPORT DOCUMENTATION: IDIMS FUNCTION AMOBEA Final Report

Avail: NTIS HC A12/MF A01 CSCL 05B

A listing is provided for AMOEBA, a clustering program based on a spatial-spectral model for image data. The program is fast and automatic (in the sense that no parameters are required), and classifies each picture element into classes which are determined internally. As an IDIMS function, no limit on the size of the image is imposed. Author


RICE SCENE RADIATION RESEARCH PLAN Final Report
J. HEILMAN In its DEVELOP. OF ADVANCE ACREAGE ESTIMATION METHODS 12 p Jun. 1982 ERTS

Avail: NTIS HC A12/MF A01 CSCL 05B

Data requirements, tasks to be accomplished, and the technical approaches to be used in identifying the characteristics of rice for crop inventories are listed as well as methods for estimating crop development and assessing its conditions. A.R.H.
A.R.H. 10


A quarterly listing of those documents and related publications that have been issued and placed in the AgRISTARS tracking system is presented. The Tracking List Report provides a catalog, by project, of technical publications arranged by type of document and gives the reference AgRISTARS document numbers, title and date of publication, the issuing organization, and the National Technical Information Service reference number. Author


A quarterly listing of those documents and related publications that have been issued and placed in the AgRISTARS tracking system is presented. The Tracking List Report provides a catalog, by project, of technical publications arranged by type of document and gives the reference AgRISTARS document numbers, title and date of publication, the issuing organization, and the National Technical Information Service reference number. Author


Radar simulations were performed at five-day intervals over a twenty-day period and used to estimate soil moisture from a generalized algorithm requiring only received power and the mean elevation of a test site near Lawrence, Kansas. The results demonstrate that the soil moisture of about 90% of the 20-m by 20-m pixel elements can be predicted with an accuracy of + or - 20% of field capacity within relatively flat agricultural portions of the test site. Radar resolutions of 93 m by 100 m with 23 looks or coarser gave the best results, largely because of the effects of signal fading. For the distribution of land cover categories, soils, and elevation in the test site, very coarse radar resolutions of 1 km by 1 km and 2.6 km by 3.1 km gave the best results for wet moisture conditions while a finer resolution of 93 m by 100 m was found to yield superior results for dry to moist soil conditions. A.R.H.


The typical patterns of spectral development (profiles) for corn and soybeans are presented, based on field-collected reflectance data transformed to correspond to LANDSAT-MSS Tasseled Cap coordinates. Reasonable variations in field conditions and cultural practices are shown to significantly influence profile features. The separability of the two crops is determined to be primarily related to the maximum value of the reflectance equivalent of Greenness, and to the plateau effect seen in corn Greenness profiles. The impact of changes in conditions on separability is described. In addition, association is made between profile features and stages of development for corn and soybeans. Corn is shown to peak at a stage well before tasseling or maximum LAI while the characteristics of the soybean profile are shown to be unrelated to any particular stage of development. Author
01 AGRICULTURE AND FORESTRY

N83-12504*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

EXTENSION OF LABORATORY-MEASURED SOIL SPECTRA TO FIELD CONDITIONS

Spectral responses of two glaciated soils, Chalmers silty clay loam and Fincastle silt loam, formed under prairie grass and forest vegetation, respectively, were measured in the laboratory under controlled moisture equilibria using an Exotech Model 20C spectroradiometer to obtain spectral data in the laboratory under artificial illumination. The same spectroradiometer was used outdoors under solar illumination to obtain spectral response from dry and moistened field plots with and without corn residue cover, representing the two different soils. Results indicate that laboratory-measured spectra of moist soil are directly proportional to the spectral response of that same field-measured moist bare soil over the 0.52 micro meter to 1.75 micro meter wavelength range. The magnitudes of difference in spectral response between identically treated Chalmers and Fincastle soils are greatest in the 0.6 micrometers to 0.8 micro meter transition region between the visible and near infrared, regardless of field condition or laboratory preparation studied.

Author

N83-12505*# Texas A&M Univ., College Station. Inst. of Statistics.

MISSING OBSERVATIONS IN MULTIYEAR ROTATION SAMPLING DESIGNS

Because Multiyear estimation of at-harvest stratum crop proportions is more efficient than single year estimation, the at-harvest stratum crop proportion estimator is considered when missing segments are not replaced, and when missing segments are replaced by segments not sampled in previous years. The principle recommendations are to replace missing segments according to some specified strategy, and to use a sequential procedure for selecting a sampling design; i.e., choose an optimal two year design and then, based on the observed two year design after segment losses have been taken into account, choose the best possible three year design having the observed two year parent design.

Author

N83-12506*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.


Research results and accomplishments of sixteen tasks in the following areas are described: (1) corn and soybean scene radiation research; (2) soil moisture research; (3) sampling and aggregation research; (4) pattern recognition and image registration research; and (5) computer and data base services.

Author

N83-13517 Iowa State Univ. of Science and Technology, Ames.

REMOTE SENSING OF LAND RESOURCES: APPLICATION OF LANDSAT SATELLITE IMAGERY Ph.D. Thesis J. GOLCHIN 1982 197 p Avail: Univ. Microfilms Order No. DA8221189 LANDSAT satellite images were used to study the major factors which affect water consumption by irrigation in west-central Iowa. These factors are soil moisture, area under irrigation, and crop types. Once the monitoring system of these factors is established, the amount of water withdrawn for supplementary irrigation can be estimated. The use of the microdensitometer and measurement of image reflectivity was emphasized in the soil moisture portion. The results indicated that there is a linear relation between the measured reflectivity from the LANDSAT image and the generalized surface oil moisture. Applying a simple manual interpretation method of black and white and false color transparencies, both irrigated lands and crop types were identified. The main instrument used in this part was the Zoom Transfer Scope. The results for both experiments were promising and supported the methods of interpretation. Examination of the methods introduced in this study showed that the manual interpretation of LANDSAT imagery is a low-cost and easy approach to monitor the irrigated areas and the crop types. Dissert. Abstr.

N83-13519*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

USE OF LANDSAT IMAGES TO STUDY CERRADO VEGETATION [UTILIZACAO DE IMAGENS ORBITAIS DO SATELITE LANDSAT PARA ESTUDO DA VEGETACAO DE CERRADO] N. D. J. PARADA, Principal Investigator and P. H. FILHO Aug. 1982 9 p refs In PORTUGUESE; ENGLISH summary Presented at the Congr. Nacional sobre Essencias Nativas, Campos do Jordao, 12-18 Sep. 1982 Sponsored by NASA ERTS (E83-10025; NASA-CR-169498; NAS 1.26:169498; INPE-2526-2/195) Avail: NTIS HC A02/MF A01 Channel 5 and 7 LANDSAT imagery at the scale of 1:250,000 made during passes in the dry and rainy seasons were used to select the optimal season for cerrado characterization prints. More than 100,000 ha of cerrado, cerradao, and (woodsy pasture) vegetation and reforestation activities. Imagery acquired during the dry season permitted a good discrimination between 'cerrado' and 'cerradao' vegetation and reforestation. In relation to the areas under irrigation, only the recently modified area presented good discrimination of cerrado vegetation. Imagery of the rainy season did not provide a reasonable separation between cerrado and reforestation areas but the altered area could be easily discriminated.

A.R.H.

N83-13529*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

DEVELOPMENT OF THEMATIC MAPPER VEGETATIVE INDICES FOR ASSESSING BIOMASS IN CORN, SOYBEANS AND WHEAT B. R. GARDNER, D. R. THOMPSON, K. E. HENDERSON, and B. L. BLAD, Principal Investigators Aug. 1982 88 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract PROJ. AGRISTARS) (E83-10035; NASA-TM-85170; SR-J2-04337; JSC-18264; NAS 1.15:85170) Avail: NTIS HC A05/MF A01 CSCL 02C Spectral transformations that utilize thematic mapper (TM) bands were found to be highly related to various agronomic parameters such as leaf area index, percent ground cover, total fresh biomass, and plant moisture for corn, soybeans, and wheat. It was found that different spectral transformations are necessary in order to produce the maximum predictability for each agronomic variable. The TM bands in the water absorption region (1.55 micrometers to 1.75 micrometer and 2.08 micrometer 2.35

11
micrometer) appear to provide information concerning the water condition of the canopy.

The Williams type model, developed similarly to previous models of C.V.D. Williams, uses monthly temperature and precipitation data as well as soil and topological variables to predict the yield of the spring wheat crop. The models are statistically developed using the regression technique. Eight model characteristics are examined in the evaluation of the model. Evaluation is at the crop reporting district level, the state level and for the entire region. A ten year bootstrap test was the basis of the statistical evaluation. The accuracy and current indication of modeled yield reliability could show improvement. There is great variability in the bias measured over the district, but there is a slight overall positive bias. The model estimates for the east central crop reporting districts in Minnesota are not accurate. The estimate of yield for 1974 were inaccurate for all of the models.

**Evaluation of the Williams-Type Spring Wheat Model in North Dakota and Minnesota**


An attempt is made to identify the need for, and the current capability of, a technology which could aid in monitoring the Earth's vegetation resource on a global scale. Vegetation is one of our most critical natural resources, and accurate timely information on its current status and temporal dynamics is essential to understand many basic and applied environmental interrelationships which exist on the small but complex planet Earth.

**Estimating Total Standing Herbaceous Biomass Production with LANDSAT MSS Digital Data Progress Report**


Major activities described include development and evaluation of theoretical models that describe both active and passive microwave sensing of soil moisture, the evaluation of these models for their applicability, the execution of a controlled field experiment during which passive microwave measurements were acquired to validate these models, and evaluation of previously acquired aircraft microwave measurements. The development of a root zone soil water and soil temperature profile model and the calibration and evaluation of gamma ray attenuation probes for measuring soil moisture profiles are considered. The analysis of spatial variability of soil information as related to remote sensing is discussed as well as the implementation of an instrumented field site for acquisition of soil moisture and meteorologic information for use in validating the soil water profile and soil temperature profile models.


Major activities described include development and evaluation of theoretical models that describe both active and passive microwave sensing of soil moisture, the evaluation of these models for their applicability, the execution of a controlled field experiment during which passive microwave measurements were acquired to validate these models, and evaluation of previously acquired aircraft microwave measurements. The development of a root zone soil water and soil temperature profile model and the calibration and evaluation of gamma ray attenuation probes for measuring soil moisture profiles are considered. The analysis of spatial variability of soil information as related to remote sensing is discussed as well as the implementation of an instrumented field site for acquisition of soil moisture and meteorologic information for use in validating the soil water profile and soil temperature profile models.

**Evaluating Spring Wheat Crop Yields Using LANDSAT MSS and Digital Data**


Major activities described include development and evaluation of theoretical models that describe both active and passive microwave sensing of soil moisture, the evaluation of these models for their applicability, the execution of a controlled field experiment during which passive microwave measurements were acquired to validate these models, and evaluation of previously acquired aircraft microwave measurements. The development of a root zone soil water and soil temperature profile model and the calibration and evaluation of gamma ray attenuation probes for measuring soil moisture profiles are considered. The analysis of spatial variability of soil information as related to remote sensing is discussed as well as the implementation of an instrumented field site for acquisition of soil moisture and meteorologic information for use in validating the soil water profile and soil temperature profile models.

**Use of Near-Infrared Video Recording System for the Detection of Freeze Damaged Citrus Leaves**


A video recording system with a visible light blocking filter to give sensitivity in the 0.78 m to 1.1 m waveband detected freeze-damaged citrus leaves rapidly. With this technique, the time to analyze images can be decreased from about one day for conventional photography to less than one hour for video recording.
CONSTRUCTION OF A REMOTELY SENSED AREA SAMPLING FRAME FOR SOUTHERN BRAZIL

A remotely sensed area sampling frame was constructed for selected areas in Southern Brazil. The sampling unit information was stored in digital form in a latitudinal/longitudinal characterized population. Computerized sampling procedures were developed which allow for flexibility in sample unit specifications and sampling designs.

A R H

ADJUSTING THE TASED CAP BRIGHTNESS AND GREENNESS FACTORS FOR ATMOSPHERIC PATH RADIANCE AND ABSORPTION ON A PIXEL BY PIXEL BASIS
R. D. JACKSON, P. N. Slater, and P. J. PINTER, Principal Investigators Jul. 1982 24 p refs Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract Di-12-14-5001-38; PROJ. AGRISTARS) (E83-10053; NASA-CR-169569; EW-U2-04334; JSC-18260; NAS 1.28:169569) Avail: NTIS HC A02/5F A01 CSCL 02F
A radiative transfer model was used to convert ground measured reflectances into the radiance at the top of the atmosphere for several levels of atmospheric path radiance. The radiance in MSS7 (0.8 to 1.1 m) was multiplied by the transmission fraction for atmospheres having different levels of precipitable water. The radiance values were converted to simulated LANDSAT digital counts for four path radiance levels and four levels of precipitable water. These values were used to calculate the Kauf-Thomas brightness, greenness, yellowness, and nonsuch factors. Brightness was affected by surface conditions and path radiance. Greenness was affected by surface conditions, path radiance, and precipitable water. Yellowness was affected by path radiance and nonsuch by precipitable water, and both factors changed only slightly with surface conditions. Yellowness and nonsuch were used to adjust brightness and greenness to produce factors that were affected only by surface conditions such as soils and vegetation, and not by path radiance and precipitable water.

A R H

COMPARISON OF LANDSAT-2 AND FIELD SPECTROMETER REFLECTANCE SIGNATURES OF SOUTH TEXAS RANGELAND PLANT COMMUNITIES
The accuracy was assessed for an atmospheric correction method that depends on clear water bodies to infer solar and atmospheric parameters for radiative transfer equations by measuring the reflectance signature of four prominent south Texas rangeland plants with the LANDSAT satellite multispectral scanner (MSS) and a ground based spectroradiometer. The rangeland plant reflectances produced by the two sensors were correlated with no significant deviation of the slope from unity or of the intercept from zero. These results indicated that the atmospheric correction produced LANDSAT MSS estimates of rangeland plant reflectances that are as accurate as the ground based spectroradiometer.

A R H
year spring wheat yield was particularly low, the Williams type model should not be excluded from further consideration. Author

N83-14567*# Agricultural Research Service, Weslaco, Tex.

COMPARISONS AMONG A NEW SOIL INDEX AND OTHER TWO-AND FOUR-DIMENSIONAL VEGETATION INDICES

The 2-D difference vegetation index (DVI) and perpendicular vegetation index (PVI), and the 4-D green vegetation index (GVI) are compared in LANDSAT MSS data from grain sorghum (Sorghum bicolor, L. Moench) fields for the years 1973 to 1977. PVI and DVI were more closely related to LAI than was GVI. A new 2-D soil line index (SLI), the vector distance from the soil line origin to the point of intersection of PVI with the soil line, is defined and compared with the 4-D soil brightness index, SBI. SLI (based on MSS 5 and MSS 6) was smaller in magnitude than SBI but contained similar information about the soil background. These findings indicate that vegetation and soil indices calculated from the single visible and reflective infrared band sensor systems, such as the AVHRR of the TIROS-N polar orbiting series of satellites, will be meaningful for synoptic monitoring of renewable vegetation.

Author

N83-14568*# National Oceanic and Atmospheric Administration, Columbia, Mo.

CROP WEATHER MODELS OF BARLEY AND SPRING WHEAT YIELD FOR AGROPHYSICAL UNITS IN NORTH DAKOTA

Models based on multiple regression were developed to estimate barley yield and spring wheat yield from weather data for Agrophysical units (APU) in North Dakota. The predictor variables are derived from monthly average temperature and monthly total precipitation data at meteorological stations in the cooperative network. The models are similar in form to the previous models developed for Crop Reporting Districts (CRD). The trends and derived variables were the same and the approach to select the significant predictors was similar to that used in developing the CRD models. The APU models show slight improvements in some of the statistics of the models, e.g., explained variation. These models are to be independently evaluated and compared to the previously evaluated CRD models. The comparison will indicate the preferred model area for this application, i.e., APU or CRD.

Author

N83-14569*# National Aeronautics and Space Administration.

EVALUATION OF THE WILLIAMS-TYPE MODEL FOR BARLEY YIELDS IN NORTH DAKOTA AND MINNESOTA

The Williams-type yield model is based on multiple regression analysis of historical time series data at CRD level pooled to regional level (groups of similar CRDs). Basic variables considered in the analysis include USDA yield, monthly mean temperature, monthly precipitation, soil texture and topographic information, and variables derived from these. Technologic trend is represented by piecewise linear and/or quadratic functions of year. Indicators of yield reliability obtained from a ten-year bootstrap test (1970-1979) demonstrate that biases are small and performance based on root mean square appears to be acceptable for the intended AgRISTARS large area applications. The model is objective, adequate, timely, simple, and not costly. It considers scientific knowledge on a broad scale but not in detail, and does not provide a good current measure of modeled yield reliability.

Author

N83-14574*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

AN AUTOMATIC AGRICULTURAL ZONE CLASSIFICATION PROCEDURE FOR CROP INVENTORY SATELLITE IMAGES [UM PROCEDIMENTO AUTOMATICO PARA CLASSIFICACAO DE AREAS AGRICOLAS EM IMAGENS DE SATELITE, PARA USO EM PREVISAO DE SAFRAS]
N. D. J. PARADA, Principal Investigator, G. C. NETO, F. R. D. VELASCO, and M. O. B. DEOLIVEIRA Jul. 1982 11 p refs In PORTUGUESE; ENGLISH summary Presented at the 34th Reuniao da SBPC, Campinas, Sao Paulo, Brazil, 6-14 Jul. 1982 Sponsored by NASA ERTS (E83-10063; NASA-CR-169576; NAS 1.26:169576; INPE-2494-PRE/166) Avail: NTIS HC A02/MF A01 CSCL 02C

A classification procedure for assessing crop area proportion in multispectral scanner image is discussed. The procedure is into four parts: labeling; classification; proportion estimation; and evaluation. The procedure also has the following characteristics: multitemporal classification; the need for a minimum field information; and verification capability between automatic classification and analyst labeling. The processing steps and the main algorithms involved are discussed. An outlook on the future of this technology is also presented.

Author

N83-14576*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

AN APPLICATION OF CLUSTER ANALYSIS FOR DETERMINING HOMOGENEOUS SUBREGIONS: THE AGROCLIMATOLOGICAL POINT OF VIEW

A stratification oriented to crop area and yield estimation problems was performed using an algorithm of clustering. The variables used were a set of agroclimatological characteristics measured in each one of the 232 municipalities of the State of Rio Grande do Sul, Brazil. A nonhierarchical cluster analysis was used and the pseudo F-statistics criterion was implemented for determining the "cut point" in the number of strata.

Author

N83-14577*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

VEGETATION SURVEY IN AMAZONIA USING LANDSAT DATA

Automatic Image-100 analysis of LANDSAT data was performed using the MAXVER classification algorithm. In the pilot area, four vegetation units were mapped automatically in addition to the areas occupied for agricultural activities. The Image-100 classified results together with a soil map and information from RADAR images, permitted the establishment of the final legend with six classes: semi-deciduous tropical forest; low land evergreen tropical forest;
secondary vegetation; tropical forest of humid areas, predominant pastureland and flood plains. Two water types were identified based on their sediments indicating different geological and geomorphological aspects. A.R.H.

N83-14579# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

REMOTE SENSING TECHNIQUES FOR CONSERVATION AND MANAGEMENT OF NATURAL VEGETATION ECOSYSTEMS [SENSORIAMENTO REMOTO NA CONSERVACAO E MANEJO DE ECOSISTEMAS NATURAIS VEGETAIS]


The importance of using remote sensing techniques, in the visible and near-infrared ranges, for mapping, inventory, conservation and management of natural ecosystems is discussed. Some examples realized in Brazil or other countries are given to evaluate the products from orbital platform (MSS and RBV imagery of LANDSAT) and aerial level (photography) for ecosystems study. The maximum quantitative and qualitative information which can be obtained from each sensor, at different level, are discussed. Based on the developed experiments it is concluded that the remote sensing technique is a useful tool in mapping vegetation units, estimating biomass, forecasting and evaluation of fire damage, disease detection, deforestation mapping and change detection in land-use. In addition, remote sensing techniques can be used in controlling implantation and planning natural/artificial regeneration. Author

N83-14585# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

EVALUATION OF REFORESTATION USING REMOTE SENSING TECHNIQUES


The utilization of remotely sensed orbital data for forestry inventory. The study area (approximately 491,100 ha) encompasses the municipalities of Ribeirao Preto, Atibaia, Cravinhos, Serra Azul, Luis Antonio, Sao Simao, Sant Rita do Passa Quatro and Santa Rosa do Vitario (Sao Paulo State). Materials used were LANDSAT data from channels 5 and 7 (scale 1:250,000) and CCT's. Visual interpretation of the imagery showed that for 1977 a total of 97,986.00 ha and for 1979 38,003.75 ha were reforested. The results obtained show that LANDSAT data can be used efficiently in forestry inventory studies. Author

N83-14586# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

ESTIMATION OF THE SUGAR CANE CULTIVATED AREA FROM LANDSAT IMAGES USING THE TWO PHASE SAMPLING METHOD


The two phase sampling method and the optimal sampling segment dimensions for the estimation of sugar cane cultivated area were developed. This technique employs visual interpretations of LANDSAT images and panchromatic aerial photographs considered as the ground truth. The estimates, as a mean value of 100 simulated samples, represent 99.3% of the true value with a CV of approximately 1%; the relative efficiency of the two phase design was 157% when compared with one phase aerial photographs sample. Author

N83-14619# Catholieke Universiteit te Leuven (Belgium). Lab. voor Bodemgenese en Bodemgeografie.

MULTITEMPORAL SOIL AND VEGETATION OBSERVATIONS BY METEOSAT OVER CENTRAL AFRICA


Avail: NTIS HC A11/MF A01

The extent to which METEOSAT could contribute to the study of dynamic land surface features in central Africa was verified. The rain forest-humid savanna limit can be distinguished through intercomparison of multitemporal data. In the savanna area, response patterns in the visible and in the thermal infrared channel agree with soil distribution patterns. The expansion or retraction of lakes and marshes and the progress of the drying out of vegetation with the advance of the dry season was also followed. Author (ESA)

N83-14624# Copenhagen Univ. (Denmark). Inst. of Geography.

MULTITEMPORAL ANALYSIS OF LANDSAT DATA FOR INVESTIGATIONS OF AGRICULTURAL LAND USE: PROBLEMS AND POTENTIALS


Avail: NTIS HC A11/MF A01

The great demands on computer time, the decreased spatial resolution due to inaccuracies in digital overlay of two or more LANDSAT scenes, and the difficulties in using standard classification algorithms on multitemporal data sets are considered. Ways of minimizing these problems are mentioned, and examples drawn from a Danish crop identification study are shown. Two examples of use of multitemporal analysis in current projects in developing countries are presented. In Zambia the intensity of land use in a shifting cultivation system is being studied, and by means of multitemporal analysis the intensification process can be detected. In Kenya within and between year variations of amount and location of grazing resources are studied as a means of understanding migration patterns of pastoral nomads. Author (ESA)

N83-14625# Center for Remote Sensing, Colombo (Sri Lanka), Survey Dept.

MULTISTAGE LAND USE MAPPING AND CHANGE MONITORING IN SRI LANKA


Avail: NTIS HC A11/MF A01

A 1:100,000 scale land use/land cover map series of Sri Lanka was produced. Analog interpretation of computer enhanced and bulk LANDSAT imagery, and aerial photography, based on extensive ground truth, were used in a medium technological level multistage approach. Rice yield forecasting images and forest cover change maps are presented. Author (ESA)

N83-14626# Joint Research Centre of the European Communities, Ispra (Italy).

USE OF REMOTE SENSING TECHNIQUES FOR RICE PRODUCTION FORECASTING IN WEST AFRICA (MALI AND GUINEA: NIGER-BANI PROJECT)


Avail: NTIS HC A11/MF A01

The west African rice system under controlled submersion conditions is described, and data on visual and digital interpretation
of LANDSAT images of the Mali test site are presented to show the potential and limitations of that imagery for the assessment of the harvestable areas—one month before harvest. The same assessment is feasible from the interpretation of IR photographs with a six rice-class classification. Interpretation of RBV imagery acquired during the 1980 campaign allows forecasting to be extended to 3 months before harvest as a result of the recognition of the flooded areas. This indicates that the maximum extension of flooding constitutes the main limiting factor of rice production.

Author (ESA)

N83-14653# Army Engineer Topographic Labs., Fort Belvoir, Va.

EFFECTS OF GROUND COVER AND LEAF AREA ON THE SPECTRAL REFLECTANCE OF VEGETATION-SOIL TARGET
M. B. SATTERWHITE and P. HENLEY 29 Sep. 1982

The relations between spectral reflectance, percent ground cover, and leaf area index (LAI) for vegetation-soil targets were evaluated for green vegetation against either a light-toned sand and a dark-toned organic loam soil. The percent ground cover and LAI were calculated for the ground area in the radiometer's field of view. The special reflectances of the different targets were measured in the 400 to 1100 nm region. For the vegetation-organic loam targets, the present cover and LAI varied directly with the target reflectance in the green (520-600 nm) and the infrared (700-1100 nm) regions, but varied inversely with reflectance in the red region (650-700 nm). For the vegetation-sand targets, the percent cover and LAI varied inversely with reflectance in the visible region and directly in the IR region. Results show that the major change in reflectance of vegetation-soils was related more to the change in percent cover. For less than 100 percent cover, the LAI varied directly with percent ground cover. A change in LAI produced less change in target reflectance than did a change in percent cover. Once the canopy is closed, i.e., 100 percent cover, variation in LAI had little effect.

Author (GRA)

N83-14655# Army Engineer Topographic Labs., Fort Belvoir, Va.

SPECIAL REFLECTANCE OF SOME PLANT INDICATORS OF SALINE AND NONSALINE SOILS
M. B. SATTERWHITE and J. W. EASTES 23 Sep. 1982

The task of finding a water supply in an arid region and determining something of its potability can be aided by using various remote sensing techniques for gathering geological, botanical, and terrain data. The objective of this study was to determine if salt-tolerant and salt-intolerant plant species could be distinguished by some unique spectral bandpass in the 0.4 to 1.1 micrometers spectral region. A number of study sites in Nevada having either salt-tolerant or intolerant plant species were selected. Spectral measurements were made on six salt-tolerant and two salt-intolerant species during June-July when the plants were in full vegetative stage and not under any apparent water deficit stress. The reflectance spectra of the halophyte and nonhalophyte species showed that they could not be differentiated using selected bandpasses because the spectral characteristics (intensity and wavelength range) were too similar for both groups. Comparison of individual spectra showed some salt-tolerant and intolerant species could be distinguished by their reflectance spectra. Even so, different species occupying similar landform conditions had similar spectral reflectance signatures. The canopy geometry and background were important factors affecting these spectral signatures.

Author (GRA)

N83-15740# National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.

AUTOMATED SEGMENT MATCHING ALGORITHM-THEORY, TEST, AND EVALUATION
M. T. KALCIC, Principal Investigator Jun. 1982 46 p

Results to automate the U.S. Department of Agriculture's process of segment shifting and obtain results within one-half pixel accuracy are presented. Given an initial registration, the digitized segment is shifted until a more precise fit to the LANDSAT data is found. The algorithm automates the shifting process and performs certain tests for matching and accepting the computed shift numbers. Results indicate the algorithm can obtain results within one-half pixel accuracy.

A.R.H.

N83-15741*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

GATES TO GREGG HIGH VOLTAGE TRANSMISSION LINE STUDY

The usefulness of LANDSAT data in the planning of transmission line routes was assessed. LANDSAT digital data and image processing techniques, specifically a multi-date supervised classification approach, were used to develop a land cover map for an agricultural area near Fresno, California. Twenty-six land cover classes were identified, of which twenty classes were agricultural crops. High classification accuracies (greater than 80%) were attained for several classes, including cotton, grain, and vineyards. The primary products generated were 1:24,000, 1:100,000 and 1:250,000 scale maps of the classification and acreage summaries for all land cover classes within four alternate transmission line routes.

Author

N83-15743# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

COMPUTER PROGRAM DOCUMENTATION FOR THE PASTURE/RANGE CONDITION ASSESSMENT PROCESSOR
K. S. MCINTYRE and T. G. MILLER, Principal Investigators Jul. 1982 46 p

The processor which drives for the RANGE software allows the user to analyze LANDSAT data containing pasture and rangeland. Analysis includes mapping, generating statistics, calculating vegetative indexes, and plotting vegetative indexes. Routines for using the processor are given. A flow diagram is included.

A.R.H.
The nature of the forests. Single date LANDSAT analysis should be followed by field verification to acquire additional information about forest conditions. Further symbolization of LANDSAT data was prepared for the study area quadrangles. Further symbols suggest that such classes are indicative of mid to late seral aspen/conifer forest mixing. Photo interpretations of the print composite maps by a diazo-type process. A.R.H.

Detection of Aspen-Conifer Forest Mixes from LANDSAT Digital Data

R. A. Jaynes and J. A. Merola 1982 30 p refs Sponsored by Dept. of Agriculture ERTS (Contract NAGW-95) (E83-10106; NASA-CR-169680; NAS 1.26:166860; CRSC-82-4)

Aspen, conifer and mixed aspen/conifer forests were mapped for a 15-quadrangle study area in the Utah-Idaho Bear River Range using LANDSAT multispectral scanner data. Digital classification and statistical analysis of LANDSAT data allowed the identification of six groups of signatures which reflect different types of aspen/conifer forest mixing. Photo interpretations of the print symbols suggest that such classes are indicative of mid to late seral aspen forests. Digital print map overlays and acreage mosaicking if the area encompasses two LANDSAT scenes; (3) forming the forest/nonforest mask in ORSER compressed map format using the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (Contract NAS9-16369) (E83-10113; NASA-CR-167634; NAS 1.26:167634; RSC-4496-132-VOL-1)

Microwave Remote Sensing of Soil Moisture, Volume 1 Final Report


Microwave Remote Sensing of Soil Moisture, Volume 2 Final Report


Various models for calculating crop canopy reflectance, in the visible and infrared wavelengths, from the optical and geometrical properties of a canopy and its constituents are reviewed. The radiative transfer equation is discussed as well as both analytical and numerical crop reflectance models which are manifestations of the solution of this equation. Recommendations are made for further work in modeling of canopy reflectance.

Agriculture and Forestry

National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

Multispectral Characterization of the LANDSAT-D Visible-IR Scanner Subsystems

B. L. Markham, Principal Investigator and J. L. Barker Jun. 1982 65 p refs Submitted for publication ERTS (E83-10107; NASA-TM-83955; NAS 1.15:83955) Avail: NTIS HC A04/MF A01 CSCL 20F

Relative spectral response data for the multispectral scanner subsystems (MSS) to be flown on LANDSAT-D and LANDSAT-D backup, the protolight and flight models, respectively, are presented and compared to similar data for the LANDSAT 1, 2, and 3 subsystems. Channel-by-channel (six channels per band) outputs for soil and soybean targets were simulated and compared within each band and between scanners. The two LANDSAT-D scanners proved to be nearly identical in mean spectral response, but they exhibited some differences from the previous MSS's. Principal differences between the spectral responses of the D-scanners and previous scanners were: (1) a mean upper-band edge in the green band of 606 nm compared to previous means of 593 to 598 nm; (2) an average upper-band edge of 697 nm in the red band compared to previous averages of 701 to 710 nm; and (3) an average bandpass for the first near-IR band of 702-814 nm compared to a range of 693-793 to 697-802 nm for previous scanners. These differences caused the simulated D-scanner outputs to be 3 to 10 percent lower in the red band and 3 to 11 percent higher in the first near-IR band than previous scanners for the soybeans target. Otherwise, outputs from soil and soybean targets were only slightly affected. The D-scanners were generally more uniform from channel to channel within bands than previous scanners.

Agriculture and Forestry

Texas A&M Univ., College Station. Remote Sensing Center.

Rangeland Biomass Estimation Demonstration Final Report


Because of their sensitivity to chlorophyll density, green leaf density, and leaf water density, two hand-held radiometers which have sensor bands coinciding with thematic mapper bands 3, 4, and 5 were used to calibrate green biomass to LANDSAT spectral ratios as a step towards using portable radiometers to speed up ground data acquisition. Two field reflectance samples monitored
incoming radiation concurrently with sampling. Software routines were developed and used to extract data from uncorrected tapes of MSS data provided in NASA LANDSAT universal format. A LANDSAT biomass calibration curve estimated the range biomass over a four scene area and displayed this information spatially as a product in a format of use to ranchers. The regional biomass contour map is discussed.

A.R.H.

(E83-10115; NASA-CR-169698; NAS 1.26:169698; IR-2) Avail: NTIS HC A05/MF A01 CSCL 02C
Crop calendars for 1979 and 1980 were investigated in support of an effort to develop techniques for mapping the High Plains aquifer region. Optimal LANDSAT image dates for 1980 were preliminarily identified based on ESS weekly crop weather reports and 1979 ESS agricultural statistics were entered into the computer. A questionnaire was compiled and sent to ASCS county agents with approval of the Extension Directors in each state involved. Data from returning questionnaires were tabulated and development started on a set of computer programs to allow the preparation of computer assisted graphic displays of much of the collected data.

A.R.H.

Some mathematical/statistical problems within the AGRISTARS program amendable to investigations involving the use of surface fitting techniques are overviewed. The Bayes and maximum likelihood rules, bias determination, regression estimators, parameter estimation, and classifier design are addressed. M.G.

(E83-10120; NASA-CR-169723; NAS 1.26:169723) Avail: NTIS HC A12/MF A01 CSCL 05B
Field spectroradiometric and airborne multispectral scanner data were related to vineyard yield and other agronomic variables in an attempt to determine the optimum wavelengths for yield prediction modeling. Reflections between vine canopy reflectance and several management practices were also considered. Spectral analysis of test vines found that, although some correlations with vine yield were significant, they were inadequate for producing a yield prediction model. The findings also indicate that the vines examined through the field spectroradiometers were not truly representative. Geologic lines identified from aerial photographs, LANDSAT images, and maps were compared to gas well locations in three New York counties. Correlations were found between the dominant trends in regional liners and gas field boundaries and trends. Other projects being conducted under the grant include determining vegetable acreage in mucklands, site selection for windmills, spectral effects of sulfur dioxide, and screening tomato seedlings for salt tolerance.

A.R.H.

(E83-10123; NASA-CR-169726; SM-L2-04234; JSC-17816; NAS 1.26:169726; LEMSCO-17502) Avail: NTIS HC A02/MF A01 CSCL 02C
The FRIEDMAN program is a FORTRAN-coded implementation of Friedman’s nonparametric test for several related samples with one observation per treatment/block combination, or as it is sometimes called, the two-way analysis of variance by ranks. The FRIEDMAN program is described and a test data set and its results are presented to aid potential users of this program.

Friedman

2
ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

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

A program is discussed that entails the design, development, and testing of microwave remote sensing systems and techniques intended to overcome the weather-related visibility limitations of optical sensors. The program includes the design and development of an experimental X-band SLAR and a dual-frequency L-band scatterometer, the development of radar-signature analysis techniques, design studies for spaceborne microwave sensors, and an experiment to verify design assumptions pertaining to SAR image information. The development of SAR data processing equipment is briefly noted.

F.G.M.

(Available at a reduced price as microfiche or microfilm. Contact N00014-C-0435; NSF DPP-79-19816)
Three strong episodes of arctic haze that occurred in interior Alaska during late winter 1982 are investigated by means of laser and X-ray spectrometry, by tracing back air trajectories from central Alaska at the 500-mbar level, and by examining satellite photographs of the possible source area. It is found that the air masses involved in the haze episodes came from arctic regions west of Alaska and were charged with suspended submicrometer heavy-metal particles apparently derived from anthropogenic sources of pollution. The back air trajectories are traced to the central Eurasian sector of the Arctic, in particular, the area of the Taimyr Peninsula in Siberia. A Landsat image of the area around the large polymeric ore mining and smelting complex at Norilsk in the Taimyr district is presented that shows two large plumes emanating from smelters processing sulfide-rich Ni-Cu ores.

F.G.M.
02 ENVIRONMENTAL CHANGES AND CULTURAL RESOURCES

A83-11866
PHOTOINTERPRETATION, REMOTE SENSING, AND PHOTOGRAMMETRIC ASSESSMENT OF LANDUSE ELEMENTS APPLIED TO ROAD-PLANNING STUDIES [PHOTO-INTERPRETATION, TELEDETECTION ET ELEMENTS PHOTOGRAMMETRIQUES APPLIQUES AUX ETUDES ROUTIERES]

In French.

Photointerpretation and photogrammetry have numerous applications in road-planning studies in developing countries. This paper examines the products of these two methods for the treatment of aerial photographs (and of remotely sensed data in general), including products associated with photographic techniques (types of emulsion and processing), photoidentification (geomorphology and hydrology), and photogrammetric plotting (relief and planimetry). Attention is also given to the automation of geometrical and photographic techniques, in the area of computer-aided design as well as in the area of image processing.

B. J.

A83-12571*
National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LANDSAT OBSERVATIONS OF MOUNT ST. HELENS

The eruption of Mount St. Helens on May 18, 1980, and subsequent destruction of approximately 593 square kilometers (229 square miles) of vegetation, clearly provided a unique opportunity for earth-oriented satellite remote sensing systems. Landsat, a relatively high resolution Multispectral Scanner (MSS) system, imaged Mount St. Helens both before and after its major eruption. Digital data have been used to create a damage assessment map and a change detection image. Several classes of timber damage and land cover modification have been developed. Acreages for each class have been tabulated. (Author)

A83-12572
MOUNT ST. HELENS QUICK RESPONSE DAMAGE ASSESSMENT USING HIGH-ALTITUDE INFRARED PHOTOGRAPHY

A rapid assessment was needed to devise land management plans for timber sale operations, rehabilitation efforts, and fire protection activities. High-altitude color-infrared photography was collected in May and June by the Ames Research Center. The photographs, together with information from a helicopter trip into the area, formed the basis for the construction of 58 map-registered overlays within a three-week period. These overlays gave detailed depictions of the damage to timber resources, the transportation network, and the watershed. Using the 14 timber loss overlays, the Department of Agriculture (Forest Service) digitized cells depicting ownership, degree of damage, and the preemption cover classes. These digitized data furnished such information as the total area affected within and outside the national forest, the total timber acreage destroyed or damaged, the sizes of the timber destruction, and the acreage of biomass land before and after the eruption. The hydrology and transportation overlays provided information for an alert system to locate areas needing comprehensive studies.

C. R.

A83-14095
THE RELATIONSHIPS BETWEEN REFLECTANCE IN THE LANDSAT WAVEBANDS AND THE COMPOSITION OF AN AUSTRALIAN SEMI-ARID SHRUB RANGELAND

A83-14228#
RENEWABLE RESOURCES MONITORING NEEDS IN MANITOBA

A83-14230#
OPERATIONAL LAND COVER TYPE MAPPING IN ONTARIO BY LANDSAT BASED DIGITAL ANALYSIS AND MAP PRODUCTION

A83-14232#
A POSITION-BASED RESOURCE MAPPING STUDY OF THE KANANASKIS VALLEY USING LANDSAT

For effective management of natural resources, environmental monitoring is necessary on a temporal basis. To enable quantitative evaluation of changes, details are also required concerning the spatial distribution of ground-cover types. All this information can be stored efficiently using a position-based land information system. In non-urban areas, Landsat data can be used to provide a basic framework for such a land information system. The coverage, the repetitive nature of the imagery and the resolution are all suitable for resources monitoring. This paper describes the application of a general position-based resource mapping system using Landsat, recently developed in Australia, to environmental monitoring in the Kananaskis Valley, Alberta. A common grid, used to resample the rectified pixel data, provides the basis for the land information system to which conventional survey and mapping data can be appended. (Author)

A83-14236#
ENVIRONMENTAL MONITORING OF THE ATHABASCA OIL SANDS REGION
S. ARONOFF (California, University, Berkeley, CA), G. A. ROSS, and W. A. ROSS (Calgary, University, Calgary, Alberta, Canada) In: Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 100-109. Research supported by the Canada Centre for Remote Sensing, Alberta Oil Sands Environmental Research Program, and TES Research and Consulting, Ltd. refs

This study was designed to examine the application of remote sensing to environmental monitoring of the 30,000 square km region under the jurisdiction of the Alberta Oil Sands Environmental Research Program (AOSERP) and to demonstrate appropriate ways to integrate field-acquired and remotely-sensed data. False color infrared aerial photography acquired during the period of maximum foliage development was found to be most valuable for vegetation
mapping and the detection of environmental disturbance. Thermal infrared night-time imagery, used with true color aerial photography, was found to be most valuable in the detection of thermal anomalies related to water features and in the analysis of oil sands plant sites. Landsat color composite transparencies were found to be valuable in providing an overview of the major ecological communities in the area, and of the progress of land-clearing operations. Digital analysis of two summer images was done using the computer-based image analysis system at the Canada Centre for Remote Sensing in Ottawa. Change detection analysis of open water, cleared land, and vegetation appeared to be the most valuable application of Landsat digital data to environmental monitoring of the region (Author).

A83-14242/#
VEGETATION AND HUMAN IMPACT MAPPING FOR THE MANAGEMENT OF THE SUNSHINE AREA, CANADIAN ROCKY MOUNTAINS

A83-14250/#
ECOLOGICAL LAND CLASSIFICATION IN THE YUKON

A83-14263/#
REMOTE SENSING AND WASTE MANAGEMENT

Four remote sensing techniques - archival black and white, color, and color infrared photography plus thermograph - are examined to ascertain which is most suitable for waste management. Six landfill sites in southern Ontario are used in evaluating techniques for locating landfilled areas, monitoring operational practices, and monitoring surface discharges of leachate. The suitability of color and color infrared photography and thermography for monitoring active leachate discharge from landfill sites is discussed. Color and color infrared film exposed at either 1:9000 or 1:6000 scale throughout 1980 is analyzed, noting that predawn thermography was flown in March, April, and November 1980. It is found that the 1980 photography and thermography identified current site conditions and located some surface leachate discharges. Site conditions and restrictions inherent in each remote sensing technique, however, prevented complete detection of leachate discharge. What is more, all the data required some understanding of landfills and site physical setting to be fully interpreted. (C.R.)

A83-14277/#
THE USE OF SATELLITE INFORMATION IN WEATHER FORECASTING AT THE PACIFIC WEATHER CENTRE

Projected impacts of the development of a satellite meteorological ground station in Vancouver to compensate for the termination of an ocean-based meteorological station, Papa, are discussed. Currently, GOES satellite data, containing imagery, derived vertical temperature and moisture profiles, and winds aloft data are received in San Francisco and relayed to Vancouver, while polar orbiting satellite data are received in Edmonton for relay. Of primary meteorological interest in Canada are migratory high and low pressure systems on a scale of 1000-5000 km. It is noted that predictions of frost onset, low clouds, fog, thunderstorms, and icing hazards using satellite data have been historically verified. The new station will accept visual and IR images, have color enhancement, animation, and overlay capabilities for use with the GOES data. (M.S.K.)

A83-14292/#
RESULTS OF STEREOSCOPIC IMAGE SIMULATIONS FOR THE SPOT HRV CARRIED OUT AT THE GUN LAKE SITE IN BRITISH COLUMBIA [RESULTATS DE SIMULATIONS D'IMAGES STEREOSCOPIQUES HRV SPOT SUR LE SITE DE GUN LAKE, C.B.]

Results are presented of simulations of stereoscopic visible high resolution images taken by the French SPOT satellite over an 18 square kilometer area in the Canadian Rockies. The simulated images were produced with the help of MSS data from the Daedalus sensor and of a numerical model of the terrain. The methodology is discussed for both vertical and lateral views of the terrain and for the automated reconstitution of the numerical model. The results are presented in the form of stereoscopic pairs which can be viewed three-dimensionally by means of a pocket stereoscope. (C.D.)

A83-14305
INVESTIGATING THE POSSIBILITY OF PRODUCING A LAND-USE MAP FOR CUBA ON THE BASIS OF SPACE IMAGERY [ISSLEDOVANIE VOZMOZHNOSTI SOSTAVLENIIA KARTY ISPOL'ZOVANIIA ZEMEL' TERRITORII KUBO PO KOSMICHESKIM SNIMKAMI]

In Russian.

An attempt is made to use space imagery in conjunction with standard photogrammetric devices and interpretation tools for producing a land-use map for one of the eastern regions of Cuba. It is shown that the use of the space techniques makes it possible to obtain simultaneously, in the shortest time possible, a series of small land-use maps without having to await the production of larger-scale maps. (V.L.)

A83-14504
A STUDY OF ATOMIC DIFFUSION FROM THE LANDSAT IMAGERY

Financiado da Estudos e Projetos refs (Contract FINEP-B-54-01-042-00-00)

A Landsat multispectral scanner (MSS) data of smoke plumes that originated in eastern Cabo Frio (22 deg, 59 min S; 42 deg, 02 min W), in Brazil, and crossed over into the Atlantic are analyzed.
and presented to illustrate the way in which high-resolution Landsat imagery can aid in evaluating specific air pollution events. Conventional interpretation techniques are applied to analyze the images in such a way as to arrive at certain plume characteristics. Analysis of the visible smoke plumes reveals that the plume was 130 km long and attained a maximum width of 937 m, 10 km away from the chimney emitting the effluent. The results show that diffusion is governed mainly by wind and air temperature differences. With colder water, low-level air is extremely stable and the vertical diffusion is minimal; water warmer than the air, however, induces vigorous diffusion. C.R.

A83-16713# AUTOMATED MEASUREMENTS OF ATMOSPHERIC VISIBILITY

The concept of using a solid-state, linear-array imaging device coupled with computerized scene analysis and display to measure daytime atmospheric visibility is described. Computer software is implemented for routine conversion of observed target and sky radiances into measurements of horizon contrast, visual range, target color impairment, and target modulation depth, i.e., target texture and clarity. An assembled, working instrument has been applied to field measurements. Several examples of field measurements are presented. The instrument is fully automated, and is available for visibility research; its applicability to routine visibility monitoring and as an operational tool for aircraft operations is explored. (Author)

A83-16714# ARCTIC HAZE AND THE ARCTIC GAS AND AEROSOL SAMPLING PROGRAM /AGASP/
(AIAA PAPER 83-0439)

The spring atmosphere in the Arctic has been observed to have anthropogenic pollution levels (Arctic haze) equivalent to those in cities such as Denver and Los Angeles. These high carbon content aerosols (efficient energy absorbers) have a probable Eurasian source. Model studies suggest that aerosol-induced heating has the potential of reducing the Arctic ice cap. A multi-agency group is undertaking an airborne study of the phenomenon using the long range NOAA WP-3D research aircraft. This research will characterize the physical and chemical aspects of the haze constituents and determine their distribution and trajectories. In situ radiative effects will also be measured. Together, these measurements will allow for closing the loop on theory and modeling of the effects of Arctic haze. Aerosol data will be used to determine the applicability of using the proposed NOAA-Air Force-NASA Wind Satellite (WINDSAT) for the measurement of tropospheric wind in the Arctic. (Author)

A83-17248 RADAR SIGNATURES OF TERRAIN - USEFUL MONITORS OF RENEWABLE RESOURCES

A general overview of the backscattering behavior of terrain surfaces is presented, and the potential use of radar in the monitoring of renewable resources is examined. Imaging radar fundamentals are discussed with regard to real-aperture radar, synthetic-aperture radar, and the Seasat SAR. The backscattering behavior of natural targets is considered with attention given to penetration depth, angular response, and frequency response. Three applications of remote sensing are examined: the mapping of soil moisture content, the identification of crop types and the monitoring of crop vigor, and the monitoring of snowpack dynamics. Possible future trends in the development of space SARs are considered. Author

(Contract NAS1-16312)

The technology advancements needed to implement the atmospheric observation satellite systems for air quality research were identified. Tropospheric measurements are considered. The advancements and sensors are based on a model of knowledge objectives in atmospheric science. A set of potential missions and attendant spacecraft and sensors is postulated. The results show that the predominant technology needs will be in passive and active sensors for accurate and frequent global measurements of trace gas concentration profiles. Author

(Contract NAS1-16312)

The technology advancements that will be necessary to implement the atmospheric observation systems for air quality research are examined. Upper and lower atmospheric air quality and meteorological parameters necessary to support the air quality investigations were included. The technology needs were found predominately in areas related to sensors and measurements of air quality and meteorological measurements. Author

M. E. GRAZIANI 1982 63 p
(USGS-CIRC-865) Avail: NTIS HC A04/MF A01

Geographic research, particularly research utilizing remotely sensed data, is reported in approximately 390 references. Testing the use of satellite and high altitude remotely sensed data in a geographic context is covered. N.W.
remaining problems to be solved as part of environmental monitoring efforts include: (1) optimal unification and task distribution in the information acquisition between individual observing subsystems (ground based, satellites, aircraft, etc.); (2) development of new measuring techniques, especially for radiation characteristics, and their metrological maintenance; (3) establishment of subsystems for data collection, processing and retrieval; and (4) development of scientific guidance for the observing systems and techniques.

Author (ESA)

N83-12650# Hydrometeorological Centre of the USSR (Moscow). Inst. of Experimental Meteorology.

INSTRUMENTS AND METHODS FOR MONITORING BACKGROUND SOIL POLLUTION


Avail: NTIS MF A01; print copy available at WMO, Geneva

Airborne instruments used for aerosol sampling in the troposphere include an airlock aerosol sampler Vega-I and a three-stage impactor IFAZ with outlet filter. Measurements are made at flight heights between 0.5 and 10 km. Volumetric sampler output at the indicated speed of the aircraft of 350 km/hr amounts to 160 and 230 cu m/hr at heights of 0.5 and 10 km for Vega-I and for IFAZ impactor 470 and 720 cum/hr respectively. A multistage impactor which can obtain nine dispersed phases of aerosols is used for surface aerosol sampling. Pesticides are sampled on slides impregnated with ethylene glycol. Soil sampling is carried out using the method of soil geochemical profiles i.e., a narrow soil section stretched in one direction that crosses different elements of relief and biogeocenoses. Gas chromatography, atomic absorption spectroscopy and neutron activation are used for trace element determination.

Author (ESA)

N83-13703# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil). Div. de Aplicacao Geofisica.

AN INTRODUCTION TO PROJECT FREEZE [PROJETO GEADA: APRESENTACAO]

F. C. ALMEIDA Jun. 1982 30 p refs In PORTUGUESE; ENGLISH summary

(INPE-2435-NTE/186) Avail: NTIS HC A03/MF A01

The use of infrared imagery from meteorological satellites to record and locate freezing temperatures in subtropical Brazil is described. Techniques employed during the testing phase of the project are examined. The use of environmental satellites for freeze monitoring and the application of these methods to monitor the severe frosts of the winter of 1981 are discussed.

Transl. by J.D.
METHOD OF INTERPRETATION OF REMOTELY SENSED DATA AND APPLICATIONS TO LAND USE [METODOLOGIA DE INTERPRETACION DE DATOS DE SENSORIAMENTO REMOTO E APLICACOES NO USO DA TERRA]


Instructional material describing a methodology of remote sensing data interpretation and examples of applications to land use survey are presented. The image interpretation elements are discussed for different types of sensor systems: aerial photographs, radar, and MSS/LANDSAT. Visual and automatic LANDSAT image interpretation is emphasized. Author

THE GROUP AGROMET MONITORING PROJECT (GAMP)


The GAMP project, which uses METEOSAT data to monitor rainfall, evaporation, soil moisture, and germination in arid and semiarid regions is described. An area of the Sahelian Zone of Mali was monitored in 20 X 30 km blocks using 5 climatic stations and 16 rain gauges. The test period was 17 days at the beginning of the growing season. At the start of the period substantial rainfall caused germination, but the young plants were killed by a later drought.

Author (ESA)

AGROECOLOGICAL CLASSIFICATION BY REMOTE SENSING TECHNIQUES


Temporal multispectral clustering (TMC) and radiation and land morphology automatic mapping (RM) techniques are introduced. Land use classification, climatic inventory maps are presented. The TMC consists of a nonhierarchical cluster algorithm and a multivariate data ordination code. It separates optical scanner data according to their temporal variations. For RM, global radiation values can be obtained by an empirical relationship which depends on the solar coordinates and on the slope and exposure of an identified landscape unity. The slope of each landscape unity can be defined as the ratio between the lowest distance between two points of known elevation, and the relative height increase; its exposure is the geographical direction of this line. The RM algorithm automatically calculates these values, using a digitalized contour lines data bank.

Author (ESA)

APPROACHES TO DESERTIFICATION MONITORING IN THE SUDAN


A project for the development, testing and application of environmental monitoring methods for regional studies of desertification and its control, using LANDSAT data, was formulated. Data processing using a geographical data base, population density monitoring, and land use appropriateness versus theoretically optimal land use were studied. Results indicate that LANDSAT can contribute significantly to the development of models which explain desertification status and rate as functions of physical, biological, agricultural, and socioeconomic variables.

Author (ESA)

IDENTIFYING ENVIRONMENTAL FEATURES FOR LAND MANAGEMENT DECISIONS Semiannual Report

8 May 1981 32 p refs ERTS (Contract NSG-7226)

(E83-10109; NASA-CR-169681; NAS 1.26:169681) Avail: NTIS HC A03/MF A01 CSCL 08B

The benefits of changes in management organization and facilities for the Center for Remote Sensing and Cartography in Utah are reported as well as interactions with and outreach to state and local agencies. Completed projects are described which studied (1) Unita Basin wetland/land use; (2) Davis County foothill development; (3) Farmington Bay shoreline fluctuation; (4) irrigation detection; and (5) satellite investigation of snow cover/mule deer relationships. Techniques developed for composite computer mapping, contrast enhancement, U-2 CIR/LANDSAT digital interface; factor analysis, and multivariate statistical analysis are described.

A.R.H.

THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1981 - 31 Mar. 1982

B. G. BARR and E. A. MARTINKO, Principal Investigators Jul. 1982 234 p Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(Contract NGL-17-004-024)

(E83-10114; NASA-CR-169697; NAS 1.26:169697) Avail: NTIS HC A11/MF A01 CSCL 05A

Capabilities to process data for state agencies in Kansas were upgraded through the vehicle of a low cost data processing system. Short term projects in which agencies identified areas of immediate needs, and longer terms projects, continued from previous years, are described including studies of Arkansas River irrigation; evaluation of rangeland in the Cimarron National Grassland; a model of the Walnut Creek watershed groundwater; selection of a pronghorn antelope release site; the establishment of a geographical data base for tax reassessment in Finney County; a land use/land cover inventory and hazards assessment, and applied R & D in agricultural remote sensing. The topics discussed at a short course in remote sensing and publications are listed.

A.R.H.

A CONTRAST IN GEOMORPHIC PERCEPTION FROM SEASAT RADAR IMAGES


(Contract NAS7-100)

Digitally correlated Seasat synthetic-aperture radar (SAR) images of the Alaska Range, Alaska, and the drumlin-drift belt in Ireland are analyzed for the perception and identification of geomorphic features. The two terrains display strongly contrasted
types of glacial topography whose identification in each case is
related to the geometry of the Seasat imaging radar. Identification of
terrain shape and form is important within the caves imposed by
the intrinsic distortions on the radar images. Image texture
serves coarsely to distinguish topography. Image tones are
scene-dependent and do not uniquely identify specific targets.
Extensive alignments of linear and curvilinear features provide some
of the more important image information from which to
geologic interpretations in each case. (Author)

A83-10981
LOW THRESHOLD INGaAsP/InP LASERS WITH
MICROCLEAVED MIRRORS SUITABLE FOR MONOLITHIC
INTEGRATION
U. KOREN, A. HASSON, K. L. YU, T. R. CHEN, S. MARGALIT,
and A. YARIV (California Institute of Technology, Pasadena, CA)
NON-NSAP-supported research. refs
Low threshold InGaAsP/InP injection lasers on seminsulating
InP substrates have been developed with mirrors fabricated by
the microcleave technique. Miniature suspended bridges
containing the laser channels have been formed and then
microcleave has been accomplished by the use of ultrasonic
vibrations. Lasers with current thresholds as low as 18 mA with
140 micron cavity length and with 35-45 percent differential
quantum efficiency have been obtained. (Author)

A83-12877
DEFENSE MAPPING AGENCY /DMA/ OVERVIEW OF MAPPING,
CHARTING, AND GEODESY /ICAG/ APPLICATIONS OF
DIGITAL IMAGE PATTERN RECOGNITION
W. C. MAHONEY (U.S. Defense Mapping Agency, Aerospace
Center, St. Louis, MO) In: Techniques and applications of image
understanding; Proceedings of the Meeting, Washington, DC, April
DMA applications of digital image pattern recognition are
discussed with reference to geometric modeling; data base stereo
reconstruction; the application of stereo reconstruction functions;
the complexity of mapping, charting, and geodesy pattern
recognition processes; and the design of hierarchical
rule-structures. The complexity of pattern recognition interaction
with the digital processes is indicated, especially as it affects
geometric modeling in the generation of digital terrain elevation
data and digital feature analysis data. The current standards of
mathematical performance associated with these data bases are
presented, and the need for an improved capability to extract
data at all required levels of detail density is discussed. It is
concluded that digital image processing and exploitation has
already demonstrated application to a wide range of individual
mapping, charting, and geodesy problems. B.J.

A83-12617#
MONITORING REVISION REQUIREMENTS FOR CANADIAN
MAPS
E. FLEMING (Department of Energy, Mines and Resources,
Topographical Survey Div., Ottawa, Canada) In: Canadian
Symposium on Remote Sensing, 7th, Winnipeg, Canada,
September 8-11, 1981, Proceedings. Ottawa, Canadian
Two principal topographic maps used for Canada are the
1:250,000 for which there is complete coverage of the country
and the 1:50,000 which is 66% complete. The total maps in these
two series which are entered into revision cycles now numbers
9491 and is increasing at the rate of 400 maps per year. Innovative
techniques using Landsat imagery are being developed which will
facilitate map revision in many parts of the country. Revision of
1:250,000 maps using Landsat as the primary information source
is proving operationally feasible. Change detection studies at
1:50,000 are making it possible to plan aerial photography over
the areas showing most change and to re-validate those maps on
which no change is detected. The geographical areas of the country
where these techniques are applicable are being defined. (Author)

A83-14303
LINES AND RING STRUCTURES ON THE TERRITORY
OF POLAND [LINEAMENTY I KOL'TSEVYE OBRAZOVANII
TERRITORII POL'SKOII HARNOII RESPUBLIKI]
IU. BAZHINSKIY, B. DANEL-DANESKOIA, M. GRANICHNYI, and
M. VILOCHINSKIY (Pol'ska Akademia Nauk, Instytut Geologii, Warsaw,
In Russian.
A tectonic map of Poland is presented which shows lineaments
and ring structures derived from space imagery. It is suggested
that the origin of the lineaments is associated with the tectonic
shifts of the folded basement, in particular those that occurred
during the recent epoch. V.L.

A83-14857
A SIMPLE RELATION BETWEEN ACTIVE AND PASSIVE
MICROWAVE REMOTE SENSING MEASUREMENTS OF EARTH
TERRAIN
L. TSANG, A. J. BLANCHARD, R. W. NEWTON (Texas A & M
University, College Station, TX), and J. A. KONG (MIT, Cambridge,
MA) IEEE Transactions on Geoscience and Remote Sensing,
(Contract NSF ECS-80-14579)
A simple approximate relation between backscattering
coefficient and emissivity measurements is derived. The relation
is applicable to active and passive microwave remote sensing of
earth terrain where volume scattering plays a dominant role. From
the relation, one can obtain a rough estimate of the backscattering
coefficient from the emissivity and vice versa. Such estimation is
useful in checking experimental measurements and also helps to
ascertain the validity of theoretical models. It also safeguards
against obtaining arbitrarily high values for both backscattering
coefficients and emissivities. (Author)

A83-16239*
THE GEOLOGY OF EUROPA
B. K. LUCCHITTA and L. A. SODERBLOM (U.S. Geological Survey,
Flagstaff, Ariz.) In: Satellites of Jupiter. Tucson, AZ, University of
Arizona Press, 1982, p. 521-555, 940, 941. refs
(Contract PROJECT VOYAGER; NASA ORDER W-13709; NASA
ORDER W-08395)
The map units and lineations of Europa are detailed, and the
geologic processes, and history, and thick and thin ice models of
the satellite are discussed. It is concluded that Europa lacks
evidence of a horizontally stratified crust, the geology appears
carved and dismembered by pressure of the crust and intrusions into an icy
shell. The surface consists of plains and mottled terrain, the former
being older. Numerous straight and curved lineations, streaks,
stripes, and bands cross Europa's surface on a global and surface
scale. Most lineations appear related to fractures in the crust.
Five fresh craters in the 10 to 30 km diameter range are visible.
The dark spots, stripes, and bands that appear to have replaced
sections of the crust suggest that material was transported to the
surface from the subjacent silicate lithosphere. The apparent low
density of craters superposed on Europa's surface suggests that
the surface is about 100 million years old. C.D.

A83-17679
CONCERNING A METHOD FOR THE DETERMINATION OF
INITIAL GEODETIC DATA [OB ODOMI METODE
USTANOVLÆVIA ISKHODNYKH GEODEZÌČESKÌH
DANÝKHY]
F. KH. LAN (Moskovskii Institut Inzhenerov Geodezii,
Aerofotos'ëmi i Kartografii, Moscow, USSR) Geodeziia i
Aerofotógraﬁya, no. 5, 1982, p. 75-78. In Russian. refs
A method for the determination of initial geodetic data is
proposed which is based on the use of planetary heights of
the quasi-geoid. It is shown that, within the limits of the territory of
Vietnam, the rms deviation of the real geoid from the Krasovskii
ellipsoid oriented by this method does not exceed 6 m. It is noted
that the proposed method is suitable for constructing an astronomical-geodetic network over the entire territory which is studied, and is effective in approximating the quasi-geoid to the reference ellipsoid.

B.J.

N83-10693# California Univ., Livermore. Lawrence Livermore Lab.

AERIAL GEOLOGIC LOG FROM LIVERMORE, CALIFORNIA TO THE NEVADA TEST SITE, NYE COUNTY, NEVADA

J. L WAGONER Jan. 1982 121 p refs

(Contract W-7405-ENG-48)

(DE82-019392; UCRL-53217) Avail: NTIS HC A06/MF A01

Theoretical and experimental investigations were performed in order to obtain indications concerning the accuracy in the entire domain of close-range photogrammetry. For all important steps, a theoretical simulation was done and experimentally verified, using few air photos included which will help the traveler identify specific geologic features. Geologic cross sections of the area from Livermore Valley to Gold Mountain describe the geologic structure across the geologic provinces. A LANDSAT mosaic of the flight path is also included.

DOE

N83-11563 Bayerische Akademie der Wissenschaften, Munich (West Germany).

REPORT ON THE SPECIAL PROGRAM 78 SATELLITE GEODESY OF THE TECHNICAL UNIVERSITY OF MUNICH Progress Report, 1980 [DIE ARBEITEN DES SONDERFORSCHUNGSBEREICHES 78 SATELLITENGEODÄSIE DER TECHNISCHE UNIVERSITÄT NUEMCHEN IM JAHRE 1980]

M. SCHNEIDER Bayerischen Akademie der Wissenschaften. 1981 216 p refs In GERMAN

(ASTRON-GEODAET-ARB-41; ISBN-3-7696-9784-7; ISSN-0065-5325) Avail: Issuing Activity

Various topics include: (1) direction finding; (2) range finding; (3) Doppler measurements; (4) construction of a receiver for radio interferometry; (5) mobile laser range finding system; (6) figure-and field parameter determination/geopotential; (7) dynamics of the Earth-Moon system; and (8) kinematics of geodetic point fields.

Author (ESA)

N83-11564 Bayerische Akademie der Wissenschaften, Munich (West Germany).

THEORETICAL AND EXPERIMENTAL INVESTIGATIONS ON THE ACCURACY OF CLOSE-RANGE PHOTOGRAMMETRY PH.D. Thesis - Stuttgart Univ. [THEORETISCHE UND EXPERIMENTELLE ARBEITEN ZUR GENAUIGKEIT DER NAHBEREICHSPHOTOGRAMMETRIE]

W. U. BOETTINGER Bayerischen Akademie der Wissenschaften 1981 148 p refs In GERMAN

(SER-C-256; ISBN-3-7696-9313-3; ISSN-0065-5325) Avail: Issuing Activity

Theoretical and experimental investigations were performed in order to obtain indications concerning the accuracy in the entire domain of close-range photogrammetry. For all important steps, a theoretical simulation was done and experimentally verified, using well chosen cases. A measuring chamber with high internal stability and equipped with geodetical instruments was constructed. An average point accuracy of ± 0.05 mm was obtained. The investigation of a conventional calibration and orientation system with regard to its applicability in close-range photogrammetry led to modifications in the system. The orientation accuracy corresponds approximately to that of aerial photography. Adding a third picture for orientation, according to the bundle method, improves the result by 15%. A 50% accuracy improvement occurs in the registration direction for convergence angle of about 30 deg arc and a basis height ratio of 1:1. All theoretical and experimental investigations show that this is the best situation for close-range photogrammetry.

Author (ESA)

N83-11571# Naval Surface Weapons Center, Dahlgren, Va.

EVALUATION OF GEODETIC PRODUCTS PRODUCED BY THE NSWC REDUCTION OF SEASAT RADAR ALTIMETER DATA Final Report


(AD-A117897; NSWC/TR-81-260) Avail: NTIS HC A03/MF A01

An estimation is made of the possible errors associated with the processing by NSWC of raw SEASAT altimetry data to produce ocean geodetic data, e.g., geoid heights and vertical deflections. Also the noise level of the SEASAT radar altimeter is estimated. Then the SEASAT geodetic data are examined for self-consistency on repeat-track sequences and compared with other independent geodetic data obtained from ocean gravity surveys by ships. Anomalies in the comparisons are examined to determine probable causes.

Author (GRA)


(Contract NSF DPP-68-00508)

(PB82-187923; ARL-TR-81-49) Avail: NTIS HC A02/MF A01

Data acquisition and tracking procedures for navigation and beacon satellites maintenance and repair of electronic equipment, and physical upkeep of the station are summarized. The data gathered were used in geodetic studies, ionospheric investigations, and for navigational purposes. In addition, a program utilizing the refraction term error from the Doppler tracking data as a diagnostic to investigate certain characteristics of the ionosphere was brought into full operation.

GRA


(E83-10027; NASA-CR-169500; NAS 1.26:169500; REPT-4) Avail: NTIS HC A02/MF A01

CSCL 02C

Data tapes were decoded and 24 tracks over the Indian region were reduced to common elevation. Profiles of raw scalar and vector field data and the residuals along few passes were prepared. An anomaly data set was created from the Investigator-B tape. Data was sampled on an 0.5 deg by 0.5 deg grid.

A.R.H.

N83-13524# Indian Inst. of Geomagnetism, Bombay.

MAGSAT PROJECT Quarterly Report

8 May 1981 1 p Sponsored by NASA ERTS

(E83-10030; NASA-CR-169503) Avail: NTIS HC A02/MF A01

CSCL 05B

Programs for the conversion of MAGSAT tapes (both CHRONICLE and CHRONINT formats) from IBM binary to DEC 10 binary were developed in ASSEMBLY language) and programs for selection of only a particular part of CHRONICLE tape (e.g., passes over the Indian subcontinent) were also prepared. Data on a few selected quiet and disturbed days were studied by substracting the main field, and the anomalies over the Indian region were partly identified on few of the passes. A national Workshop on MAGSAT was arranged. The potentialities and usefulness of MAGSAT data particularly in the study of crustal lithology was discussed.

Author
03 GEODESY AND CARTOGRAPHY

N83-13525*# Purdue Univ., Lafayette, Ind. Dept. of Geosciences.
Progress on the analysis MAGSAT data is reported. The MAGSAT data from 40 deg S to 70 deg N latitude and 30 deg W to 60 E longitude was reduced to radial polarization. In addition, gravity anomaly data from this area were processed and a variety of filtered maps were prepared for combined interpretation of the gravity and magnetic data in conjunction with structural and tectonic maps of the area. The VERSATEC listings and cross-reference maps of variable and array names for the spherical Earth analysis programs NVERTSM, SMFLD, NVERTG, and GFLD were also prepared. M.G.

N83-13526*# Indian Inst. of Geomagnetism, Bombay.
MAGSAT FOR GEOMAGNETIC STUDIES OVER INDIAN REGION Progress Report, 1 Apr. - 31 Jul. 1982
R. G. RASTOGI, Principal Investigator 1 Aug. 1982 13 p Sponsored by NASA ERTS (E83-10032; NASA-CA-169505; NASA 1.26:169505; PR-3) Avail: NTIS HC A02/ MF A01 CSCL 05B
Software was prepared for removal of the external field due to the ring current and the associated induced part. Fast Fourier transformation was used to analyse the field of lithosphere with and without external current (+ induced internal current) component. A vertical component in the equatorial electrojet current system was identified from MAGSAT records. A.R.H.

The MAGSAT data were used to produce a scalar anomaly map of the U.S. In order to remove the east-west striping anomalies, which are believed to be caused by the low-order polynomials used to reduce the orbital bias errors, a 2-D spectral filtering using the Fast Fourier transform method was applied. The result was a low-pass filtered map, with the east-west stripings removed, resembles much closer the surface aeromagnetic map based on the U.S. MAGNET data. The spectral filtering was also applied to the MAGSAT vector data. Department of Defense gravity data was processed to produce a filtered U.S. gravity map whose spectral contents are comparable to those of the MAGSAT vector data. M.G.

N83-13528*# Ohio State Univ., Columbus. Dept. of Geodetic Science and Surveying.
EFFECTS OF ADOPTING NEW PRECESSION, NUTATION AND EQUINOX CORRECTIONS ON THE TERRESTRIAL REFERENCE FRAME S. Y. ZHU and I. I. MUELLER In its Basic Res. for the Geodyn. Program p 2-18 Oct. 1982 refs Avail: NTIS HC A05/ MF A01 CSCL 05B
The effects of adopting new definitive precession and equinox corrections on the terrestrial reference frame was investigated. It is noted that: (1) the effect on polar motion is a diurnal periodic term with an amplitude increasing linearly in time whole on UT1 it is a linear term; (2) general principles are given to determine the effects of small rotations of the frame of a conventional inertial reference system (CIS) on the frame of the conventional terrestrial reference system (CTS); (3) seven CTS options are presented, one of which is necessary to accommodate such rotation. Accommodating possible future changes in the astronomical nutation is discussed. The effects of differences which may exist between the various CTS's and CIS's on Earth rotation parameters (ERP) and how these differences can be determined are examined. It is shown that the CTS differences can be determined from observations made at the same site, while the CIS differences by comparing the ERP's determined by the different techniques during the same time period. E.A.K.

N83-13539*# Ohio State Univ., Columbus. UTILIZATION OF RANGE-DIFFERENCE OBSERVATIONS IN GEODYNAMICS In its Basic Res. for the Geodyn. Program p 19-45 Oct. 1982 (Contract NASS-25886) Avail: NTIS HC A05/ MF A01 CSCL 05B
The utilization of simultaneous laser range differences (SRD) for the determination of Earth orientation and baseline variations is summarized. Results from the Aug. 1980 Lagoes data collected during the short MERIT campaign, and simulations for a possible station arrangement for the main campaign are reported. E.A.K.

N83-13540*# Ohio State Univ., Columbus. DEFORMATION EFFECT OF SIMULTANEOUS DOPPLER-DERIVED RANGE DIFFERENCES C. ZHANG and I. I. MUELLER In its Basic Res. for the Geodyn. Program p 46-94 Oct. 1982 refs Avail: NTIS HC A05/ MF A01 CSCL 05B
A mathematical model for the use of simultaneous Doppler derived correlated ranges in the geometric mode is presented. The model was tested with data taken during the EDOC-2 campaign with different integration intervals. The results of this adjustment are compared with the EDOC-2 adopted solution and those from an uncorrelated model used earlier to provide more economical calculations. It is shown that the correlated mode is superior to the uncorrelated one when the optimum integration interval of 23 seconds is used. E.A.K.
Elevation matrices derived from correlation of digital stereo images often contain errors resulting from a breakdown of the correlation process. One such matrix was corrected using a relaxation algorithm where each point was given a reliability based on comparison with its nearest and next-nearest neighbors. These reliabilities were then used to determine if and how much a point was to be corrected; the process was iterated. The algorithm removed small error areas, but large erroneous regions were not corrected, even when terrain slope classification information was considered.

M. A. MAYHEW, Principal Investigator 1 Dec. 1982 67 p refs
Sponsored by NASA ERTS
(E83-10057; NASA-CR-169591; NAS 1.26:169591)
BTS33-82-79/BB) Avail: NTIS HC A04/MF A01 CSCL 08N

Long wavelength anomalies in the total magnetic field measured by MAGSAT over the United States and adjacent areas are inverted to an equivalent layer crustal magnetization distribution. The model is based on an equal area dipole grid at the Earth's surface. Model resolution, defined as the closest dipole spacing giving a solution having physical significance, is about 220 km for MAGSAT data in the elevation range 300-500 km. The magnetization contours correlate well with large scale tectonic provinces. A higher resolution (200 km) model based on relatively noise free synthetic 'pseudodata' is also presented. Magnetic anomaly component data measured by MAGSAT is compared with synthetic anomaly component fields arising from an equivalent source dipole array at the Earth's surface generated from total field anomaly data alone. An excellent inverse correlation between apparent magnetization and heat flow in the western U.S. is demonstrated. A.R.H.

MAGSAT ANOMALY FIELD INVERSION AND INTERPRETATION FOR THE US Final Report
M. A. MAYHEW, Principal Investigator 1 Dec. 1982 67 p refs
Sponsored by NASA ERTS
(E83-10057; NASA-CR-169591; NAS 1.26:169591; BTS33-82-79/BB)
Avail: NTIS HC A04/MF A01 CSCL 08N

A technique that eliminates external field sources and the effects of strike aliasing was used to extract from marine survey data the intermediate wavelength magnetic anomaly field for (B) in the North Pacific. A strong correlation exists between this field and the MAGSAT field although a directional sensitivity in the MAGSAT field although a directional sensitivity in the MAGSAT field can be detected. The intermediate wavelength field is correlated to tectonic features. Island arcs appear as positive anomalies of induced origin likely due to variations in crustal thickness. Seamount chains and oceanic plateaus also are manifested by strong anomalies. The primary contribution to many of these anomalies appears to be due to a remnant magnetization.

J. L. LABRECQUE, S. C. CANDE, and R. D. JARRARD, Principal Investigators (Arco Oil and Gas Co., Dallas, Tex.) 1983 78 p refs
Original contains color illustrations - ERTS
(Contract NAS5-25891)
(E83-10086; NASA-CR-169597; NAS 1.26:169597)
N83-14596# Lamont-Doherty Geological Observatory, Palisades, N. Y.
THE INTERMEDIATE WAVELENGTH MAGNETIC ANOMALY FIELD OF THE NORTH PACIFIC AND POSSIBLE SOURCE DISTRIBUTIONS Final Report
J. L. LABRECQUE, S. C. CANDE, and R. D. JARRARD, Principal Investigators (Arco Oil and Gas Co., Dallas, Tex.) 1983 78 p refs
Original contains color illustrations - ERTS
(Contract NAS5-25891)
(E83-10086; NASA-CR-169597; NAS 1.26:169597) Avail: NTIS HC A05/MF A01 CSCL 08N

A series of plots illustrating the inversion of MAGSAT scalar anomaly data and the production of scalar anomaly maps at constant altitude are presented and discussed.

M. G.

GRAVIMETRIC MAPS OF THE CENTRAL AFRICAN REPUBLIC
J. ALBOUY and R. GODIVIER, Principal Investigators 1982 14 p
Sponsored by NASA ERTS
(E83-10084; NASA-CR-169596; NAS 1.26:169596)
Avail: NTIS HC A02/MF A01 CSCL 08B

Gravimetric maps of the Central African Republic are described including a map of Bouguer anomalies at 1/1,000,000 in two sections (eastern sheet, western sheet) and a map, in color, of Bouguer anomalies at 1/2,000,000. Instrumentation, data acquisition, calibration, and data correction procedures are discussed.

M. G.
The source parameters for the remainder of these features are presently unidentified ambiguous. Results indicate that the sea surface field is a valuable source of information for secular variation analysis and the resolution of intermediate wavelength source parameters.

N83-14597* # Macquarie Univ., North Ryde (Australia). Centre for Geophysical Exploration Research.


The first version of the MAGSAT selection and reduction software was completed as well as a major enhancement to support geomagnetic vector data selection and reduction. All MAGSAT data over an area between 90°E and 180°E and between 0° and 50°S were reduced. This area includes the Australasian region and surrounding oceans. Nearly 200 profiles across Australia satisfied the criteria for data. The reduced geomagnetic field inferred to be caused by sources within the lithosphere was interpreted. During reduction, magnetic effects caused by all other causes were eliminated. Some possible correlation with major tectonic structures and known continental scale heat flow anomalies were noted.


Research into an approach for altitude adjustments for MAGSAT or similar data acquired over a range of altitudes is progressing. The technique shows promise not only in the production of refined anomaly maps but also in the derivation of regional charts of the magnetic elements from satellite and ground data. Correlations between MAGSAT anomalies and other geophysical and geological data are being explored further and quantitative modelling of some features has begun. The form of some anomalies may change as the maps are refined by the technique being developed. Emphasis is being given to the Canadian regions, although analogous features elsewhere are being considered.


INVESTIGATION OF MAGSAT AND TRIAD MAGNETOMETER DATA TO PROVIDE CORRECTIVE INFORMATION ON HIGH-LATITUDE EXTERNAL FIELDS Final Report T. A. POTEMRA, Principal Investigator, M. SUGIURA, and L. J. ZANETTIC Jul. 1982 19 p refs Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E83-10093; NASA-CR-169603; NAS 1.26:169603) Avail: NTIS HC A02/MF A01 CSCL 08N

Disturbances in the MAGSAT magnetometer data set due to high latitude phenomena were evaluated. Much of the categorization of disturbances due to Birkeland currents, ionospheric Hall currents, finite structure and wave phenomena was done with the MAGSAT data catalog. A color graphics technique was developed for the display of disturbances from multiple orbits, from which one can infer a 'global-image' of the current systems of the auroral zone. The MAGSAT 4/81 magnetic field model approximates the Earth's main field at high latitudes very well for the epoch 1980. MAGSAT's low altitude allows analysis of disturbances in the magnetometer data due to ionospheric electrojet currents. These current distributions were modeled properly for single events as a precursor to the inference of the Birkeland current system. MAGSAT's orbit was approximately shared with that of the Navy/APL TRIAD satellite. This allowed space-time studies of the magnetic disturbance signatures to be performed, the result being an approximately 75% agreement in, as well as high frequency of, signatures due to Birkeland currents. Thus the field-aligned currents are a steady-state participant in the Earth's magnetospheric current system.

N83-14601* Business and Technological Systems, Inc., Seabrook, Md.


An iterative least squares estimation algorithm with the capability for including a priori statistical information was implemented to recover multiple magnetic dipole models of the Earth's main magnetic field. The dipoles are fixed to a specified radius at or below the core-mantle boundary and centered on equal area blocks. The algorithm can solve for dipole magnitudes only (fixed orientations), or allow full freedom of orientation and solve for vector components. External field parameters and observable anomaly biases can also be estimated simultaneously. Time dependence is modeled using first time derivatives for dipole vector components. Single-epoch and time dependent dipole models are derived using MAGSAT and observatory annul means data. Equivalent spherical harmonic representation are computed in closed form from the dipole models and compared with truncated spherical harmonic models estimated in the standard way from the same data sets. In particular, a 21 deg spatial resolution model based on 93 dipoles was computed based on observatory annual means data and a selected MAGSAT data set and was compared with candidate IGRF 1975 models and their 1980 secular variation.


An equivalent source anomaly map and a map of the relative magnetization for the investigation region were produced. Gravimetry, bathymetry, and MAGSAT anomaly maps were contoured in pseudocolor displays. Finally, an autoregressive spectrum estimation technique was verified with synthetic data and shown to be capable of resolving exponential power spectra using small samples of data. Interpretations were made regarding the relationship between MAGSAT data spectra and crustal anomaly spectra.


PRELIMINARY STUDY OF GPS ORBIT DETERMINATION ACCURACY ACHIEVABLE FROM WORLDWIDE TRACKING DATA An equivalent source anomaly map and a map of the relative magnetization for the investigation region were produced. Gravimetry, bathymetry, and MAGSAT anomaly maps were contoured in pseudocolor displays. Finally, an autoregressive spectrum estimation technique was verified with synthetic data and shown to be capable of resolving exponential power spectra using small samples of data. Interpretations were made regarding the relationship between MAGSAT data spectra and crustal anomaly spectra.


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E.A.K.
The geographical variability of short wavelength geoid power spectra (geoid roughness), was mapped for the world's oceans between latitudes 72 deg N and 72 deg S. A spectral analysis of SEASAT altimeter data, reduced to sea surface heights, was performed at 2 minute intervals for 15 consecutive days of the 3-day repeat orbit. The geoid roughness represented by these spectra for wavelengths shorter than about 220 km is separated from the total sea height variance and is displayed in the form of a global contour map. The global average geoid roughness is 32 cm RMS, varying from a high in excess of 2 m RMS near deep ocean trenches to a low of 2 cm RMS in the southeast Pacific. The results of a preliminary study to determine the feasibility of using Kalman filter techniques for geomagnetic field modeling is proceeding. The program SPHERE, which was adapted to function correctly on the Cyber computer, is now operational, for deriving gravity and magnetic models in a spherical coordinate system. A.R.H.

MAGSAT data were used to construct a variety of spherical harmonic models of the main geomagnetic field emanating from Earth's liquid core at poch 1980. These models were used to: (1) accurately determine the radius of Earth's core by a magnetic method, (2) calculate estimates, of the long-term ange of variation of geomagnetic Gauss coefficients; (3) establish a preferred truncation level for current spherical harmonic models of the main geomagnetic field from the core; (4) evaluate a method for taking account of electrical conduction in the mantle when the magnetic field is downward continued to the core-mantle boundary; and (5) establish that upwelling and downwelling of fluid motion at the top of the core is probably detectable, observationally. A fluid dynamics forecast model was not produced because of insufficient data. A.R.H.
GEODESY AND CARTOGRAPHY

predictions from other pre-MAGSAT field models. The field estimate obtained by recursive estimation was found to be superior to all other models.

Author


Schemes for the representation and approximation of surfaces, based on Coon's and triangular patches and blending are discussed. The necessary criteria/characteristics for resulting spaces are outlined. M.G.

04 GEOLCY AND MINERAL RESOURCES

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


Results of a sedimentary rock type discrimination project using Seasat radar and Landsat multispectral image data of the San Rafael Swell, in eastern Utah, are presented, which has the goal of determining the potential contribution of radar image data to Landsat image data for rock type discrimination, particularly when the images are coregistered. The procedure employs several images processing techniques using the Landsat and Seasat data independently, and then both data sets are coregistered. The images are evaluated according to the ease with which contacts can be located and rock units (not just stratigraphically adjacent ones) separated. Results show that of the Landsat images evaluated, the image using a supervised classification scheme is the best for sedimentary rock type discrimination. Of less value, in decreasing order, are color ratio composites, principal components, and the standard color composite. In addition, for rock type discrimination, the black and white Seasat image is less useful than any of the Landsat color images by itself. However, it is found that the incorporation of the surface textural measures made from the Seasat image provides a considerable and worthwhile improvement in rock type discrimination. N.B.


The goal of the study described here is to determine new criteria for improved target discrimination in areas of hydrothermal mineralization. It is noted that the portion of materials, that is, geological surfaces detected by sensing devices, must be accurately determined before elemental and mineralogical characterization. The depth from which visible-near infrared radiation is reflected from target surfaces depends on composition and fabric. Reflectance spectra are obtained from binary mixtures of hematite, goethite, kaolinite and montmorillonite with a reflecting sphere spectrometer over a wavelength range of 400-2500 nm. The reflection (or absorption) intensity is plotted vs. the sample thickness (determined by scanning electron microscopy) to determine the sample thickness at which absorption saturates. The optical depth is seen to vary as a function of mineralogy and wavelength. In general, the maximum depth from which reflection features are discerned is from 12 to 47 microns measured in the visible-near infrared spectral region. C.R.


A technique is presented for searching multispectral images in which compositional information is retained throughout the computer processing. The images are examined for materials with known spectral signatures that are related to known composition. The technique involves determining what the spectral response of a material of interest would be at different wavelengths based on laboratory measurements, and searching a stack of spatially registered images for picture elements with the desired spectral signature. Laboratory spectral reflectance curves are compared to Viking Lander and Orbiter images of Mars and Landsat images of Hawaii, and it is concluded that it is possible to derive compositional information from multispectral images. Since the technique need not be limited to visible and near-infrared images, it represents an important tool for geological exploration. C.D.


Synthetic aperture L-band radar images of Medicine Lake Highland, California, as obtained from the JPL-NASA aircraft and Seasat orbital systems, are presented. Image interpretation is based on two types of information: slope and topographic effects for geomorphic information, and reflectivity or backscatter in flat terrain, which is related to surface roughness and the surface dielectric constant. Cinder cones and lava tubes are visible (geomorphic features), and three types of lava surfaces are: aa, pahoehoe, and block. In addition, to infer lava flow relative ages, overlapping flow fronts and roughness attenuation observations may be used. It is hoped that this research will improve the understanding of the radar signature of volcanic areas, and will be helpful in interpreting data obtained from spaceborne sensors over the earth and, in particular, Venus. R.K.R.
A83-10099* Arkansas Univ., Fayetteville.

GEOLOGICAL TERRAIN MODELS

The initial phase of a program to determine the best interpretation strategy and sensor configuration for a radar remote sensing system for geologic applications is discussed. In this phase, terrain modeling and radar image simulation were used to perform parametric sensitivity studies. A relatively simple computer-generated terrain model is presented, and the data base, backscatter file, and transfer function for digital image simulation are described. Sets of images are presented that simulate the results obtained with an X-band radar from an altitude of 800 km and at three different terrain-illumination angles. The simulations include power maps, slant-range images, ground-range images, and ground-range images with statistical noise incorporated. It is concluded that digital image simulation and computer modeling provide cost-effective methods for evaluating terrain variations and sensor parameter changes, for predicting results, and for defining optimum sensor parameters.

F.G.M.


SOME EXAMPLES OF THE UTILITY OF HCMM DATA IN GEOLOGIC REMOTE SENSING

Examples of HCMM (Heat Capacity Mapping Mission) data in geologic remote sensing are presented, and the data set is composed of HCMM and aircraft digital scanner data and ground truth data from four western U.S. test sites. Data are used in the thermal model to test thermal data effectiveness, and changes in temperature with depth and time for dry soils are described by the model. It is found that the HCMM thermal inertia image is useful in the separability of bedrock and alluvium in Death Valley, and aa and pahoehoe flows in the Pisgah basalt flow. In a color composite of HCMM day temperature, night temperature, and day visible images of the Pisgah Crater test site, it is possible to distinguish alluvium, playa, aa and pahoehoe basalt flow, rhyolite intrusions, and other elements. Ground checking of units at a few points will extend capabilities to large areas and assist in creating telegeologic maps.

R.K.R.

A83-11959


A83-11988

ENVIRONMENTAL MONITORING OF THE ATHABASCA OIL SANDS USING LANDSAT DATA S. ARONOFF, G. A. ROSS, and W. A. ROSS (Calgary, University, Calgary, Alberta, Canada) Photogrammetria, vol. 38, Oct. 1982, p. 77-86. Research supported by the Alberta Oil Sands Environmental Research Program. refs

The Athabasca Oil Sands have undergone rapid and extensive strip mine development. This activity is expected to resume as the cost of petroleum continues to rise. Sixteen spring, summer, and fall Landsat color composite transparencies at the 1/1 million scale were evaluated for use in environmental monitoring. Roads, cleared areas, and water features were best imaged on the May 1, 1976 color composite. Summer Product 8 imagery (July and August) was most useful for vegetation analysis and also had the best year to year signature consistency. For this reason, summer Product 8 imagery was considered most suitable for environmental monitoring of the oil sands region. Two summer images were overlayed and registered, then changes were classified using a supervised classification algorithm. Change detection analyses of open water, cleared land, and vegetation appeared to be the most valuable applications of Landsat digital data to environmental monitoring of the region.

(Author)

A83-12036* Alaska Univ., Fairbanks.


High-altitude radar and thermal imagery collected by the NASA research aircraft WB57F were used to examine the structural setting and distribution of radiant temperatures of geothermal anomalies in the Pilgrim Springs, Alaska area. Like-polarized radar imagery with perpendicular look directions provides the best structural data for lineament analysis, although more than half the mapped lineaments are easily detectable on conventional aerial photography. Radiometer data and imagery from a thermal scanner were used to evaluate radiative surface temperatures, which ranged from 3 to 17 C. The evening imagery, which utilized density-slicing techniques, detected thermal anomalies associated with geothermal heat sources. The study indicates that high-altitude predawn thermal imagery may be able to locate relatively large areas of hot ground in site-specific studies in the vegetated Alaskan terrain. This imagery will probably not detect gentle lateral gradients.

S.C.S.

A83-12641


The principal uses of Landsat imagery in volcanological studies are for regional reconnaissance, for the interpretation of large volcanic structures and to facilitate the comparison of structures in different parts of the world. Standard black and white single band prints and standard false color composites are the cheapest and most readily available forms of Landsat imagery. However, standard Landsat images have a poorer resolution and lower information content than enhanced images. The most generally useful enhancement techniques for volcanic studies have proved to be destriping, contrast stretching and edge enhancement. Enhancement techniques are illustrated with examples of young volcanic structures from the Central Andes. The next few years should see significant advances in satellite remote sensing technology with higher resolution imagery (down to 10-30 m) and imagery in a wider range of spectral bands becoming available.

(Author)
The Shuttle Imaging Radar (SIR-A) penetration of the extremely dry Selima Sand Sheet, dunes and drift sand of the eastern Sahara. Previous unknown buried valleys, geologic structures, and possible Stone Age occupation sites have been revealed through the Shuttle Imaging Radar (SIR-A) penetration of the extremely dry Selima Sand Sheet, dunes and drift sand of the eastern Sahara. Radar penetration of dry sand and soils varies with the wavelength of the incident signals, which is 24 cm for the SIR-A system, as well as incidence angle and electrical properties of the material of the incident signals, topography and roughness. Ocean features were also observed, including large internal waves in the Andaman Sea.

MINERAL IDENTIFICATION FROM ORBIT - INITIAL RESULTS FROM THE SHUTTLE MULTISPECTRAL INFRARED RADIOMETER


Sensor output may be modelled to determine optimum sensor characteristics and data acquisition conditions. A major input to simulation models is the spectral reflectance of the target under investigation. The discriminability of various ground targets depends largely upon the spectral reflectance characteristics of those targets. In order to determine the feasibility of discriminating between surficial deposits, radiometric measurements were made under cloud-free conditions of the reflectance of major types of surficial deposits in the area of Syracuse, New York. The difference observed in reflectance spectra are reported and the implications of these differences for the discrimination of surficial deposits are discussed.

LANDSAT FOR RESOURCE EVALUATION AND MANAGEMENT IN THE ALBERTA FOOTHILLS


The present investigation has the objective to evaluate possibilities regarding a utilization of digital Landsat data for classification applications concerning surficial geology. The study region selected is located in the Canadian Arctic in a zone of continuous permafrost. The vegetation is tundra, developing only where soil moisture conditions permit it. Precambrian crystalline bedrock is exposed over more than 80% of the area. The results obtained in the investigation show that present Landsat data with a resolution of 80x60M can be used to classify surficial geology at a scale of 1:125,000 with a high level of accuracy.
A tool for locating buried pre-glacial valleys in eastern South Dakota

A method for the quantitative evaluation of the results of space imagery interpretation in prospecting applications

A method for the quantitative evaluation of the results of space imagery interpretation in prospecting applications

A survey conducted to evaluate user preference for resolution versus speckle relative to the geologic interpretability of spaceborne radar images is discussed. Thirteen different resolution/looks combinations are simulated from SeaSat synthetic-aperture radar data of each of three test sites. The SAR images were distributed with questionnaires for analysis to 85 earth scientists. The relative discriminability of geologic targets at each test site for each simulation of resolution and speckle on the images is determined on the basis of a survey of the evaluations. A large majority of the analysts respond that for most targets a two-look image at the optimum averaging area, searching for meaningful features, and predicting and verifying numerical solutions. The procedure is illustrated by an example.

A description is presented of the application of Landsat imagery to geomorphological mapping at small scale in areas of low relief amplitude. The determination of the geomorphologic units and aspects of feature detection are considered for a sector of the Pampean Plain in the southern part of Santa Fe province. Aerial photographs and topographical maps at various scales were used in connection with the study of this sector. A mapping scale of 1:1,000,000 was chosen. The geological characteristics of the Pampean Plain are discussed along with the approaches employed in connection with the visual interpretation of Landsat MSS imagery. It is pointed out that false color composites enhanced some features and, combined with black and white images, improved the interpretation. Questions of geomorphologic interpretation and mapping are also investigated.

A method for the quantitative evaluation of the results of space imagery interpretation in prospecting applications

A method for the quantitative evaluation of the results of space imagery interpretation in prospecting applications

A description of a tool for locating buried pre-glacial valleys in eastern South Dakota is provided. This tool evaluates the effectiveness of Landsat data as a tool for locating buried pre-glacial valleys in eastern South Dakota.

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**04 GEOLGY AND MINERAL RESOURCES**

N83-12512# Los Alamos Scientific Lab., N. Mex.

**STATISTICAL TECHNIQUES APPLIED TO AERIAL RADIOMETRIC SURVEYS (STARRS): DISCRIMINANT-ANALYSIS METHODS APPLIED TO AERIAL RADIOMETRIC DATA AND THEIR APPLICATION TO URANIUM FAVORABILITY IN SOUTH TEXAS. NATION URANIUM RESOURCE EVALUATION**


(Contract DE-AC13-76GJ-01664; W-7405-ENG-36) (DE82-020961; GJBX-15682-82) Avail: NTIS HC A09/MF A01

In an effort to use radiometric signatures of geologic units, ten discriminant analysis techniques were applied to aerial radiometric data collected along the Texas Gulf Coast. Results show that partial discriminant analysis with the linear discriminant function applied to the raw data is useful for establishing radiometric signatures and for classifying new observations. Signatures for favorable and unfavorable units along the Texas Gulf Coast were established and new observations were then classified as being from units favorable or unfavorable for hosting uranium deposits based on the established training sets.

DOE

N83-12513# High Life Helicopters, Inc., Puyallup, Wash.

**AIRBORNE GAMMA-RAY SPECTROMETER AND MAGNETOMETER SURVEY. VOLUME 1. DETAIL AREAS, CHRISTMAS MOUTAINS, SOLITARIO, GREEN VALLEY-O-2 RANCH, TEXAS Final Report**

1982 88 p Prepared in cooperation with QEB, Inc.

(Contract DE-AC13-76GJ-01664) (DE82-021614; GJBX-195-82-VOL-1) Avail: NTIS HC A05/MF A01

An airborne survey was made by a gamma-ray spectrometer with a large crystal volume, and with a high sensitivity proton precession magnetometer. Radiometric data were corrected for live time, aircraft and equipment background, cosmic background, atmospheric radon, Compton scatter, and altitude dependence. The corrected data were statistically evaluated, gridded, and contoured to produce maps of the radiometric variables, uranium, potassium, and thorium; their ratios; and the residual magnetic field. These maps were analyzed to produce a multivariant analysis contour map based on the radiometric response of the individual geologic units. A principal factor analysis was performed using the radiometric and magnetic contour maps, the multivariant analysis map, and factor analysis techniques to produce a geochemical analysis map for the area. Systems used in the survey, calibration of the systems, data collection procedures, data processing procedures, the data presentation, interpretation rationale, and interpretation methodology are described.

DOE

N83-12584# Nevada Univ., Reno. Div. of Earth Sciences


(Contract DE-AC08-81NV-10220) (DE82-018598; DOE/IN-10220/1) Avail: NTIS HC A06/MF A01

Geological, geophysical and geochemical surveys were used in conjunction with temperature gradient hole drilling to assess the geothermal resources in Pumpernickel Valley and Carlin, Nevada. A statewide assessment of geothermal resources that was completed in 1970 was used. The exploration techniques were based on previous federally-funded assessment programs that were completed in 10 other areas in Nevada and include: literature search and compilation of existing data, geologic reconnaissance, chemical sampling of thermal and non-thermal fluids, interpretation of satellite imagery, interpretation of low-sun angle aerial photographs, two-meter depth temperature probe survey, gravity survey, seismic survey, soil-mercury survey, and temperature gradient drilling.

DOE

N83-12713# Automatic Corp., Inc., Falls Church, Va.

**DETERMINATION OF THE CONTRIBUTION OF SIDE-LOOKING AIRBORNE RADAR TO STRUCTURAL GEOLOGIC MAPPING**


(PB82-185042) Avail: NTIS HC A06/MF A01

To assist the U.S. Geological Survey in carrying out the Congressional mandate to investigate the use of side looking airborne radar (SLAR), Automatic, Inc. has conducted a research program to determine the unique, incremental contribution of SLAR imagery to structural geologic mapping. Imagery from two SLAR systems and from three other remote sensing systems was interpreted, and the resulting information was quantified and intercompared using a computer assisted geographic information system. The study area includes three U.S. Geological Survey quadrangles.

Author (GRA)

N83-13522*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)

**GEOLOGICAL-STRUCTURAL INTERPRETATION USING PRODUCTS OF REMOTE SENSING IN THE REGION OF CARRANCAS, MINAS GERAIS, BRAZIL [INTERPRETAÇÃO GEOLOGICA-ESTRUTURAL UTILIZANDO PRODUTOS DE SENSÓRIAMENTO REMOTO NA REGIÃO DE CARRANCAS, MINAS GERAIS, BRASIL]**


(E83-10029; NASA-CR-169502; NAS 1.26:169502; INPE-258RPE/416) Avail: NTIS HC A02/MF A01 CSCL 08G

The efficiency of some criteria developed for the utilization of small scale and low resolution remote sensing products to map geological and structural features was demonstrated. Those criteria were adapted from the Logical Method of Photointerpretation which consists of textural qualitative analysis of landforms and drainage net patterns. LANDSAT images of channel 5 and 7, 4 LANDSAT-RBV scenes, and 1 radar mosaic were utilized. The region of study is characterized by supracrustal metasediments (quartzites and micaschist) folded according to a 'zig-zag' pattern and gneissic basement. Lithological-structural definition was considered outstanding when compared to data acquired during field work, bibliographic data and geologic maps acquired in larger scales.

Author

N83-13528*# Massachusetts Univ., Amherst. Dept. of Geology


S. E. HAGGERTY, Principal Investigator 13 Aug. 1982 47 p refs

(Contract NAS5-26414) (E83-10034; NASA-CR-169507; NAS 1.26:169507) Avail: NTIS HC A03/MF A01 CSCL 08G

The Curie Balance was brought to operational stage and is producing data of a preliminary nature. Substantial problems experienced in the assembly and initial operation of the instrument were, for the most part, rectified, but certain problems still exist. Relationships between the geology and the gravity and MAGSAT anomalies of West Africa are reexamined in the context of a partial reconstruction of Gondwanaland.

A.R.H.

J. W. HEAD, III, Principal Investigator 30 Aug. 1982 3 p HCMM

CCT format permitted the mapping of lithologic facies in the Pedra Branca Granite, using geobotanical associations, which occur in zones of cassiterite-rich metasomatic alterations in the granitic body of the Serra da Pedra Branca was investigated. Computer compatible tapes of dry and rainy season imagery were analyzed. Image enlargement, corrections, lineal contrast stretch, and ratioing of noncorrelated spectral bands were performed using the Image 100 with a grey scale of 256 levels between zero and 255. Only bands 5 and 7 were considered. Band ratioing of noncorrelated channels (5 and 7) of rainy season imagery permits distinction of areas with different vegetation coverage percentage, which corresponds to geobotanical associations in the area studied. The linear contrast stretch of channel 5, especially of the dry season image is very unsatisfactory in this area.

A.R.H.
the low solar elevation and the homogeneity in the vegetation cover, specially the grass that becomes dry during this season. Rainy season images, on the other hand, allowed the separation of the lithological types, a fact that can be attributed to a greater differentiation among the geobotanical associations. The muscovite-granite facies with greisenization zones within the Serra de Pedro Branco were mapped. This methodology can be successfully applied to similar known granite bodies elsewhere in the Tin Province of Goias.

**Author**

**N83-14582**

Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**LANDSAT AND RADAR MAPPING OF INTRUSIVE ROCKS IN S.E.-BRAZIL**

N. D. J. PARADA, Principal Investigator, A. R. DOSSANTOS, C. E. DOSANJOS, J. C. MOREIRA, M. P. BARBOSA, and P. VENEZIANI

May 1982 12 p


The feasibility of intrusive rock mapping was investigated and criteria for regional geological mapping established at the scale of 1:500,000 in polycyclic and metamorphic areas using the logic method of photointerpretation of LANDSAT imagery and radar from the RADAMBRASIL project. The spectral behavior of intrusive rocks, was evaluated using the interactive multispectral image analysis system (Image-100). The region of Campos (city) in northern Rio de Janeiro State was selected as the study area and digital imagery processing and pattern recognition techniques were applied. Various maps at the 2:250,000 scale were obtained to evaluate the results of automatic data processing. Author

**N83-14587**

Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**THE COMPUTER TREATMENT OF REMOTELY SENSED DATA:**

**AN INTRODUCTION TO TECHNIQUES WHICH HAVE GEOLOGIC APPLICATIONS [O TRATAMENTO POR CUPUTADOR DE DADOS DE SENSORES REMOTOS: UMA INTRODUCAO DE TECNICAS QUE VISAM APLICACOES GEOLOGICAS]**

N. D. J. PARADA, Principal Investigator, W. R. PARADELLA, and I. VITORELLO

May 1982 16 p

In PORTUGUESE; ENGLISH summary Presented at the 32nd Brazilian Geol. Congr., Salvador, Bahia, 12-18 Sep. 1982 Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (E83-10078; NASA-CR-169589; NAS 1.26:169589; INPE-2419-PRE/127) Avail: NTIS HC A02/MF A01 CSCL 08G

Several aspects of computer-assisted analysis techniques for image enhancement and thematic classification by which LANDSAT MSS imagery may be treated quantitatively are explained. On geological applications, computer processing of digital data allows, possibly, the fullest use of LANDSAT data, by displaying enhanced and corrected data for visual analysis and by evaluating and assigning each spectral pixel information to a given class. Author

**N83-14590**

Iowa Univ., Iowa City. Dept. of Geology.

**USE OF MAGSAT ANOMALY DATA FOR CRUSTAL STRUCTURE AND MINERAL RESOURCES IN THE US MIDCONTINENT**

Quarterly Report, period ending 30 Sep. 1982

R. S. CARMICHAEL, Principal Investigator

30 Sep. 1982 5 p

ERTS (Contract NAS 5-26425) (E83-10082; NASA-CR-169594; NAS 1.26:169594; OR-7) Avail: NTIS HC A02/MF A01 CSCL 08G

Progress in the correlation of MAGSAT anomaly maps with geological and geophysical data sets is reported. An excerpt from Bouguer gravity map of the U.S. was filtered to retain wavelengths of 250 km, thus being physically somewhat analogous to MAGSAT data at 400 km height. Residual anomalies were extracted to compare with the satellite magnetics.

M.G.

**N83-14593**

Technicolor Graphic Services, Inc., Sioux Falls, S. Dak.

**AN INVESTIGATION OF MAGSAT AND COMPLEMENTARY DATA EMPHASIZING PRECAMBRIAN SHIELDS AND ADJACENT AREAS OF WEST AFRICA AND SOUTH AMERICA**

Quarterly Report, 1 Apr. - 30 Sep. 1982

D. A. HASTINGS, Principal Investigator

30 Sep. 1982 4 p

Sponsored by NASA ERTS (Contract DI-14-08-0001-20129) (E83-10085; NASA-CR-169607; NAS 1.26:169607) Avail: NTIS HC A02/MF A01 CSCL 08G

A mineral deposits overlay was prepared to the van der Grinten projection geological world map and coloring of the map was initiated. The Mercator projection version was proofread and some preliminary modeling of MAGSAT anomalies for South America were undertaken.

A.R.H.

**N83-14598**

California Univ., Santa Barbara. Geography Remote Sensing Unit.

**NEOTECTONICS OF THE SAN ANDREAS FAULT SYSTEM: BASIN AND RANGE PROVINCE JUNCTURE**


J. E. ESTES and J. C. CROWELL, Principal Investigators

Oct. 1981 7 p

ERTS (Contract NAG5-177) (E83-10090; NASA-CR-169600; NAS 1.26:169600) Avail: NTIS HC A02/MF A01 CSCL 08G

A thorough evaluation of all LANDSAT coverage of the study area (considering atmospheric clarity, seasonal aspects, specific swath location, and digital quality) resulted in the selection of two consequent (continuously recorded) scenes for detailed analyses. The acquisition of HCMM and SEASAT imagery as well as high altitude U-2 uniform coverage is being considered. A bibliography of previous geological studies and methodological examples is estimated to be 70% complete.

A.R.H.

**N83-14620**


**COMBINED USE OF DAILY THERMAL CYCLE OF METEOSAT IMAGERY AND MULTISPECTRAL LANDSAT DATA: APPLICATION TO THE SANDIAGARA PLATEAU, MALI**


Combined use of LANDSAT and METEOSAT digital data for the mapping of various lithologies in the Sahel zones is summarized. The thermal inertia maps of Meteosat are particularly good for geological, but ground resolution is too low to permit better than large scale mapping. The LANDSAT data is particularly suited to detailed small scale studies, but does not contain enough multispectral information for proper lithologic discrimination during the dry season of the Sahel zone.

Author (ESA)

**N83-14627**

Institute of Geological Sciences, Nottingham (England).

**SATELLITE REMOTE SENSING IN MINERAL EXPLORATION IN DEVELOPING COUNTRIES**


A. R. HALL, Principal Investigator

May - Oct. 1981 5 p

ERTS (Contract NAG5-177) (E83-10090; NASA-CR-169600; NAS 1.26:169600) Avail: NTIS HC A02/MF A01 CSCL 08G

Appropriate levels of image processing and infrastructure for small developing countries to make effective use of satellite remote sensing in mineral exploration by small developing nations are discussed. It is suggested that EARSel has an important role to play in undertaking research to evaluate data from the next generation of satellites on behalf of and in cooperation with developing countries. The provision of access to sophisticated image processing equipment and to experienced personnel as an alternative to the smaller developing countries
investing their limited resources in remote sensing field is also important. Author (ESA)

REMOTE SENSING APPLICATIONS TO THE DEVELOPMENT OF AN INTEGRATED DATA BASE FOR OIL AND GAS EXPLORATION
Avail: NTIS HC A11/MF A01

Techniques employed in oil and gas exploration and the utility of satellite data to the exploration process are discussed. The application of satellite information to geologic analysis, planimetric mapping and other data collection efforts associated with the search for oil and gas are considered. Geographic information and image processing features that were utilized in three projects are outlined and the potential of data sources such as LANDSAT-D is assessed. Experience shows that satellite imagery is of greatest benefit when it is integrated into a comprehensive data base with conventional data. Author (ESA)

N83-14629# Institute of Geological Sciences, Nottingham (England).
REMOTE SENSING OF THE GRANITES OF SOUTHEAST ASIA
Avail: NTIS HC A11/MF A01

Remote sensing using LANDSAT imagery and air photography in support of field investigations is shown to be useful in subdividing the granite bodies of the SE Asia tin belt. In many cases, however, the distinctions in chemistry and physical properties between the various phases of granite are so small that no remote sensing discrimination between them is possible. In NW Malaysia, cloud cover and vegetation hamper imagery. Subdivisions of the granite bodies on the basis of morphological and vegetation variations correlate with lithological variations in the underlying granite. Most subdivisions of the more rugged, high relief and high altitude areas of granite are based on slight variations in morphology alone; the main variation in the vegetation is with altitude. Author (ESA)

N83-14634# Geological Survey of Norway, Trondheim.
DIGITAL METHODS FOR LINEAMENT ANALYSIS
Avail: NTIS HC A11/MF A01

Lineaments taken from LANDSAT images from an area covering most of Finnmark, Norway, were studied. Data programs for digitalization, statistics, plotting and gridding, run on a HP 3000 computer (2 MB core, 750 MB disk) are described. Lineaments are digitalized by the DIGLIN program. This program, written in BASIC, is operated on a graphic terminal and converted with a digitalization table. A cross-hair is placed over the point to be digitalized and for which the coordinates are required. The data as x and y coordinates as well as an identification are then transferred from band cassette to a file on the HP 3000. The program LINER converts the data to a readable file for the program LINEAMENT, which calculates a directional frequency and a directional length histogram, from specified group number, lineament length and subarea. The KONTUR program provides contour maps. For Finnmarksvidda, the lineament directions were gridded and presented as contour maps, facilitating manual and digital correlation with other geodata. Author (ESA)

TECTONICS OF WEST CENTRAL MEXICO AND ADJACENT ARIZONA: A REMOTE SENSING AND FIELD STUDY IN ARID AND SEMI-ARID AREAS
(Contract W-7405-ENG-38) (DEB2-002393; LA-UR-81-2920; CONF-811133-1) Avail: NTIS HC A02/MF A01

Large scale fault zones in west central New Mexico and eastern Arizona were mapped using conventional fieldwork aided by Landsat and Seasat images and high altitude air photos. These faults, which are of post early Miocene age, trend NE-SW and N-S and extend over 200 km. The fault zones bound very large horst and graben blocks which, although located on the physiographic Colorado Plateau, are characteristic of Basin and Range deformation. Their intersection was the locus of extensive Cenozoic volcanism. The procedure developed in this project permitted investigation of an area of about 1.8 x 10 to the 5th power of arid and semiarid land whose structures previously were poorly defined. Author (ESA)

N83-15795# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

The central-western part of Rio Grande do Sul Shield was geologically mapped to test the use of MSS-LANDSAT data in the study of mineralized regions. Visual interpretation of the images the scale of 1:500,000 consisted, in the identification and analysis of the different tonal and textural patterns in each spectral band. After the structural geologic mapping of the area, using visual interpretation techniques, the statistical data obtained were evaluated, specially data concerning size and direction of fractures. The IMAGE-100 system was used to enlarge and enhance certain imagery. The LANDSAT MSS data offer several advantages over conventional white and black aerial photographs for geological studies. Its multispectral characteristic (band 6 and false color composition of bands 4, 5 and 7 were best suitable for the study). Coverage of a large imaging area of about 35,000 sq km, giving a synoptical view, is very useful for perceiving the regional geological setting. Author (ESA)
Includes sea-surface temperature, ocean bottom surveying imagery, drift rates, sea ice and icebergs, sea state, fish location.

A83-10068 DETECTION OF COASTAL ZONE ENVIRONMENTAL CONDITIONS USING SYNTHETIC APERTURE RADAR

Two SAR systems for monitoring oceanic and coastal zone environments are described. One system is airborne, uses both X- and L-band polarizations, while the second is on board the Seasat spacecraft and uses only L-band polarization. The SARs have been employed for detecting gravity waves, surface currents, fronts, surf zone conditions, coastal vegetation, and for performing bathymetry. The use of fast Fourier transforms for gravity wave analysis is mentioned, as are a semi-causal model and a one-step spectral estimation computer scheme. Comparisons with sea-truth data have shown the gravity wave data to be accurate in terms of direction of propagation and wavelength measurement. The SAR data are noted to lack recognizable information on wave height, and further studies to characterize the modulation transfer function more precisely are indicated. M.S.K.

A83-10071 A COMPARISON DATA SET FOR THE EVALUATION OF REMOTE SENSING SYSTEMS ABILITY FOR OCEAN WAVE DATA COLLECTION

A83-10068 THE APPLICATION OF MICROWAVE REMOTE SENSING FOR SNOW AND ICE RESEARCH

The use of active and passive microwave remote sensing techniques in arctic and antarctic snow and ice research is reviewed. In particular, the research program proposed by NASA's Ice and Climate Experiment (ICEX) Science and Applications Working Group is discussed. Aerial and satellite microwave observations of polar sea ice are recounted, as are satellite radar altimeter measurements of Greenland. The proposed I C E X instrument ensemble is briefly described; it consists of a large-antenna multifrequency microwave radiometer, a wide-swath-imagery radar, a scatterometer, a radar ice-elevation altimeter system, and a laser ice-elevation altimeter system. It is noted that the I C E X instruments are to be deployed on satellites flying high-inclination orbits and that near-simultaneous observations of multiple ice and snow parameters by complementary sensors are needed for many of the cryospheric processes to be studied. F.G.M.

A83-10091* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE RADIANCE OF EARLY FALL SEA ICE AT 1.55 CM

Satellite microwave radiance images at 1.55 cm are examined to determine the amount of ice which survives the arctic summer and to determine the regional variation of this multiyear ice emissivity. In the central arctic concentrations are measured in the range 0.75-0.95 and emissivities in the range 0.77 and 0.83 with high values of both near the Canadian Archipelago. (Author)

A83-10092* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE LASER ALTIMETER FOR MEASUREMENT OF ICE SHEET TOPOGRAPHY

Results of a preliminary conceptual design study are presented for a laser altimeter that is capable of high-resolution mapping of the polar ice sheets and is proposed for inclusion in the National Oceanic Satellite System spacecraft or other polar-orbiting satellites. The instrument consists of a pulsed-laser transmitter operating at a wavelength of 532 nm and a duration of 5 nsec, a receiver telescope, a photomultiplier-tube detector, data processing and control electronics, and an attitude sensing and measurement system; a laser footprint diameter of 70 m is planned. The altimeter components are described, and the accuracy of both the altimeter measurement and the attitude measurement is evaluated. A range precision of about 10 cm is estimated, along with an altitude measurement accuracy of approximately 10 arcsec. F.G.M.

A83-10093* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ICE-SHEET DYNAMICS BY SATELLITE LASER ALTIMETRY

Glaciological applications of a satellite laser altimeter system with a range precision of approximately 10 cm and a footprint diameter of 70 m are discussed. Available data on ice-sheet dynamics are reviewed, and the measurement errors associated with the laser altimeter are examined. It is shown that information collected with the system could make it possible to detect changes in average elevation (i.e., in average ice thickness) of less than 15 cm for areas of hundreds of sq km to a few thousand sq km. Other possible applications of the system are briefly considered, including the mapping of the positions of ice-sheet margins, the mapping of the junction between a grounded ice sheet and a floating ice shelf, and the estimation of iceberg calving rates. F.G.M.
A83-10094
FEASIBILITY OF MAPPING OCEAN SURFACE CURRENTS USING DELTA K-MICROWAVE RADARS MOUNTED ON GEOSTATIONARY SATELLITE PLATFORMS

The feasibility of developing a dual-frequency (delta k) microwave radar system that operates from two geostationary satellites is considered. The system would be used to obtain synoptic surface-current maps for large ocean areas. The measurement technique that would be employed is described, along with a possible scheme for illuminating the ocean surface area to be mapped by the radar system. Calculations of the total system S/N ratio are presented for various average power levels. It is shown that the overall system S/N ratios approach 10 dB for average power levels of 1 W when there is no atmospheric absorption and that, when atmospheric conditions are less favorable, reasonable S/N levels close to 10 dB can be obtained by increasing the average power.

F.G.M.

A83-10104
MICROWAVE REMOTE SENSING MEASUREMENTS OF OIL POLLUTION ON THE OCEAN

Microwave and optical remote sensors were flown over fresh and weathered crude oil released from a surface research vessel and also over a slick formed on the sea by frozen oleyl alcohol cubes released from a helicopter. For the crude oil experiments, microwave radiometric measurements at 1.43, 2.65, 22, and 31 GHz are reported, along with the variable incidence angle scattering measurements at 13.9 GHz. For these experiments, unusual depressions in the L-band brightness temperature were observed, possibly related to dispersants applied to the crude oil. Similar depressions, but with much larger values, were observed over the oleyl alcohol monomolecular slicks. Images obtained at 31 and 22 GHz were used to infer oil volume, yielding values which bound the known amounts spilled. Ku band measurements obtained in repeated passes over crude oil slicks are also discussed.

V.L.

A83-10113
ON THE CIRCULATION OF THE WESTERN GULF OF MEXICO - A SATELLITE VIEW

The mechanisms of the predominant anticyclonic circulation of the western Gulf of Mexico are investigated on the basis of satellite IR observations of the relative sea surface temperature (SST). It is shown that the distribution of SST could serve as an indication of dynamical processes in the western and northwestern Gulf of Mexico, at least for the fall, winter, and spring seasons. Analysis of the data supports the hypothesis that the detached Loop Current rings are a source of anticyclonicity for the circulation regime of the western Gulf.

V.L.

A83-10115
THE 100 DAYS OF SEASAT-A

The accomplishments of Seasat-A are reviewed. The radar altimeter monitored average wave height to within 0.5 to 1 meter along a 2 to 12 m swath, and measured changes in the ocean geoid to a precision of 10 cm. The radar scatterometer measured wind speeds from 3 to 28 m/sec within 2 m/sec and direction within 20 deg over two 500 km swaths. The five-frequency microwave radiometer measured surface temperature by measuring the microwave brightness of the surface to within 1 C, measured foam brightness which can be converted into a measurement of high wind speed, mapped ice coverage, and provided atmospheric correction data to the active radars by measuring liquid and gaseous water content in the upper atmosphere. The Synthetic Aperture Radar provided detailed images of open ocean, coastal, inland geology and culture, and ice-covered regions. Relevant oceanographic satellite applications include offshore oil and gas, environmental forecasting, marine transportation, deep ocean mining, and marine fisheries.

C.D.
A83-10832
TIDAL PHENOMENA IN ARCTIC OCEAN ICE /ACCORDING TO SPACE DATA/ [PRILIVNEE JAVLENIA VO L'ADKH SIEVYNOGO LEDOVITOGO OKEANA /PO KOSMICHESKIM DANNYM/]
V. V. BOGORODSKII (Gosudarstvennyi Komitet SSR po Gidrometeorologii i Kontrolu Prirodnyh Sredy, Arkticheskii i Antarkticheskii Nauchno-Issledovatel'skii Institut, Leningrad, USSR) and M. G. NAZIROV (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izuchenii Prirodnykh Resursov, Moscow, USSR) In: Investigations of the Arctic, the Antarctic and the world ocean; Conference-Seminar, Moscow, USSR, February 9-13, 1981, Reports. Leningrad, Gidrometeoizdat, 1982, p. 105-117. In Russian. refs
An analysis of satellite photographs is used to study the tidal factor conditioning the large-scale features of the spatial structure of the Arctic Ocean ice cover. Certain stable regional features of the transformation of tide waves in ice during their quasi-circumpolar course are identified. A relationship is established between the stationary formation of ice clearings (polyn'yas) and the orographic blockage of tide waves. B.J.

A83-10833
SOME FEATURES OF THE SPATIAL STRUCTURE OF THE ARCTIC OCEAN ICE COVER IN CONNECTION WITH TURBULENT FRICTION AND GEOSTROPHIC CAPTURE OF TIDE WAVES [NEKOTOREY CHERTY PROSTRANSTVENNOGO STRUKTURY LEDIANOGO POKROVA ARKTICHESKICHISEI MOREI V SVIAZI S TURBULENTNYM TRENIEI I GEOSTROFICHESKIM ZAKHVATOM PRILINVNOI VOLNY]
M. G. NAZIROV and V. G. TROFIMOVA (Gosudarstvennyi Nauchno-Issledovatel'skii Tsentr Izuchenii Prirodnykh Resursov, Moscow, USSR) In: Investigations of the Arctic, the Antarctic and the world ocean; Conference-Seminar, Moscow, USSR, February 9-13, 1981, Reports. Leningrad, Gidrometeoizdat, 1982, p. 118-121. In Russian. refs

A83-10836
THE UTILIZATION OF INFRARED /IR/ AERIAL AND SPACE OBSERVATIONS OF ARCTIC SEAS IN NAVIGATION AND DURING THE SOLUTION OF OTHER NATIONAL-ECONOMIC PROBLEMS [ISPOL'ZOVANIE INFRAKRASNYYKH /IK/ AEROKOSMICHESKIH NABLJUDENII ARKTICHESKIH MOREI V NAVIGACII I PRI RESHENII DRUGIHX NACRODKHOZIAISTVENNYKH ZADACH]
Dimensionless parameters for remote IR measurements of the thickness of sea ice are proposed. The influence of tide and topographic waves on the structure of sea ice cover is discussed. The variability of the surface temperature field of two Arctic seas during the summer-autumn period over a number of years is examined. The heat balance components of these seas for September are calculated. B.J.

A83-11352
ESTIMATING WIND SPEED FROM HF SKYWAVE RADAR SEA BACKSCATTER
(Contract NOAA-03-7-022-35111)
Linear expressions are derived for different radar frequencies wether the ocean surface wind speed to a theoretical estimate of the -10 dB width of the HF sea echo Doppler spectrum. This spectrum width changes in a complex way with the continuum of second-order echoes which surround the stronger, first-order echo. The second-order echo amplitude is directly related to changes in the directional ocean wave spectrum, resulting in a high dependence of the wind speed estimates derived on the total energy and direction distribution of the wave field. Doppler spectra recorded under known ocean wind and wave conditions illustrate the difficulty of applying the present theoretical expressions to the estimation of wind speed. It is concluded that the -10 dB width is not an adequate wind speed estimator. O.C.
SATELLITE ESTIMATES OF OCEAN-AIR HEAT FLUXES DURING COLD AIR OUTBREAKS

Two studies concerned with the detection of oil in the ice environment are summarized. In one, digital Landsat MSS data was used to detect oil spilled from the damaged 'Kurdistan' tanker. The separation among water, ice, and oil-ice mixture was found best on Band 4 and worst on Band 7. In another, four sensors (an impulse radar, an ultrasonic device, a microwave radiometer and gamma ray spectrometer) were experimentally tested in a laboratory for detecting oil under ice. All sensors were unsuccessful in detecting oil under a piece of ice. Only the ultrasonic device was able to detect oil under the fresh-water ice. The potential role and utility of these and other remote sensors in detecting oil pollution in ice environment are discussed through a review of techniques being used for oil surveillance in the temperate oceans and for ice surveillance. (Author)
A83-14316
CONCERNING THE DETERMINATION OF THE TEMPERATURE OF THE OCEAN SURFACE FROM MULTICHANNEL SATELLITE MEASUREMENTS OF RADIATION IN INFRARED ATMOSPHERIC WINDOWS [K VOPROSU OB OPREDELENII TEMPERATURY POVERKHNOTI OKEANA PO MNOGOKANAL'NYM SPUTNIKOVYM IZMERENIAMI IZLUCHENIIA V 'OKNAKH PROZHRACHNOSTI' (K-DIAPAZONA SPEKTRA]]

A83-14502* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE USE OF LASER PROFILOMETRY FOR OCEAN WAVE STUDIES
(Contract NAVY PROJECT RR-032-08-41; NASA TASK 146-40-15-25; NAVAIR TASK WF95553000)
Airborne laser profilometer measurements of wave skewness and spectra are presented. The measurements were made during high wind and sea state conditions in the North Atlantic. The sea states ranged from 4.5 to 8.7 m and varied from swell to wind wave dominated situations. Skewness values for the five cases ranged from 0.08 to 0.28 and compare favorably with other existing measurements. Also, the Phillips and Wallops spectral models show excellent agreement with profilometer spectra of developing seas. For one case where the seas were fully developed, the Pierson-Moskowitz spectrum provides the best representation. (Author)

A TUTORIAL ASSESSMENT OF ATMOSPHERIC HEIGHT UNCERTAINTIES FOR HIGH-PRECISION SATELLITE ALTIMETER MISSIONS TO MONITOR OCEAN CURRENTS
(Contract N0024-81-C-5301)
Information from a number of sources is synthesized, and an error budget is deduced giving the projected overall height uncertainty correction for a suggested next-generation high-precision radar altimeter. Uncertainties deriving from the wet and dry troposphere, clouds, and the ionosphere are reviewed. It is assumed that the next generation of precision altimeters will be dual-frequency (13.5 and 6 GHz) and will be designed to correct for the ionospheric error. The altimeter-carrying satellite will have a nadir-pointing near coherent-beam dual-frequency microwave radiometer for mitigating the wet tropospheric uncertainty. Whereas there are a number of caveats, the combined uncertainty in the height correction due to the atmosphere for the suggested system should be nominally 3 cm rms compared with at least 6 cm associated with the Seasat-A mission. Improvements in height resolution of the kind discussed here are considered vital for future satellite missions designed to monitor ocean currents. C.R.

A83-14861* Rutgers Univ., New Brunswick, N. J.
OBSERVATIONS OF OCEANIC SURFACE-WIND FIELDS FROM THE NIMBUS-7 MICROWAVE RADIOMETER
(Contract NAS5-26123)
Brightness temperatures from the five-frequency dual-polarized scanning multichannel microwave radiometer (SMMR) on Nimbus 7 have been used to obtain surface wind fields over the ocean. The satellite-derived wind field for 1200Z, Feb. 19, 1979, in the eastern North Pacific has been compared with an operationally generated surface-wind analysis field. Previous point comparisons at selected locations have indicated that satellite winds are accurate to 3 m/sec. The results, although of a preliminary nature, indicate that SMMR-derived winds may be used to determine large-scale wind fields over the ocean, particularly in areas of strong wind gradients such as found in cyclonic systems. (Author)

A83-15058 THE PERMANENTLY SPARSE AREAS OF ICE COVER IN THE OPEN REGIONS OF THE OKHTSK SEA (POSTOIANNAYE RAZREZHENIIA LEDIANOGO POKROVA V OTKRITYYKH RAIONAKH OKHTSKOGO MORIA)
NOAA and Meteor satellite data from 1977-1980 identified areas in the Okhotsk Sea where the ice cover is permanently sparse. The data show that these areas are governed by a system of permanent currents and Coriolis forces acting on the drifting ice. The areas coincide with cyclonic gyres and regions where currents diverge. S.C.S.

FLIGHT PATH DESIGN ISSUES FOR THE TOPEX MISSION
(AIAA PAPER 83-0197)
The proposed Ocean Topography Experiment (TOPEX) is an earth satellite mission currently under consideration by NASA. The primary purpose of the experiment is to determine the general circulation of the oceans and its variability. High precision, space based altimeter measurements will be combined with surface measurements and ocean models to accomplish the mission objectives. The paper will discuss mission requirements on orbit design, orbit selection space, derived requirements on navigation and satellite design issues which impact orbit selection. Unique aspects of the TOPEX orbit design are highlighted, such as high precision repeating orbits, 'frozen orbit' values of eccentricity and periapses, precise maneuver and orbit determination requirements and insuring crossing arcs over a calibration-site. (Author)

A83-16701* National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
OSTA-1/OCEAN COLOR EXPERIMENT
H. H. KIM (NASA, Goddard Space Flight Center, Greenbelt, MD) and H. VAN DER PIEPEN (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen, West Germany) American Institute of Aeronautics and Astronautics; Aerospace Sciences Meeting, 21st, Reno, NV, Jan. 10-13, 1983, 8 p.
(AIAA PAPER 83-0415)
Ocean Color Experiment (OCE) on the OSTA-1 mission acquired ocean images at several widely separated locations on the earth. Digital computer enhancement and band ratioing techniques were used to emphasize patterns of chlorophyll and sediment distribution
in the Yellow Sea and, in one case, of bottom topography in the Great Bahama Bank. Two scenes in the Gulf of Cadiz from orbits 30 and 32 were geometrically corrected to show the movement of plankton patches. This technique enables ocean current velocities to be deduced. A duplicate of the OCE instrument mounted on a DFVLR aircraft was flown over an area of the Atlantic Ocean off the coast of Portugal during the Shuttle mission.

(Author)

A83-17709
SKY-WAVE RADAR SEA-STATE SENSING - EFFECTS OF IONOSPHERIC MOVEMENT AND PROPAGATION GEOMETRY
In the sky-wave radar technique, the parameters of sea waves beyond the horizon are deduced from the Doppler spectra of ionospherically propagated sea echoes, ionospheric movements and multipath can contaminate the sea echo spectrum from a given location. Measurements of the multipath and Doppler spread for a 620 km ionospheric path during MARSEN are reported. For one hop by way of the F2 layer, a typical r.m.s. Doppler shift over 10 min was 0.005 Hz and Doppler spread, to -10 dB, was 0.08 Hz. Multihop and side-scatter modes of propagation and their Doppler structure were identified. The possible use of side scatter at the sea surface is analyzed.

(Author)

A83-17710* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
MEASUREMENTS OF OCEAN SURFACE SPECTRUM FROM AN AIRCRAFT USING THE TWO-FREQUENCY MICROWAVE RESONANCE TECHNIQUE
The present investigation is concerned with the results of a two-frequency (Delta k) microwave radar experiment conducted from an aircraft and aimed primarily at the development of remote sensing techniques to measure ocean surface wave spectral characteristics. The experiment was conducted as part of the Maritime Remote Sensing (MARSEN) project in the North Sea during the autumn of 1979. The objective was to demonstrate the feasibility of and study the performance of the Delta k technique from a higher altitude platform, at shallower incidence angles, and feasibility of and study the performance of the Delta k technique during the autumn of 1979. The objective was to demonstrate the characteristics. The experiment was conducted as part of the sensing techniques to measure ocean surface wave spectral for a 700 km ionospheric path during MARSEN are reported. For one hop by way of the F2 layer, a typical r.m.s. Doppler shift over 10 min was 0.005 Hz and Doppler spread, to -10 dB, was 0.08 Hz. Multihop and side-scatter modes of propagation and their Doppler structure were identified. The possible use of side scatter at the sea surface is analyzed.

(Author)

A83-17711* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SPECTRAL SIGNAL TO CLUTTER AND THERMAL NOISE PROPERTIES OF OCEAN WAVE IMAGING SYNTHETIC APERTURE RADARS
It is noted that in such cases as low-altitude swell and the short wave-length end of a wind wave spectrum, the wave image spectrum may simply be lost in the background noise spectrum. This spectrum comprises the clutter spectrum, deriving from the range/frequency nature of the backscattering surface elements, and the normal thermal noise spectrum, originating in the SAR system itself. The spectral signal-to-background resolution limit is investigated, with particular emphasis placed on the short wavelength detection limit for wind seas. It is shown that for a given power, the maximum detection cut-off wavenumber is attained if the SAR resolution is selected in such a way that the clutter and noise spectra are equal at the cut-off wavenumber. To first order, interference must be operating it is found to have no influence on the signal-to-background detection cut-off wavenumber, provided that the reduced Nyquist cut-off wavenumber resulting from the reduced multilook spatial resolution remains greater than the signal-to-background cut-off wavenumber.

C.R.

A83-17714* Hamburg Univ. (West Germany).
THE EFFECT OF MONOMOLECULAR SURFACE FILMS ON THE MICROWAVE BRIGHTNESS TEMPERATURE OF THE SEA SURFACE
It is pointed out that monomolecular surface films of biological origin are often encountered on the ocean surface, especially in coastal regions. The thicknesses of the monomolecular films are of the order of 3 x 10 to the -9th m. Huennerfuss et al. (1978, 1981) have shown that monomolecular surface films damp surface waves quite strongly in the centimeter to decimeter wavelength regime. Other effects caused by films are related to the reduction of the gas exchange at the air-sea interface and the decrease of the wind stress. The present investigation is concerned with experiments which reveal an unexpectedly large response of the microwave brightness temperature to a monomolecular oleyl alcohol slick at 1.43 GHz. Brightness temperature is a function of the complex dielectric constant of the upper layer of the ocean. During six overflights over an ocean area covered with an artificial monomolecular alcohol film, a large decrease of the brightness temperature at the L-band was measured, while at the S-band almost no decrease was observed.

G.R.

A83-17840# SUPER HIGH ALTITUDE PHOTOGRAPHY FOR COASTAL GEOARCHOLOGY
H. G. GIERLOFF-EMDEN (Muenchen, Universitaet, Munich, West Germany) ITC Journal, no. 3, 1982, p. 313-316. refs
The data acquisition techniques currently preferred for coastal studies include conventional aerial photography (usually from an altitude of approximately 3 km) and satellite remote sensing (from an altitude of approximately 900 km for Landsat). The employment of an intermediate range involves the use of super high altitude photography from an altitude of approximately 20 km. A description is provided of the results of diverse studies of super high altitude photography to determine its applicability for coastal studies. It is pointed out that high altitude and super high altitude photography (SHAPh) has been used since the early 1960s to fill the gaps in small and medium scale mapping programs. Attention is given to applications of SHAPh to mapping, spatial resolution for coastal studies, and the interpretation of coastal features from SHAPh.

G.R.

A83-18580* Miami Univ., Coral Gables, Fla.
PHOTOPHOTOLAR PIGMENT CONCENTRATIONS IN THE MIDDLE ATLANTIC BIGHT - COMPARISON OF SHIP DETERMINATIONS AND CZCS ESTIMATES
H. R. GORDON, J. W. BROWN (Miami, University, Coral Gables, FL), D. K. CLARK (NOAA, National Earth Satellite Service, Washington, DC), O. B. BROWN, R. H. EVANS (Miami, University, Miami, FL), and W. W. BROENKOW (Moss Landing Marine Laboratories; San Jose State University, Moss Landing, CA) Applied Optics, vol. 22, Jan. 1, 1983, p. 20-29. refs
(Contract N00014-80-C-0042; NAS5-22963; NSF OCE-80-16991; NOAA-NA-79SA0741; NOAA-04-8MO1-129)
The processing algorithms used for relating the apparent color of the ocean observed with the Coastal-Zone Color Scanner on
05 OCEANOGRAPHY AND MARINE RESOURCES

Nimbus-7 to the concentration of phytoplankton pigments (principally the pigment responsible for photosynthesis, chlorophyll-a) are developed and discussed in detail. These algorithms are applied to the shelf and slope waters of the Middle Atlantic Bight and also to Sargasso Sea waters. In all, four images are examined, and the resulting pigment concentrations are compared to continuous measurements made along ship tracks. The results suggest that over the 0.08-1.5 mg/cu m range, the error in the retrieved pigment concentration is of the order of 30-40% for a variety of atmospheric turbidities. In three direct comparisons between ship-measured and satellite-retrieved values of the water-leaving radiance, the atmospheric correction algorithm retrieved the water-leaving radiance within an average error of about 10%. This atmospheric correction algorithm does not require any surface measurements for its application.


Airborne lidar oil spill experiments carried out to determine the practicability of the AOFSC (absolute oil fluorescence spectral conversion efficiency) computational model are described. The results reveal that the model is suitable over a considerable range of oil film thicknesses provided the fluorescence efficiency of the oil does not approach the minimum detection sensitivity limitations of the lidar system. Separate airborne lidar experiments to demonstrate measurement of the water column Raman conversion efficiency are also conducted to ascertain the ultimate feasibility of converting such relative oil fluorescence to absolute values. Whereas the AOFSC model is seen as highly promising, further airborne water column Raman conversion efficiency experiments with improved temporal or depth-resolved waveform calibration and software deconvolution techniques are thought necessary for a final determination of suitability.


The techniques used for ingesting SEASAT-A SASS wind retrievals into the existing operational software are described. The intent is to assess the impact of SEASAT data in he marine wind fields retrieved by the global marine wind/sea level pressure analysis. This analysis is performed on a 21/2 deg latitude/longitude global grid which executes at three hourly time increments. Wind fields with and without SASS winds are being compared. The problems of data volume reduction and aliased wind retrieval ambiguity are treated. A.R.H.


The applications of remote sensing described are not confined to satellite-derived imagery. The common link between all eight applications, which involved several remote-sensing techniques, is the usefulness of remote sensing in making needed management decisions. Similar projects in the future will definitely use satellites in some instances, while in others aircraft may remain the best tool. The purpose in presenting these case studies is to suggest the variety of ways in which remote sensing can be useful in studying the coastal and marine environment. It is hoped that the diversity of applications described, of data sources and platforms used (satellite/aircraft), as well as the high-quality photographs that resulted, may identify for the reader potential applications in his or her own area of interest.


High altitude ocean color scanner ratios of band 2 (456 to 476 nanometers) to band 4 (539 to 559 nanometers) and band 1 (418 to 438 nanometers) to band 3 (498 to 518 nanometers) had high correlation coefficient values (-0.928 and 0.891 respectively) with seven boat sampled chlorophyll a measurements. The range of chlorophyll a concentrations was small (1.7-2.58 mg/cu m). Each ratio was used to calculate chlorophyll a values for the center pixel of each scan line on flight lines 5 and 6. The two ratios produced dissimilar chlorophyll a trends. Due to the high noise level in the scanner data, no reliable synoptic chlorophyll a map could be generated with either ratio algorithm.


The Hydrographic Airborne Laser Sounder (HALS) system currently under construction for the Naval Ocean Research and Development Activity (NORDA) incorporates logarithmic amplification for dynamic range compression and a first difference processing circuit to reduce the volume scattering signal prior to the arrival of the bottom return. These non-linear signal processing steps distort the input waveforms and lead to depth measurement biases whose magnitudes depend on signal strengths, pulse location algorithms, and algorithm parameters. The behavior of the estimated biases for varying circuit parameters is shown to be sensitive to the assumed pulse shape. An appropriate gamma function representation is selected and discussed. Biases as a function of signal strengths are reported for two separate pulse location algorithms: linear fractional thresholds and a 'constant fraction discriminator' circuit as used in HALS. If return signal strengths are recorded by the operational system software, these bias predictors can be applied to field data as estimated bias correctors.


An extensive set of radiance calculations have been generated for each of twelve representative bottom types using an existing water radiance and atmospheric radiative transfer model. Total radiance values were calculated under two separate (Eltmaner) atmospheric states for a sensor platform altitude of 50 km. Calculations were also made for a sensor placed just below the sea surface. The model parameters were iterated over representative water depths and water types. A preliminary visual band optimization analysis was made over the input parameters.
The suitability of Landsat-D Thematic mapper (TM) bands is also addressed. 

Author (GRA)


The research summaries follow the categories of concern developed in the Federal plan for ocean pollution research, development and monitoring. These categories are: marine waste disposal, marine mining, marine energy, marine transportation, accidental discharge of oil and hazardous materials, coastal land use, and ocean pollution assessment and management of cumulative effects. 

Author (GRA)


From 17 September to 10 October 1978 SEASAT made collinear passes over the Gulf of Mexico. Altimeter data for eight, three-day repeat passes over the eastern Gulf were examined using an arc-segment fitting technique to determine the mesoscale temporal variability of the sea surface. The pattern of sea height variability was then compared with sea height data generated by a numerical model of the Gulf (Hurlbut and Thompson, 1980) from the simulation of a complete cycle of Loop Current intrusion and shedding of an anticyclonic eddy. The model data was found to match that from the SEASAT altimeter when an anticyclonic eddy separated from the Loop Current and the Loop began to repenetrate into the eastern Gulf. Analysis of sparse ground truth data from ship-of-opportunity XBT's, satellite infrared imagery of the Loop Current boundary, and synthetic aperture radar (SAR) imagery, also from SEASAT, tend to confirm the circulation patterns deduced from the altimeter data and the numerical model. 

Author (GRA)


The radius and the origin of a mean-Earth ellipsoid have been determined from SEASAT satellite radar altimeter observations of the ocean surface and potential coefficients. Assuming that the altimetric geoid is the best available, adjustments are made to the geoid derived from potential coefficients so that the geoid height differences are minimized. A least-squares fitting procedure based on mean geoid heights in 5 degrees x 5 degrees areas was used in the determination of the ellipsoidal parameters. Solutions from two different sets of altimetric geoid heights and geoid heights derived from potential coefficients gave a mean-Earth ellipsoid with radius, a = 6378134.9 m and origin shifts less than 1 m in the x and y components and approximately -2.5 m in the z component. 

Author (GRA)

05 OCEANOGRAPHY AND MARINE RESOURCES


Basemetric features are visible on some SEASAT SAR and SIR-A images. This study surveyed as wide a data base as possible and collected available ground truth to determine the limits of this visibility. Such parameters as tidal levels, currents, wind, rain, radar incidence angle, radar aspect angle and radar processing were all considered. Some dependence of visibility on current was discovered, and conversely, independence of radar incidence angle. The results were severely limited by the lack of detailed ground truth of an appropriate nature. 

Author (GRA)

N83-12037# Office of Naval Research, Arlington, Va. NAVAL RESEARCH REVIEWS, VOLUME 34, NO. 1 W. J. LESCURE, ill. ed. 1982 63 p refs (AD-A117981) Avail: NTIS MF A01; SOD HC $11.00 CSCL 17E


Author (GRA)


Atmospheric correction of IR satellite data for retrieval of sea surface temperatures (SST) by means of differential absorption can take on two forms. The most popular method utilizes changes in the spectral transmittance of the atmosphere between two or more IR channels (multichannel). The second form employs path length differences in the same spectral band using two satellites. The multichannel and two satellite approaches are applied to coincident imagery and in situ data and compared. 

Author (GRA)

N83-12707# World Meteorological Organization, Geneva (Switzerland). REPOR OF THE MONEX REVIEW MEETING Global Atmospheric Research Programme 1981 146 p refs Conf. held at Denpasar, Bali, 2-6 Nov. 1981 Prepared on cooperation with ICSU, Rome (GARP-SPEC-REPT-38) Avail: Issuing Activity Completion of Monex data management was planned and further monsoon investigations were proposed. Summer Monex data collection is summarized. The status of level 2 b data and nonmerged, non-FGGE data processing is reported. Winter Monex data management is surveyed. Upper air dropwindsonde and ship data for oceanic areas in the summer Monex region are given. Statistics of synoptic data from quick-look tapes, stripped FGGE tapes, level 2 b tapes and ship observations during 1 - 7 May 1979 are available. 

Author (ESA)


Papers on GATE objectives and techniques are presented. Large-scale mean state, synoptic-scale motions, boundary layer,
and radiation studies are summarized. Tropical waves are analyzed theoretically. The AVB and B scale motions in the intertropical convergent zones are investigated. Clouds, convection, and the physics of the upper tropical ocean are examined.

**World Integrated Oceanic Services System (WIOSS)** meets these and atmosphere, emphasizing their interaction, are outlined. The values of physical functions and constants, barometer reporting frequency, and reduction of level 1 data are treated. Quality control procedures are outlined. Author (ESA)


Technical regulations (standard or recommended practices and procedures) for the guidance of global observing system members are given. Surface and space based systems are covered. Observational requirements, requirements for horizontal spacing, reduction of level 1 data are treated. Author (ESA)

**World Meteorological Organization, Geneva (Switzerland).**


General principles as to the observation and study of the ocean and atmosphere, emphasizing their interaction, are outlined. The World Integrated Oceanic Services System (WIOSS) meets these requirements. The WIOSS observation system as well as the data processing and analysis system are described. Measures taken relative to telecommunications and the dissemination of WIOSS information are reported. Other activities related to WIOSS (training, R and D, operations management) are also mentioned. Author (ESA)

**World Meteorological Organization, Geneva (Switzerland).**


Marine meteorology, maritime navigation, and ocean exploration are considered, stressing applications of meteorology and international cooperation. Prediction and early warning of hazardous weather conditions and associated floods are discussed, particularly in respect to observing activities over the ocean, marine data collection, marine climatology and sea ice. The economic impact of marine meteorological information, e.g. ship weather routing, is pointed out. The need for rational use of ocean resources and environmental protection is mentioned. Tasks of the Commission are to contribute substantially to the World Weather Watch and the World Climate Program and to provide ocean data for medium-range and long-range weather forecasting and research. Author (ESA)

**World Meteorological Organization, Geneva (Switzerland).**


Information on the volume of data collected during the FGGE is presented. The frequency and the geographical distribution of observations is presented in two different ways. In map form, utilizing the gray-shading technique, the daily average number of each type of observation is shown for the whole globe from 80 deg S to 80 deg N and for the polar regions. In order to provide more detail the distribution of the observations, the tables present the daily average number of observations for each 5 deg latitude by 5 deg longitude area. Author (ESA)


Aircraft data collected in the Bering Sea in March, 1979 using a 6.6 GH sub z (C Band) microwave radiometer and a 13.9 GH sub z (K Band) scatterometer, reinforce the difficulties in interpreting first year ice types found near the ice edge in a marginal ice zone. An ice interpretation scheme using data taken with a 12.7 GH sub z (K Band) scatterometer and a 19.4 GH sub z (K Band) radiometer in Davis Strait also shows ambiguity in the first year ice signal and indicates that ice interpretation becomes more difficult near the ice edge and under warmer conditions. This report also compares X Band SAR data taken in Davis Strait with similar imagery collected in the Bering Sea. Ice core samples from the Bering test area offer a basis for speculation on changes in ice morphology which affect the signature return at the ice edge, and help explain the difficulty of the sensors in discerning the two different ice types found on the photography and in the core samples. Author (ESA)

**Research Triangle Inst., Research Triangle Park, N.C. Office of Geosciences Programs.**

**A COMPARISON OF HCMM SURFACE TEMPERATURES WITH IN SITU TEMPERATURE DATA Quartery Progress Report** F. M. VUKOVICH, Principal Investigator Jun. 1982 5 p ref HCMC (Contract NAS5-26863) (839-10040; NASA-CR-169512; NASA-1.26:169512) Avail: NTIS HC A05/MF A01 CSCL 05B

All HCMC required were processed. Calibrated and atmospherically corrected sea surface temperatures were developed for the Nantucket Shoals and Gulf of Mexico regions. These data were analyzed and the sea surface temperatures along the various transects were compared with in situ data. The
comparisons indicate that there is, on the average, a root mean square difference between the in situ data and the HCMM sea surface temperatures of + or - 1.0 C. The linear correlation coefficient was 0.97.

A microwave radar technique for remotely measuring the vector wave number spectrum of the ocean surface is described. The technique, which employs short-pulse, noncoherent radars in a conical scan mode near vertical incidence, is shown to be suitable for both aircraft and satellite application, the technique was validated at 10 km aircraft altitude, where we have found excellent agreement between buoy and radar-inferred absolute wave height spectra.

A microwave radar technique for remotely measuring the vector wave number spectrum of the ocean surface is described. The technique, which employs short-pulse, noncoherent radars in a conical scan mode near vertical incidence, is shown to be suitable for both aircraft and satellite application, the technique was validated at 10 km aircraft altitude, where we have found excellent agreement between buoy and radar-inferred absolute wave height spectra.

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Thermal synoptic cartography data from the Spanish continental ground truth configured from data collected in situ is discussed. Available NTIS HC A01/MF A01

6.6H and 18V channels for SST determination from SEASAT-SMMR analysis on the selected subsets. The statistical database given size by the application of an efficient 'leaps and bounds' technique. The technique first selects the best subsets of a given horizontal and vertical polarizations at microwave frequencies of 6.6, 10.6, 18.0, 21.0 and 37.0 GHz. Retrieval algorithms, for sea at the Northwest coast of Scotland. Sea surface and boundary layer parameters were measured. The JASIN data was used as ground truth for various sensors on the SEASAT satellite.

The scanning multichannel microwave radiometer (SMMR) aboard the SEASAT satellite measured emitted radiation in both horizontal and vertical polarizations at microwave frequencies of 6.6, 10.6, 18.0, 21.0 and 37.0 GHz. Retrieval algorithms, for sea surface temperature (SST) determination from satellites of opportunity and to obtain information on buoy trajectories as a basis for planning buoy release points for continuous coverage of the South Indian and Southern Pacific Oceans between 60 deg and 120 deg east longitude. The position data from RAMS were of significant value in analysis but were usable for real-time operations because the data were not immediately available. The analysis showed that buoy data received within 6 h of real time would make significant improvement to real-time analyses in the Southern Hemisphere.

The Nimbus 6 random access measuring system was used in an experiment conducted to: (1) measure air pressure and sea surface temperature from free drifting buoys in the South Indian Ocean; (2) use the data in the assessment of atmospheric modeling accuracy; and (3) study the practical and logistical problems in the deployment of free-floating buoys from ships of opportunity and to obtain information on buoy trajectories as a basis for planning buoy release points for continuous coverage of the South Indian and Southern Pacific Oceans between 60 deg and 120 deg east longitude. The position data from RAMS were of significant value in analysis but were usable for real-time operations because the data were not immediately available. The analysis showed that buoy data received within 6 h of real time would make significant improvement to real-time analyses in the Southern Hemisphere.

The Nimbus 6 random access measuring system was used in a mesoscale ocean variability experiment conducted to determine the horizontal extent of oceanic variables influenced by individual storms. Ten drifting buoys were used to determine the horizontal variability of velocities and temperatures in the upper layer of the ocean, at scales of 100 to 500 km, in a region expected to be stormy during the period of the experiment. In addition, 30 prototype buoys of the type to be used during the first GARP global experiment were tested to determine buoy reliability. Measurements reported by the buoys were analyzed to review the sources of error or uncertainty in such pressure measurements. It is concluded that barometric pressure measurements can be made from small buoys with accuracies of about + or - 1 mb under typical conditions.
To achieve uncertainties less than 2.0 mb under extreme conditions, it is probably necessary to average the transducer signal over several wave periods. A.R.H.

N83-14842*#  Coast Guard, Washington, D.C. Oceanographic Unit.
LAGRANGIAN DRIFT MEASUREMENTS OF SEA SURFACE CURRENTS AND ICEBERG TRACKING
Avail: NTIS HC A06/MF A01 CSCL 04B

Drogued buoys were tracked by the Nimbus 6 random access measuring system for approximately 10 days in the U.S. East Coast Continental Shelf waters between Delaware Bay and Cape Hatteras in February 1976. The resulting drift values were used to check a numerical model developed at the U.S. Coast Guard Oceanographic Unit for predicting surface currents on the Continental Shelf. Similar buoys were also tracked on the Grand Banks of Newfoundland for the U.S. Coast Guard's International Ice Patrol. Lagrangian drift velocities were measured in or near the Labrador Current. Prediction numerical models that were then in use or proposed for use by the Commander, International Ice Patrol, who has the operational responsibility for warning. Following field studies in the area of the Ice Patrol, the lagrangian drift velocities gleaned from the Nimbus 6 RAMS were used to test a numerical model of time-dependent Ekman wind generated currents. Air droppable RAMS buoys deployed from C-130 aircraft were also deployed onto icebergs that break off from Greenland glaciers and drift into the North Atlantic shipping lanes. A.R.H.

N83-14845*#  Norwegian Meteorological Inst., Blindern.
THE RAMS COLLECTION OF METEOROLOGICAL AND POSITION DATA IN THE NORWEGIAN SEA
Avail: NTIS HC A06/MF A01 CSCL 04B

The Norwegian Meteorological Institute developed an experiment using the Nimbus 6 RAMS to obtain meteorological data from remote areas of the Norwegian Sea and to determine the flow of ice in the Arctic Ocean. The purpose of the ice drift investigations were as follows: (1) To obtain ice drift speeds in the Svalbard-Greenland area and compare them with meteorological and oceanographical conditions. The results will be used to develop forecast rules (short range for sea ice movements). (2) To develop drift speeds to determine the outflow of ice of the Arctic Basin and from the eastern part of the Svalbard Archipelago to verify numerical models for ice circulation in the Arctic Basin. (3) To study the tidal influence upon the ice drift and obtain average speed of sea surface currents. This information was used to aid fishing, shipping, and oil drilling operations. B.W.

N83-14847*#  Research Triangle Inst., Research Triangle Park, N.C.
WESTERN BOUNDARY EDDIES OF THE GULF STREAM
Avail: NTIS HC A06/MF A01 CSCL 04B

Oceanic exchange processes between the water on the Continental Shelf and the Gulf Stream of the Southeast coast of the United States are discussed. Eddies on the western boundary of the Gulf Stream were observed using infrared imagery. It was shown that barotropic waves that interact with the current shear of the Gulf Stream will become unstable and propagate downstream along the shelf. Real-time temperature, depth, and salinity data were collected. The experiments revealed that a class of Gulf Stream western boundary eddies developed immediately downstream (within 100 km) from an along shore topographical feature called the Charleston Bump. The data indicated cyclonic motion associated with the western boundary eddies from the surface to about 300 m. R.J.F.

N83-14848*#  Texas A&M Univ., College Station. Dept. of Oceanography.
DRIFT BUOY COMPONENT, NORPAX ANOMALY DYNAMICS STUDY
Avail: NTIS HC A06/MF A01 CSCL 04B

Drifting buoys were used to map large-scale circulation in the North Pacific Ocean for an anomaly dynamics study. Large-scale response of the general circulation of the North Pacific to autumn and winter storm activity was studied to predict the formation and evolution of large-scale thermal anomalies. The temperature/time series for all the drifters showed the diurnal heating cycles as well as the long-term seasonal march from early summer through fall. Preliminary data showed wavelike features along with a number of eddy mesoscale structures. R.J.F.

N83-15799#  Scripps Institution of Oceanography, La Jolla, Calif. Shore Processes Lab.
INFRARED SATELLITE DATA FROM THE FIRST COASTAL OCEAN DYNAMICS EXPERIMENT, MARCH - JULY 1981
K. A. KELLY  Jul. 1981 60 p refs
(Contract N00014-75-C-0300; N00014-80-C-0440)
(AD-A120068; SIO-REF-82-15) Avail: NTIS HC A04/MF A01 CSCL 08J

As part of the Coastal Ocean Dynamics Experiment infrared images from the weather satellite NOAA-6 were collected from late March to mid-July 1981. Images which met certain quality criteria were registered to a common grid and were screened to eliminate data which were cloud-contaminated. Infrared images yield approximate sea-surface temperature maps via the blackbody relationship. This report contains photographs of the digital images and a brief description of the processing techniques which were used. Author (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.

(Contract NSG-5335)

Radar remote sensing experiments have been conducted at test sites in Kansas, Colorado, and South Dakota over the last six years to examine backscatter coefficient response to snowcovered terrain. Truck-mounted 1-35 GHz scatterometers were employed in conjunction with detailed ground-truth measurements. From these experiments and associated modeling efforts, most of the fundamental questions concerning backscatter behavior in response to important snow parameters have been, at least qualitatively, answered. The optimum angular range seems to be between 20 and 50 deg and, for these angles, the results indicate that the radar backscatter generally: (1) increases with increasing water equivalent, (2) decreases with increasing liquid water, (3) increases with increasing crystal size, (4) is insensitive to surface roughness for dry snow conditions, and (5) can be
HYDROLOGY AND WATER MANAGEMENT

sensitive to soil state if the snowcover is dry. This paper gives a summary of these results, along with empirical and theoretical models for describing the backscatter from snow. (Author)

A83-10065
MICROWAVE EMISSION SIGNATURES OF SNOW IN FINLAND

A83-10072* Arkansas Univ., Fayetteville.
WETLAND MAPPING WITH IMAGING RADAR

An analysis of Seasat radar imagery is presented to identify the radar signature of vegetation-covered water surfaces. Imagery taken on Aug. 21, 1978 displayed anomalously high returns over swamp lands near Lafayette, LA. Landsat scans of the area two days later revealed uniform vegetation cover in the area, and ground examination found the area to be filled with cypress trees in swamps. Similar results were obtained during an overflight above a region of southeast Arkansas. Mechanisms producing the high degree of reflectance are explored, and the possibility that the strong return is due to an interaction of the vegetation cover and the specular water surface underneath is mentioned. Further studies to identify the exact mechanisms producing the anomalous returns are recommended, as well as optimization of the viewing angle for general classes of vegetation density. M.S.K.

A83-10073
REMOTE SENSING OF WATER QUALITY FOR ESTUARINE ENVIRONMENTS

The capabilities of remote sensing techniques for monitoring water quality in estuarine environments is assessed, particularly for the case of oil pollution. The techniques include multispectral imagery, radar, and lidar. Landsat MSS data from band 7, 0.6-1.1 micron, can identify the land-water interface, while the 0.43-0.50 micron blue band and the 0.53-0.60 micron green band yield information on water quality. SAR operated in the X- and L-bands have detected seawage and industrial waste plumes. The Landsat MSS readings, when compared with ground truth sampling for suspended particulates, has quantitatively measured suspended solids up to 900 ppm. Sea surface smoothing as a result of oil pollution is sensitive to soil state if the snowcover is dry. This paper gives a summary of these results, along with empirical and theoretical models for describing the backscatter from snow. (Author)

Snow covers is sufficiently accurate for use in the recent generation of general circulation models in all seasons except autumn. However, information on surface albedo, on the thickness of snow covers, and on the proportion of open water within the pack ice needs to be considerably upgraded. (Author)

A83-10101
REMOTE DETERMINATION OF SURFACE EVAPORATION USING THERMAL IR MEASUREMENTS

A83-10102* Environmental Research and Technology, Inc., Concord, Mass.
SNOW HYDROLOGY STUDIES USING DATA FROM THE HEAT CAPACITY MAPPING MISSION

This paper describes a study of the snow hydrology application of thermal infrared (IR) data from the Heat Capacity Mapping Mission (HCMM) satellite. The HCMM data in both imagery and digital tape formats are analyzed for two study areas: the Salt-Verde Watershed in central Arizona and the southern Sierra Nevada in California. The analysis procedures are described, including the development of a unique contour plotting program that makes it possible to overlay HCMM thermal contours directly onto the visible channel imagery. The results indicate that satellite thermal-IR data can provide the hydrologist with additional useful information on snow cover. (Author)

A83-10120
AIRBORNE MEASUREMENT OF SURFICIAL SOIL MOISTURE USING NATURAL TERRRESTRIAL GAMMA RADIATION

A83-12038
ICE DISTRIBUTION AND WINTER SURFACE CIRCULATION PATTERNS, KACHEMAK BAY, ALASKA

The development of the hydropower potential of Bradley Lake, Alaska would considerably increase winter freshwater discharge into Kachemak Bay. This could result in increased ice formation and related problems. In order to investigate winter surface circulation in the bay and ice distribution patterns, Landsat MSS bands 5 and 7 and RBV imagery with 70 percent cloud cover or less taken between 1 November and 30 April each year from 1972 to 1980 were examined. The results show that surface water circulation is driven more by tidal forces than by wind stress. The circulation patterns indicate that if additional ice is formed from the increased winter discharge, a greater ice cover would accumulate along Homer Spit and be blown into the outer bay by the dominant northerly wind. S.C.S.
A83-14234#
TOWARD AN OPERATIONAL, SATELLITE-BASED, WETLAND MONITORING PROGRAM FOR THE FRASER RIVER ESTUARY, BRITISH COLUMBIA

A83-14251#
REMOTE SENSING APPLICATIONS FOR BRITISH COLUMBIA WETLANDS USING 35 MM AERIAL PHOTOGRAPHY

The cost of conventional aerial photography often precludes its use for monitoring, assessment and management of natural resources. A pilot project, using 35 mm vertical/stereo aerial photography as a data base, was conducted during the summer of 1980 on a wetland area. Color and color-infrared 35 mm photographs at 1:20,000, 1:10,000 and 1:4,000 were used to produce a detailed 1:2,500 scale map of a fen and bog complex near Kamloops, British Columbia. The wetland classification used follows the system currently being developed by the British Columbia Ministry of the Environment. The comparison of conventional 23 cm vs. 35 mm aerial photography obtained using a Meyer 35 mm Aerial camera sidemount is discussed with reference to cost, area covered, mapping techniques and air photo resolution. The methodology of obtaining operational 35 mm color and color-infrared using both inexpensive and expensive 35 mm camera systems is presented. (Author)

A83-14262#
BANK EROSION AND FLOOD PLAIN STUDIES OF THE ANNAPOlis RIVER - AN APPLICATION OF REMOTE SENSING DATA

An important effect of the tidal power generating station being planned in the lower reaches of the Annapolis River basin is the greater penetration of seawater into the basin on each tidal cycle. The average water elevation will be increased in order to achieve the head differentials needed to operate the turbine, and this increased elevation will affect the stability of the river banks. The contributions which various types of remotely sensed data can make to the preparation of preliminary maps of the basin are considered. These maps are seen as the basis for detailed field investigations of bank erosion, the identification of areas of accelerated erosion, the mapping of the flood plain, and the mapping of land use and land cover. C.R.

A83-14287#
WATER SURVEY OF CANADA'S EXPERIENCE WITH DATA ACQUISITION AND TELEMETRY SYSTEMS

The features of the data acquisition and telemetry systems which gauge, store, and report lake level and streamflow information in Manitoba and northwestern Ontario are briefly described and their method of operation is discussed. At four sites, satellite data collection platforms (DCPs) are installed which transmit information several times daily via satellite to data processing facilities where the data are archived. The equipment, power source, and operation of a typical DCP are described. At one site, an autoanswer telephone and modem connected to the telephone network replace the transmitter and antenna. The power requirements, data processing capabilities of this data acquisition and telemetry system (DATS) are different from those for DCPs and are briefly discussed. The costs of these programs, their operation by persons with little formal training in electronics or data communications, and their applications are discussed. C.D.

A83-14574#
TEMPORARY LAKES AND SALT PLAINS IN THE HIGH PLATEAUS OF THE ANDES /BOLIVIA/ - A CONTINUING SURVEY OF PERIODIC HYDROLOGIC PHENOMENA USING THE GEOSTATIONARY SATELLITE GOES-EST [LACS TEMPORAIRES & PLAINES DE SEL DES HAUTS PLATEAUX DES ANDES /BOLIVIE/ - SUIVI DE PHENOMENES HYDROLOGIQUES PERIODIQUES A L'AIDE DU SATELLITE GEOSTATIONNAIRE GOES-EST]

A summary of the observational techniques and parameters during GOES and SMS satellites remote sensing of hydrologic features of Lakes Tiliaca and Popoo in the Andes, together with neighboring salt plains, is presented. It is noted that the alternation of wet and dry seasons has provided ample opportunities for observing strong variations in reflected radiances. The SMS 1, 2, and GOES spacecraft sensors have been used to monitor the area, successively, since 1974. The sensors have included an IR channel operating at 10.5-12.5 microns and a visual channel at 0.55-0.75 micron. IR resolution has been 8 x 4 km, and visual, 1:1,000,000. Multitemporal comparative studies have been effected using the archived photography, revealing surface characteristics such as dry, wet, and snow-covered, along with corresponding changes over time. M.S.K.

A83-14668* Texas A&M Univ., College Station.
EVALUATING DEPTH TO SHALLOW GROUNDWATER USING HEAT CAPACITY MAPPING MISSION /HCMM/ DATA
J. L. HEILMAN (Texas A&M University, College Station, TX) and D. G. MOORE (South Dakota State University, Brookings, SD) Photogrammetric Engineering and Remote Sensing, vol. 48, Dec. 1982, p. 1903-1906. refs

(Eliminated)

A83-14854
SNOW-COVER PARAMETERS RETRIEVED FROM NIMBUS-7 SCANNING MULTICHANNEL MICROWAVE RADIOMETER /SMMR/ DATA
K. F. KUNZI, S. PATIL (Bern, Universitaet, Berne, Switzerland), and H. ROTT (Innsbruck, Universitaet, Innsbruck, Austria) IEEE Transactions on Geoscience and Remote Sensing, vol. GE-20, Oct. 1982, p. 452-467. Research supported by the Swiss National Science Foundation and Bundesministerium fuer Wissenschaft und Forschung. refs

The multifrequency, dual-polarized microwave imager on the Nimbus-7 satellite is designed to sense the ocean surface, the atmosphere, and land surfaces. Reference is made to the fact that snow cover over land has a very distinct effect on the microwave signature of the earth's surface. The goal of the study described here is to show that the three snow-cover parameters, namely extent, snow water equivalent, and onset of snow melt, can be determined using scanning multichannel microwave radiometer data. The analysis demonstrates that these parameters are retrievable with sufficient accuracy to be of operational value in climatology, meteorology, and hydrology. Snow cover extent is determined for a dry snow cover having a depth greater than about 5 cm; the snow water equivalent, it is shown, can be determined on a regional basis with approximately 2 g/sq cm rms
INVESTIGATIONS OF THE APPARENT TEMPERATURE OF SNOW COVER IN THE SUBMMILLIMETER WAVELENGTH REGION

PASSIVE MICROWAVE DETECTION OF RIVER-PLUME FRONTS IN THE GERMAN BIGHT

The usefulness of satellite derived snow cover data, the digitized archives of snow cover data for the Northern Hemisphere, and the various climatological products that can be derived from this data base are discussed. Weekly Snow and Ice Charts of the Northern Hemisphere, which were prepared by the National Earth Satellite Service (NESS), were analyzed for the period November 1966 through December 1980. Each of these weekly charts was digitized and then stored and displayed in formats in which a star symbol stood for 50% or more of a grid box covered with snow on an O stood for no snow cover. For display purposes, all water bodies were left completely blank to allow the above two symbols to define the land areas. Although ice cover was also digitized and stored in the data archive, only snow cover is analyzed.

SATELLITE OBSERVATIONS OF VARIATIONS IN NORTHERN HEMISPHERE SEASONAL SNOW COVER

The operational limitations imposed on laser hydrography by weather conditions are discussed. An estimate is developed of the probability of favorable weather conditions for airborne laser hydrography operations at seven sites on the east coast of the United States. For comparison purposes, similar estimates are made for launch based sonar hydrography and for stereo photobathymetry.

TERRAIN ANALYSIS PROCEDURAL GUIDE FOR DRAINAGE AND WATER RESOURCES (ETL SERIES ON GUIDES FOR ARMY TERRAIN ANALYSTS)

This document is one in a series of terrain analysis procedural guides being developed in support of the Topographic Support System (TSS). It was written specifically for the U.S. Army’s Terrain Analysts and presents the methodology for extracting, reducing, and recording information for the drainage and water resources data field. This data field is divided into 3 subfields: (1) water-courses and water bodies, (2) drainage basins, and (3) ground water. Step-by-step procedures are provided for producing a factor overlay and supporting data tables for each of the drainage and water resources data fields.
HYDROLOGICAL DATA TRANSMISSION
Methods of data transmission, existing facilities and requirements for hydrological purposes are reviewed. The use of satellites, meteor bursts, and the global telecommunication system (gts) to meet these requirements is considered. The gts could cope with operational and research needs which involve the exchange of information in real time. Satellites offer a data relay facility, linking ships, island stations, ocean buoys, etc. Meteor bursts minimize blockage due to terrain and allow coverage of vast areas. Author (ESA)

LONG-RANGE WATER SUPPLY FORECASTING
Current methods of forecasting water supply over periods ranging from two to four months are reviewed along with the feasibility of combining conceptual deterministic models and statistical data simulation for such forecasts. The term water supply is used with its meaning of runoff volumes over a defined period, such as weekly, monthly or seasonal flows. The techniques described apply not only to water supply projects, but also to irrigation and hydroelectric power projects. Some are equally well suited to long range forecasts of floods or low flows and such applications are discussed. Three methods of long-range water supply forecasting are highlighted: regression methods, conceptual models and time series. The operational use of forecasting methods is illustrated. The three methods, including data and computational requirements and accuracy, are compared. Results show that the potential of conceptual models for long-range water supply forecasting is large and, if the accuracy of long range weather forecasts continues to improve, it will be conceptual models which will adapt most efficiently. Author (ESA)

HYDROLOGICAL ANALYSIS IN UTAH Final Report
HCMM HYDROLOGICAL ANALYSIS IN UTAH Final Report
The feasibility of applying a linear model to HCMM data in hopes of obtaining an accurate linear correlation was investigated. The relationship among HCMM sensed data surface temperature and red reflectivity on Utah Lake and water quality factors including algae concentrations, algae type, and nutrient and turbidity concentrations was established and evaluated. Correlation (composite) images of day infrared and reflectance imagery were assessed to determine if remote sensing offers the capability of using masses of accurate and comprehensive data in calculating evaporation. The effects of algae on temperature and evaporation were studied and the possibility of using satellite thermal data to locate areas within Utah Lake where significant thermal sources exist and areas of near surface groundwater was examined. A.R.H.

SNOWMELT RUNOFF MODELING IN SIMULATION AND FORECASTING MODES WITH THE MARTINEC-MANGO MODEL Final Report
The Martinec-Mango snowmelt runoff model was applied to two watersheds in the Rio Grande basin, Colorado-the South Fork River Grande, a drainage encompassing 216 sq mi without reservoirs or diversions and the Rio Grande above Del Norte, a drainage encompassing 1,320 sq mi without major reservoirs. The model was successfully applied to both watersheds when run in a simulation mode for the period 1973-79. This period included both high and low runoff seasons. Central to the adaptation of the model to run in a forecast mode was the need to develop a technique to forecast the shape of the snow cover depletion curves between satellite data points. Four separate approaches were investigated-simple linear estimation, multiple regression, parabolic exponential, and type curve. Only the parabolic exponential and type curve methods were run on the South Fork and Rio Grande watersheds for the 1980 runoff season using satellite snow cover updates when available. Although reasonable forecasts were obtained in certain situations, neither method seemed ready for truly operational forecasts, possibly due to a large amount of estimated climatic data for one or two primary base stations during the 1980 season. A.R.H.

APPLICATION OF SATELLITE DATA TO HYDROGEOLOGICAL INVESTIGATION IN DAMAGARAM-MOUNIO, NIGER
The use of satellite data in a project which will drill 300 boreholes and dig 100 wells in an area of the Sahel subject to drought is outlined. Satellite data were used to identify negative drilling zones (zones where the crystalline bedrock is overlaid by sandy formation). These negative zones can be distinguished on LANDSAT images by their reflectance. About 60% of the holes drilled outside these zones contain water. Author (ESA)
06 HYDROLOGY AND WATER MANAGEMENT

N83-15754# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

VERIFICATION OF LANDSAT IMAGERY FOR MORPHOMETRIC AND TOPOLOGICAL STUDIES OF DRAINAGE BASINS IN A SECTION OF THE WESTERN PLATEAU OF SAO PAULO STATE: TIETE-AQUAPEI WATERSHED M.S. Thesis (AVALIACAO DAS IMAGENS LANDSAT PARA ESTUDOS MORFOMETRICOS E TOPOLOGICOS DE BACIAS HIDROGRAFICAS, EM UMA AREA DO PLANO LATO OCIDENTAL PAULISTA: INTERFLUVIO TIETE-AQUAPEI (FEIO))

N. D. J. PARADA, Principal Investigator and J. C. G. CAMARGO

The potential of using LANDSAT MSS imagery for morphometric and topological studies of drainage basins was verified. Using Tiete and Aguapei watershed (Western Plateau) as the test site because of its homogeneous landscape. Morphometric variables collected for ten drainage basins include: circularity index; river density; drainage density; topographic texture; areal and index length; basin parameter; and main river length 1st order and 2nd order channel length. The topographical variables determined were: order; magnitude; bifurcation ratio; weighted bifurcation ratio; number of segments; number of linking; trajectory length; and topological diameter. Data were collected on topographical maps at the scale of 1:250,000 and 1:59,000 and on LANDSAT imagery at the scale of 1:250,000. The results which were summarized on tables for further analysis, show that LANDSAT imagery can supply the lack of topographic charts for drainage studies.

Author

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A83-10075* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

STANDARDIZATION OF COMPUTER COMPATIBLE TAPE FORMATS FOR REMOTE SENSING DATA


Standards and guidelines being developed for future CCT formats for use in Landsat receiving-stations are presented, in order to solve the data compatibility problem, and to consider user community requirements. Data exchange at the local, regional, national, or international level is an important user requirement, and data integration from various sources should be possible. The tape super structure allows various formats to be implemented. A volume directory identifies the volume, and a file descriptor confirms it. The data is then filed, and it is determined whether the data files are appropriate to already defined file classes. If not, a new class is established. Applications of this format are in three areas: satellite imagery, geocoded polygon data, and airborne remote sensing data.

R.K.R.


SAR SQUINT ANALYSIS OF DIRECTIONAL EXTENDED TARGETS


Results are presented for multisquint processing of L-band like-polarized (HH) SAR data. Images of agricultural fields were generated by Doppler filtering of SAR signal film, with an angular width and step size of 0.8 deg. The results indicate that field reflectivities may vary by more than 10 dB over a range of less than 1 deg. Implications of observing extremely narrow-beamwidth targets are discussed for platform-pointing and antenna-stability requirements. It is suggested that a multiazimuth Venus-orbiting imaging radar could provide a significant amount of information at a relatively low weight penalty.

F.G.M.


POTENTIALS FOR CHANGE DETECTION USING SEASAT SYNTHETIC APERTURE RADAR DATA


Synthetic aperture radars (SAR) image from a non-nadir position. Thus the orientation of the target and sensor to one another is of paramount importance. This has posed problems for data interpretation and with the potentials of radar data for change detection studies. It is possible to use Seasat radar data for change detection even though the look directions are fixed for each location. Especially in regions with repeated coverage on descending or ascending orbits or where the terrain is flat and the targets nonoriented, coverage may be sufficient to provide data for change detection. Examples of Los Angeles and the Everglades of Florida help develop and support the argument.

A83-11410* Lockheed Engineering and Management Services Co., Inc., Houston, Tex.

PROBABILISTIC CLUSTER LABELING OF IMAGERY DATA


(Previously announced in STAR as N82-22590)

A83-11450 PATTERN RECOGNITION AND DIGITAL IMAGE PROCESSING AS APPLIED TO REMOTE SENSING IN INDIA


It is pointed out that with the setting up of the National Remote Sensing Agency in the mid seventies, remote sensing activities have gathered momentum and a sizable user community has sprung up. Research being done by the agency and by the Space Applications Center of India is surveyed. The work done thus far in India includes (1) the development of remote sensing sensor hardware; (2) data processing, image processing and image interpretation techniques and hardware; and (3) the application to different fields, such as forestry, water resources, soils, geology, and agriculture. India is seen to be on a par with any other

54
developed country in the utilization of remote sensing technology in the visible and IR regions of the spectrum. C.R.

**A83-11458**

**SCENE CLASSIFICATION OF LANDSAT MULTISPECTRAL SCANNER DATA BY MEANS OF THE ADAPTIVE LEARNING NETWORK METHODOLOGY**


An approach to pattern recognition and modeling known as the Adaptive Learning Network (ALN) methodology was used to classify a Landsat scene into three terrain classes: water, forest, and non-forest. The ALN classifier algorithm was derived from a training data set of 545 pixels and was used to classify 52,000 pixels of the evaluation set. The positive classification results based on a comparison with the actual terrain conditions and the large evaluation set as compared to the training data set, together with the speed and simplicity of the algorithm demonstrate that the ALN methodology is ideally suited to classification of large Landsat scenes in very short periods of time. (Author)

**A83-11461**

**AUTOMATIC MULTITEMPORAL SEGMENTATION FOR DIAGNOSTIC ANALYSIS OF REMOTELY SENSED IMAGES**

R. JEANSOULIN (Ecole Nationale Superieure d'Electrotechnique, d'Electronique, d'Informatique, et d'Hydraulique; Toulouse III, Universite, Toulouse, France) and W. FREI (Southern California University, Marina del Rey, CA) In: Conference on Pattern Recognition and Image Processing, Dallas, TX, August 3-5, 1981, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1981, p. 487-490. Research supported by the Centre National d'Etudes Spatiales. refs

A three-stage operation that greatly facilitates diachronic analysis is proposed. A region in each image of the sequence of interest is grown to encompass all the elements belonging to the fields initially designated by the user. This allows fields to be analyzed on an entity/entity basis rather than on a pixel/pixel basis, thus reducing susceptibility to noise and misregistration errors. A relative geometric deformation model for each image is determined, based upon a set of control points located by an automatic registration. The regions initially grown in the different images of the sequence are then compared, taking the geometric deformation models into account. One major advantage of the approach is that the problems caused by misregistration of successive views are eliminated, and manual intervention is reduced to the designation of one pixel within the area of interest in any image of the sequence to be analyzed, and to the initialization of the registration algorithms for each other image. C.D.

**A83-11462**

**A RELATIONAL IMAGE DATA BASE SYSTEM FOR REMOTE SENSING/LAND DBMS/**


This paper describes the design and experimental implementation of a relational image data base system (DBMS) for remote sensing, whose name is LAND DBMS. The LAND DBMS provides facilities for hierarchical command, user oriented job control language (JCL) and concurrency file control mechanism. The hierarchical command is designed for convenience of the conceptual scheme of the DBMS. The user oriented JCL supports the external scheme for processing the accessed image data. The concurrency file control mechanism is designed to maintain the consistency of the data-base. The LAND DBMS retrieves tuples in the relation which contains indirect information of the remote sensing imagery. The LAND DBMS also processes the accessed image. The image data of remote sensing is a type of computer compatible tape collected by multispectral scanner (MSS) and A-D converted. The LAND DBMS is implemented on a computer, FACOM M150-F, the multiprogramming operating system of which is FACOM OS IV/XB. (Author)

**A83-12035**

**EVALUATION OF PHOTOGRAPHIC ENHANCEMENTS OF LANDSAT IMAGERY**


The photographic processing of color Landsat imagery was evaluated to determine the optimal enhancement techniques. Twenty-six images were examined to explore the effects of gamma values upon image interpretation in a subarctic environment. Gamma values were varied on the images of bands 4 through 7 prior to the creation of the color composites. This yielded color-composited images with various color balances. These images were evaluated in terms of visible geological features (drainage, lineaments, landforms, etc.) and landcover features (exposed rock and ground, coniferous forest, etc.). The results indicate that the most informative images are created by using gamma values of 2.0 for band 4, 1.0 for band 5, and 2.0 for band 6 or 7. Other photographic enhancements tend to enhance some features at the expense of others. S.C.S.

**A83-12037**

**A COMPARISON OF UNSUPERVISED CLASSIFICATION PROCEDURES ON LANDSAT MSS DATA FOR AN AREA OF COMPLEX SURFACE CONDITIONS IN BASILICATA, SOUTHERN ITALY**


In this study, two unsupervised classification procedures are applied to ratioed and unratioed Landsat MSS data on an area of spatially complex vegetation and terrain. An objective accuracy assessment is undertaken on each classification and a comparison is made of the classification accuracies. By one procedure the entire area is clustered and by the other, a representative sample of the area is clustered and the resulting statistics are extrapolated to the remaining area using a maximum likelihood classifier. Classification of the unratioed data produced higher percentage accuracies than for the ratioed data and the monocluster block approach gave higher accuracies than clustering the entire area. The accuracy was increased to 84% by applying a 3 x 3 contextual filter to the classified image. The monocluster block approach was additionally the most economical in terms of computing time. (Author)

**A83-12602**

**BACKGROUND REFLECTANCE EFFECTS IN LANDSAT DATA**


A regression analysis was performed on Landsat MSS data to investigate the dependence of object radiance on the radiance of adjacent areas. The object radiance is increased by a path radiance component attributed to forward scattering in the atmosphere after reflection of solar radiation from the object background. Inclusion of average radiance of a few concentric rings with object reflectance in the regression model for satellite-measured radiances improves the least-squares fit at all sites tested. Multiple regression analysis indicates that radiance of an object is significantly affected by reflectance of background objects up to 500 m away. (Author)
ANALYTICAL PLOTTER FOR DATA INPUT INTO GEO-BASED OPTICAL DISK ARCHIVE, REGIONAL IMAGE BROADCAST AND MASSIVELY FRONT-END, REAL-TIME BROWSE IMAGE PRODUCTION, A HIGH BANDWIDTH OF OTHER FILM TYPES. MANIPULATION OF A FILM'S APPARENT GAMMA, FILM RECORDER CAN BE MODIFIED TO SIMULATE CERTAIN CHARACTERISTICS.


LAND-OBSERVING SATELLITES WITH MULTIPLE THEMATIC MAPPERS WILL PRODUCE DATA AT RATES OF 100 TO 300 MBPS. WHEN COUPLED WITH A HIGH DAILY SCENE PRODUCTION RATE, THESE RATES WILL REQUIRE NEW APPROACHES TO GROUND PROCESSING. CONSIDERATION IS GIVEN HERE TO FUTURE DOWNTOWN RATES AND DATA VOLUMES, AND REQUIREMENTS PECULIAR TO THE FUTURE USER COMMUNITY ARE DISCUSSED. THE ADVANCED TECHNOLOGIES REQUIRED TO ATTAIN AN OPERATIONAL SYSTEM IN THE YEARS 1985-1990 ARE CONSIDERED, TOGETHER WITH ADVANCES FORESEEN IN COMMUNICATIONS, MASS STORAGE, BULK MEMORIES, AND DATA PROCESSING. USING ADVANCED DEVICES, A CENTRALIZED DATA PROCESSING SYSTEM CAPABLE OF HANDLING THE 100 MBPS DATA RATE IS DESCRIBED. NEW APPROACHES, AMONG THEM A PARALLEL PIPELINED CALIBRATION FRONT-END, REAL-TIME BROWSE IMAGE PRODUCTION, A HIGH BANDWIDTH OPTICAL DISK ARCHIVE, REGIONAL IMAGE BROADCAST AND MASSIVELY PARALLEL PRODUCT PRODUCTION, ARE CONSIDERED. A DISTRIBUTED SYSTEM CAPABLE OF HANDLING THE 300 MBPS DATA RATE IS THEN DESCRIBED. DESIGNS FOR A LOCAL SYSTEM AND A REGIONAL PROCESSING CENTER ARE PRESENTED.

ANALYTICAL PLOTTER FOR DATA INPUT INTO GEO-BASED INFORMATION SYSTEMS


THE ANALYTICAL PLOTTER IS SHOWN TO BE ECONOMICAL, ACCURATE, AND FAST IN GATHERING DATA IN A DIGITAL FORMAT FOR 'ACTION' PLANS. IT IS THOUGHT POSSIBLE THAT, BY USING VERY SMALL SCALE AERIAL PHOTOGRAPHY, THE ANALYTICAL STEREOPLOTTER WILL BE VERY COMPETITIVE WITH CONVENTIONAL DATA GATHERING FOR MACRO SYSTEMS. THIS MAY BE IN THE OFFING BECAUSE OF THE READY AVAILABILITY OF SMALL SCALE AERIAL PHOTOGRAPHY. THE U.S. GEOLOGICAL SURVEY IS NOW OBTAINING CYCLIC AERIAL PHOTOGRAPHY AT A SCALE OF APPROXIMATELY 1:80,000. COMBINED WITH THE ANALYTICAL STEREOPLOTTER, THIS COULD WELL MAKE DATA ACQUISITION FOR ANY GEO-BASED SYSTEMS MORE ECONOMICAL AND ACCURATE THAN IS THE CASE IN MACRO GEO-BASED INFORMATION SYSTEMS. IT IS POINTED OUT THAT THIS WOULD ALSO REDUCE THE NEED FOR A MICRO SYSTEM, OR FURNISHING DATA AT A MIDDLE GROUND ACCURACY.

IMAGE ENHANCEMENT THROUGH FILM RECORDER RESPONSE CONTOURING


EVEN THOUGH DIGITIZATION INVOLVES SEVERAL EXTRA STEPS IN THE PREPRODUCTION OF THE IMAGERY, IT PERMITS MANIPULATION OR ENHANCEMENT OF THE DATA FOR SPECIAL USES. FOR EXAMPLE, IMAGE DATA ENHANCEMENT TECHNIQUES CAN BE APPLIED TO PARTIALLY RESTORE CONTRAST LOST BECAUSE OF ATMOSPHERIC LUMINANCE AND SCATTER. WHAT IS MORE SIGNIFICANT, THE DIGITAL-TO-ANALOG TRANSFER FUNCTION OF THE FILM RECORDER CAN BE MODIFIED TO SIMULATE CERTAIN CHARACTERISTICS OF OTHER FILM TYPES. MANIPULATION OF A FILM'S APPARENT GAMMA, RELATIVE SPEED, AND LINEAR-RESPONSE REGION IS EASILY EFFECTED BY MAPPING THE INPUT DATA TO A NEW DISTRIBUTION IN REAL TIME USING A HARDWARE-IMPLEMENTED LOOKUP TABLE. HOWEVER, TO ACCOMPLISH THE DESIRED PHOTOGRAPHIC RESULTS, FULL COOPERATION AND COMMUNICATION BETWEEN PHOTOGRAPHIC, ELECTRONIC, AND COMPUTER ENGINEERS IS ESSENTIAL.

RECONNAISSANCE APPLICATIONS OF IMAGE UNDERSTANDING


NUMEROUS DARPA AND PRIVATELY PURCHASED IMAGE UNDERSTANDING RESEARCH EFFORTS ARE RELATED TO VARIOUS PHASES OF RECONNAISSANCE IMAGE INTERPRETATION. THESE EFFORTS CAN CONTRIBUTE DIRECTLY TO THE VARIOUS TASKS ASSOCIATED WITH EACH PHASE OF THE INTERPRETATION. THREE MAJOR CATEGORIES TO WHICH DARPA RESEARCH IN IMAGE UNDERSTANDING MAY BE APPLIED ARE CONSIDERED: OBJECT DETECTION, TARGET MONITORING, AND IN-DEPTH ANALYSIS.

REGISTRATION OF A SYNTHETIC APERTURE RADAR/SAR RECONNAISSANCE IMAGE WITH A MAP REFERENCE DATA BASE


THE PROBLEM OF REGISTERING A RECONNAISSANCE SIDE-LOOKING SYNTHETIC APERTURE RADAR (SAR) IMAGE TO A THREE-DIMENSIONAL REFERENCE MAP IS EXAMINED. A TECHNIQUE WHICH IS BASED ON COMPUTING AN IMAGE-TO-DATE BASE CORRESPONDENCE IN TERMS OF A SAR SENSOR MODEL AS A FUNCTION OF SUCH PARAMETERS AS ALTITUDE, RANGE, SCALE, ETC.

RELAXATION MATCHING APPLIED TO AERIAL IMAGES


A SYMBOLIC MATCHING SYSTEM HAS BEEN DEVELOPED WHICH CAN BE USED FOR A VARIETY OF MATCHING TASKS IN SCENE ANALYSIS. THE SYSTEM IS DESIGNED TO HANDLE MANY OF THE PROBLEMS ENCOUNTERED IN THE ANALYSIS OF REAL SCENES, INCLUDING NOISY FEATURE VALUES, MISSING ELEMENTS, EXTRA PIECES OF OBJECTS, MANY FEATURES, AND MANY OBJECTS. THE SYSTEM IS BASED ON A RELAXATION MATCHING SCHEME; A VARIETY OF RELAXATION PROCEDURES HAVE BEEN USED WITH VARYING RESULTS. THIS PAPER DESCRIBES THE OVERALL MATCHING SYSTEM AND DISCUSSES THE PERFORMANCE OF THE VARIOUS RELAXATION TECHNIQUES.

QUALITY ASSESSMENT OF REMOTE-SENSING DATA - THE SAR CASE


IN THE CONTEXT OF A CONTINUING EFFORT TO DEVELOP TOOLS FOR QUALITY CONTROL, DIGITAL IMAGE PRODUCTS FROM REMOTE-SENSING SATELLITES, QUALITY-CONTROL PROCEDURES AND MEASUREMENTS ARE REPORTED FOR IMAGES GENERATED FROM SYNTHETIC APERTURE RADAR (SAR) DATA. THE PARTICULAR CASE CONSIDERED HERE IS THE DATA SET COLLECTED DURING THE EARTHNET SAR-580 CAMPAIGN IN JUNE-JULY 1981. THE RESULTS DEMONSTRATE (A) THE POSSIBILITY OF DISCRIMINATING BETWEEN DIFFERENT
SAR products and therefore the validity of the instruments employed for measurements; (b) the practical usability of the instruments and procedures in the light of operational quality control of SAR data. (Author)

A83-14243#
COMPARISON STUDY OF FUTURE SPOT AND LANDSAT-D SATELLITE PRODUCTS FROM A SIMULATION FLIGHT [ETUDE COMPARATIVE DES PRODUITS DES FUTURS SATELLITES EARTH SAT AND LANDSAT-D A PARTIR D'UN SURVol DE SIMULATION]
F. BONN, G. CLICHE, and C. TOUTANT (Sherbrooke, Universite, Sherbrooke, Quebec, Canada) In: Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 142-149. In French. Research supported by the Ministere de l'Education du Quebec. refs

An airborne simulation of SPOT and Landsat D images was done in August 1980 in the Granby-Mont Yamaska region, Quebec, using a 1260 Daedalus sensor (11 channels) modified by the Canada Centre for Remote Sensing. Analysis of images obtained indicated that because of its spectral characteristics Landsat D is a useful tool for crop discrimination and that, because of its spatial resolution, SPOT should be used in urban and semi-urban regions and for road and building location. (Author)

A83-14247#
APPLICATION OF LANDSAT IMAGERY TO NATURAL RESOURCES MANAGEMENT IN SIERRA LEONE, WEST AFRICA

Digital enhancement techniques were used to obtain basic natural resources information for Sierra Leone and adjacent parts of Guinea, West Africa. Preliminary results indicate that geological land use information (mineral extraction) and engineering terrain classification can be achieved through standard unsupervised classification techniques. Linear mapping for possible diamond exploration was accomplished using contrast stretch and biomass ratio data. Seasonal Landsat MSS imagery is required to obtain information on the hydrological dynamics of the coastal swamps (mangrove) and inland swamps (bollilands). General information enabling the identification of vegetation and land use patterns can be discerned from colour composite data. Contrast stretch and biomass data appear to best enhance the visual distinction of vegetative cover and the identification of potential mangrove swamp areas. (Author)

A83-14260#
CONSTRUCTION AND INTERPRETATION OF A THERMAL INERTIA IMAGE USING AIRBORNE DATA [CONSTRUCTION ET INTERPRETATION D'UNE IMAGE D'INERTIE THERMIQUE À PARTIR DE DONNEES AEROPORTEEES]

A high-resolution (4 m) thermal inertia image of the earth's surface was constructed using airborne data in the visible, near infrared and thermal infrared regions of the spectrum by combining digital images from a day flight and a night flight by means of the algorithm used for the HCMM (=Heat Capacity Mapping Mission) satellite. Interpretation of the image showed a good relationship between thermal inertia and vegetation height, but no conclusive results could be obtained for soil humidity in the region studied, which was totally covered by vegetation and where the soil was near saturation. (Author)

A83-14265#
COLOUR LANDSAT IMAGES AND MOSAICS - BASIC TOOLS IN AREAL AND ECOLOGICAL DIFFERENTIATION IN CANADA

Mosaics for the Canadian Arctic Islands are discussed in the light of current applications by Environment Canada to northern land use and ecological land surveys. The problems and merits associated with color satellite products are considered. The general development and applications of both color and panchromatic satellite mosaics are outlined. The use of color Landsat mosaics for ecodistrict mapping in the Lancaster sound region of the Arctic is discussed. A table in which panchromatic and color Landsat mosaics are listed by province and territory is included, as is a table indicating the mosaics most useful for studies on a 1:1,000,000 map sheet by sheet basis. C.R.

A83-14270#
A NATIONAL LANDSAT COLLECTION AND A PROPOSAL FOR A LIBRARY OF LANDSAT IMAGES

There have been numerous proposals from interested user groups regarding an implementation of optimum procedures for preserving the Landsat image record of Canada and for making the image record of Canada available to a wider public. The present investigation is concerned with one proposal which is currently being implemented, and another which deserves serious consideration. The first proposal is related to the establishment of a national collection of images. A study group was set up to investigate a means of establishing a national collection of Landsat images in hard copy form, which could be used as a reference source for people desiring to know what could be seen on a good Landsat image of any particular area of the country in which they were interested. The second proposal is concerned with the establishment of a library of Landsat images. Images could be borrowed from this source for some predetermined time period, after which they would either be returned, bought, or reordered. G.R.

A83-14271#
AN EXPERIMENTAL LANDSAT QUICKLOOK SYSTEM FOR ALASKA

Many potential applications of Landsat imagery require that imagery be made available to users with minimal delay from acquisition. However, users frequently experience delays of 2 to 6 weeks from data acquisition to image delivery. The Quicklook Image Recording System (QLIRS) has been developed in response to the need for near-real-time image generation. This simple, inexpensive system is intended to be used by relatively low-budget groups for production of near-real-time, partially-corrected, full-resolution Landsat images. It is designed to supplement rather than replace existing Landsat image processing facilities. The QLIRS is mainly designed for the production of film images in monochrome and optionally in color. As another option, computer-compatible magnetic tapes of image and auxiliary data.
can be produced for transfer to another computer system. (Author)

A83-14272#
DEFINITION AND POTENTIAL OF GEOCODED SATELLITE IMAGERY PRODUCTS

In the next ten years, there will be an increase in the number of imaging satellites following similar quasi-polar but different orbits. For the most suitable utilization of images from multiple complementary spaceborne (and airborne) missions and their integration with geocoded databases, it is important for remote sensing data processing and distribution agencies to develop and offer mission independent standard products in a fixed and common cartographic projection, such as the Universal Transverse Mercator (UTM) projection. In Canada, the UTM projection is being used for most national and provincial databases. Imagery which is transformed to a cartographic projection and is independent of the sensor characteristics and orbital parameters of the platform is called 'geocoded'.

G.R.

A83-14273#
REMOTE SENSING SOFTWARE FOR AIRBORNE IMAGE ANALYSIS

The high resolution and large look angles of airborne synthetic aperture radar (SAR) and multispectral scanner (MSS) sensors introduce image processing problems not encountered with the present satellite (Landsat) data. During the last three years, studies have been conducted at the Canada Centre for Remote Sensing (CCRS) with the objective to develop suitable airborne image processing algorithms to implement them on the CCRS Image Analysis System (CIAS). A description of the resulting software is provided. A synopsis of software is presented, taking into account Digital Elevation Model (DEM) processing, aspects of geometric correction, radiometric effects, loss of information in connection with shadow and layover phenomena, and spatial feature generation.

G.R.

A83-14280#
CARTOGRAPHIC ASPECTS OF DUAL-FREQUENCY DUAL-POLARIZATION SAR IMAGERY

Radar imagery was obtained using four-channel SAR equipment on board an aircraft to define the cartographic performance of the bands. The tests were performed over Ontario by flying three lines, each 60 km long, with the sensor in a shallow angle mode. An altitude of 6 km was maintained to obtain a 6 km wide ground swath. Data analysis was performed to examine the four sets of images to identify inconsistencies in scale, compare the accuracies available from each channel, and assess the accuracy for the registration of output from each channel to a base map. A two-stage transformation was employed to produce residual errors for comparisons. Significant differences in scale were found, together with scale inequalities in the azimuth and range direction, thereby making the operations of overlay of the different channels' data difficult. An X-band, like-polarization produced the best cartographic accuracy. Segmentation improved the accuracy of image-to-image or image-to-map registration.

M.S.K.

A83-14281#
REFERENCES TO THE GCP SUCCESS RATE

An examination of the causes of registration errors which cause geometric distortions during Landsat MSS data processing is carried out, and various ground control points (GCP's) are ranked for effectiveness. Experimental examination of precision registration processing has shown that a success rate is dependent on the seasonal and weather conditions independent of the type of satellite. A negative correlation has been demonstrated between the sequential similarity detecting algorithm and the registration errors in the direction normal to the satellite track. A negative correlation has also been found between the number of ground control points and the registration errors. It is shown that refinement in yaw estimation is necessary to compensate for image skew. Breakwaters were calculated to be the most effective GCPs.

M.S.K.

A83-14286#
REFERENCE FAST-LOOK IMAGES FOR MONITOR OF LANDSAT IMAGERY DATA ACQUISITION

The results of an attempt to define a reference quality for quick-look CRT displays nominally put on the screen during transmission of satellite imagery to ground receiving stations are discussed. The reference imagery is classified into normal and abnormal groups. The normal group comprises test patterns, ordinary Landsat MSS and RBV images, cloud-cover images, gamma-curve-enhanced images, pseudo-color enhanced images, and images from a high gain mode. The normal group covers images interfered with by solar noise and radio transmitters, images disturbed with by on-board operational problems, images affected by unusual spacecraft attitudes, and pseudo-pulse mode images. Image deterioration occurs when, for instance, the solar noise reflected to the predetermined level, and it is recommended that a predictive method for determining the sun-satellite coinincidence be developed. Finally, a technique is described for storage and retrieval of archived false color images.

M.S.K.
THE ACCURACY OF A COMPONENT ANALYSIS IN SPACE STUDIES OF NATURAL ENVIRONMENTS [TECHNOST' KOMPONENTNOGO ANALIZA PRI KOSMICHESKOM ISSLEDOVANIYAH PRIRODNYH SREDY]

Simple methods are presented for estimating the number of the principal components to be isolated and evaluating the accuracy of the correlation matrix eigenvalues and object coordinates within the principal component system when interpreting multispectral aerial and space imagery. The practical use of the proposed methods is illustrated by examples involving identification of agricultural fields from space imagery.

V.L.

AUTOMATION OF THE SEARCH FOR AND RECOGNITION OF REFERENCE ZONES FOR PRECISE COORDINATE CONTROL OF SPACE IMAGERY [VOPROSY AVTOHIATZATSIISI PROTSESSA POISKII RASPOZNAVANIIA OPONYKH ZON PRI TOCHKOH KOORDINATKH PRIVIKAZE KOSMICHESKOKOI VIDEOINFORMATSII]


An algorithm is developed for the automatic search for reference zones, their identification with the available standards, and determination of their coordinates. Experimental results confirming the efficiency of the proposed algorithm, which has been implemented in a computer program, are presented.

V.L.

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

RADAR IMAGES OF THE EARTH FROM SPACE

The operational principles and imagery available from microwave SAR radars for earth observations from aircraft, the Shuttle, and Seasat are explored. Using microwave frequencies is noted to offer imagery access in day or night, all-weather conditions. SAR radar functions by obtaining a series of reflected signals over a single path, with data processing combining the echoes into an image corresponding to what may be obtained with a large antenna. A stable, reference signal is added to the incoming signals in order to establish the phase and amplitude of echoes. Because the wavelengths of the images can be precisely controlled, Doppler shifts can be detected, thus allowing point by point scattering analysis in two-dimensions. The Shuttle SIR-A and the Seasat radar feature a ground resolution of 25 m. Applications of the satellite systems to terrain, ice mapping, and for a Venus radar mapper mission are described.

M.S.K.

TO MIX OR MATCH - OR CHOOSING MATCHED SAMPLES IN COMPARATIVE AERIAL SURVEYS

The problem of sampling design in repetitive aerial surveys is addressed. Specifically, the trade-offs in sampling design to maximize either the precision of an estimate of the change in a population (between two surveys) or of an estimate of the current level of a survey variable are examined. Optimal designs for change detection require that a matched set of quadrats be selected. But optimal designs for estimation of levels of the survey variable often involve taking unmatched quadrats. Practical designs attempt to strike a balance between these objectives. This design problem is described and illustrated.

(Author)
concept in the processing of imagery data provided by an active sensor, i.e. radar. The investigation makes use of a data provided by a synthetic aperture radar (SAR) of the Seasat satellite. Seasat was placed into orbit in 1978. A corresponding Landsat imagery section was selected as reference image for the rectification procedure.

G.R.


Dual-wavelength correlation data are presented for ground-level and airborne measurements of topographic and ocean backscatter near the 9.5-micron wavelength. Data were acquired with a pulsed carbon dioxide, dual-laser, dual-wavelength lidar system. The best system performance gave a dual-wavelength uncorrelated noise component of 2.8% and 9% standard deviation for ground-based and airborne data, respectively. This sets one limit on lidar measurement accuracy with a single pulse pair. (Author)


Digitally processed Seasat SAR imagery of the Denver, Colorado, area is analyzed with regard to the types of urban data that can be detected and/or inferred from satellite-borne L-band systems. Black-and-white images of the scene were generated at three scales to determine the advantages and detail discernible at each level of display. The large-scale imagery was density-sliced to evaluate the feasibility of producing a semiautomated land-cover classification from the SAR data. Gray level classes were assigned colors to aid interpretation and subsequently compared with the black-and-white images to assess the contribution of each technique and benefits of combining the data from both procedures. (Author)


Attention is given to a method which makes it possible to incorporate information from ancillary data sources into the results of an existing classification of remotely sensed data. The method is based upon probabilistic label relaxation procedures which are used for imbedding spatial context data in image-labeling problems. The source of ancillary information is utilized in the form of a set of probabilities. These are introduced into a modified relaxation method called supervised relaxation labeling which, on application, develops a labeling for remotely sensed data that strikes a balance in consistency between spectral, spatial, and ancillary data sources of information. A description is given of results of a forestry classification in which accuracy is improved from 68% to 81% by incorporating topographic elevation in the outlined manner. G.R.


The feasibility of using satellite photographs to construct three-dimensional photogrammetric networks with the ultimate aim of mapping remote areas was investigated, with emphasis on the application of analytic phototriangulation. Particular consideration was given to the precision with which the coordinates of points could be measured on space photographs. It is concluded that the use of space photographs for purposes of large-scale mapping requires the solution of a number of technical problems, including the need to increase the precision with which points are identified and coordinates are measured. B.J.

N83-10459*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. SOME FUNDAMENTAL CONCEPTS IN REMOTE SENSING In its The LANDSAT Tutorial Workbook p 9-38 1982 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS Avail: NTIS MF A01; SOD HC $55.00 CSCL 05B

The term remote sensing is defined as well as ideas such as class, pattern, feature, pattern recognition, feature extraction, and theme. The electromagnetic spectrum is examined especially those wavelength regions available to remote sensing. Relevant energy and wave propagation laws are discussed and the characteristics of emitted and reflected radiation and their detection are investigated. The identification of classes by their spectral signatures, the multispectral approach, and the principal types of sensors and platforms used in remote sensing are also considered. A.R.H.

N83-10460*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. FAMILIARIZATION WITH LANDSAT IMAGERY In its The LANDSAT Tutorial Workbook p 39-80 1982 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS Avail: NTIS MF A01; SOD HC $55.00 CSCL 05B

Learning objectives of the activities provided include: (1) reading the annotation of a LANDSAT image; (2) becoming acquainted with the characteristics of 1:1,000,000 scale transparencies and prints of MSS images; (3) noting the general information visible in LANDSAT photo products; (4) observing changes of appearance of any ground feature or class in the black and white images made from the four MSS bands and the characteristic color of each class in color composites; (5) determining the degree to which a LANDSAT image meets map accuracy standards and can be fitted to map projections; (6) assessing the effects of LANDSAT enlargements and scale changes and of the limitations of satellite resolution relative to aerial photos; (7) observing the influence of time of acquisition (season) on a scene; (8) getting a feel for image quality as dependent on processing and photoreproduction; (9) appreciating the characteristics of the RBV and thermal band imagery obtained from LANDSAT-3, and (10) becoming familiar with certain attributes of adjacent LANDSAT images which permit them to be joined in mosaics and to be viewed in stereo. A.R.H.
DATA PROCESSING AND DISTRIBUTION SYSTEMS

N83-10461*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SOME SPECTRAL AND SPATIAL CHARACTERISTICS OF LANDSAT DATA

In its The LANDSAT Tutorial Workbook p 81-99 1982 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198.

ERTS
Avail: NTIS MF A01; SOD HC $55.00 CSCL 05B

Activities are provided for: (1) developing insight into the way in which the LANDSAT MSS produces multispectral data; (2) promoting understanding of what a 'pixel' means in a LANDSAT image and the implications of the term 'mixed pixel'; (3) explaining the concept of spectral signatures; (4) deriving a simple signature for a class or feature by analysis: of the four band images; (5) understanding the production of false color composites; (6) appreciating the use of color additive techniques; (7) preparing Diazo images; and (8) making quick visual identifications of major land cover types by their characteristic gray tones or colors in LANDSAT images.

A.R.H.

N83-10462*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PHOTINTERPRETATION OF LANDSAT IMAGES

In its The LANDSAT Tutorial Workbook p 101-143 1982 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198.

ERTS
Avail: NTIS MF A01; SOD HC $55.00 CSCL 05B

Learning objectives include: (1) developing a facility for applying conventional techniques of photointerpretation to small scale (satellite) imagery; (2) promoting the ability to locate, identify, and interpret small natural and man made surface features in a LANDSAT image; (3) using supporting imagery, such as aerial and space photography, to conduct specific applications analyses; (4) learning to apply change detection techniques to recognize and explain transient and temporal events in individual or seasonal imagery; (5) producing photointerpretation maps that define major surface units, themes, or classes; (6) classifying or analyzing a scene for specific discipline applications in geology, agriculture, forestry, hyrology, coastal wetlands, and environmental pollution; and (7) evaluating both advantages and shortcomings in relying on the photointerpretive approach (rather than computer based analytical approach) for extracting information from LANDSAT data.

A.R.H.

N83-10463*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPUTER PROCESSED LANDSAT DATA

In its The LANDSAT Tutorial Workbook p 145-232 1982 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198.

ERTS
Avail: NTIS MF A01; SOD HC $55.00 CSCL 05B

Background information and exercises are provided to: (1) establish or expand understanding of the concepts, methods, and terminology of computer processing of image producing data; (2) develop insight into the advantages of computer based image processing compared with the photointerpretation approach for processing, classifying, interpreting, and applying remote sensing data; (3) foster a broad perspective on the principal of the main techniques for image enhancement, pattern recognition, and thematic classification; (4) appreciate the pros and cons of batch and interactive modes of image analysis; (5) examine and evaluate some specific computer generated products for subsences in Pennsylvania and New Jersey; and (6) interrelate these particular examples of output with more theoretical explanations of computer processing strategies and procedures.

A.R.H.

N83-10464*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

NEAR SURFACE OBSERVATIONS

In its The LANDSAT Tutorial Workbook p 233-276 1982 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198.

ERTS
Avail: NTIS MF A01; SOD HC $55.00 CSCL 05B

Learning objectives include: (1) developing an understanding of the implications of the term 'near surface observations'; (2) associating the appearance of large ground features as seen in satellite imagery with their appearance as seen from the ground; (3) grasping criteria and procedures for selecting training sites on the ground for use in supervised classification; (4) running through an example of training site selection; (5) becoming familiar with several methods of accuracy assessment; (6) becoming aware of the approach and value of making supporting measurements of the spectral and physical properties of materials on the ground and from aircraft; (7) taking note of the different types of instruments used in making specific ground measurements; and (8) appreciating the rationale underlying laboratory and field studies on or near the Earth's surface for the purpose of developing new sensor systems.

A.R.H.

N83-10465*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GEOGRAPHIC INFORMATION SYSTEMS

W. J. CAMPBELL In its The LANDSAT Tutorial Workbook p 277-308 1982 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198.

ERTS
Avail: NTIS MF A01; SOD HC $55.00 CSCL 05B

Information and activities are provided to: (1) enhance the ability to distinguish between a Geographic Information System (GIS) and a data management system; (2) develop understanding of spatial data handling by conventional methods versus the automated approach; (3) promote awareness of GIS design and capabilities; (4) foster understanding of the concepts and problems of data base development and management; (5) facilitate recognition of how a computerized GIS can model conditions in the present 'real world' to project conditions in the future; and (6) appreciate the utility of integrating LANDSAT and other remotely sensed data into the GIS.

A.R.H.


IMAGE PROCESSING TECHNIQUES

L. A. GERHARDT In AGARD Image Process. Tech. 5 p May 1982

Avail: NTIS HC A11/MF A01

Image generation, image processing, image transmission, image enhancement, and interpretation are discussed.

Author


IMAGE PROCESSING OF REMOTELY SENSED PHENOMENA

K. A. ULBRICHT In AGARD Image Process. Tech. 18 p May 1982

Avail: NTIS HC A11/MF A01

A review of applications and possibilities of digital image processing of remotely sensed phenomena of the Earth is given. Several application examples processed on DIBIAS and representing different disciplines are discussed, showing possibilities of image processing. Among them are geologic, oceanographic, and cartographic examples, as well as applications in the field of atmospheric physics, correlation of SEASAT SAR to a LANDSAT scene, and an evaluation of a commercial compression algorithm.

Author
OE 7 DATA PROCESSING AND DISTRIBUTION SYSTEMS

N83-12490*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
OPERATION PLAN FOR THE DATA 100/LARS TERMINAL SYSTEM
(Contract NAS9-15800; PROJ. AGRISTARS) (E83-10011; NASA-CR-167754; JSC-16747; NAS 1.26:167754; LEMSCO-15128) Avail: NTIS HC A02/MF A01 CSCL 09B
The data 100/LARS terminal system provides an interface for processing on the IBM 3031 computer system at Purdue University's Laboratory for Applications of Remote Sensing. The environment in which the system is operated and supported is discussed. The general support responsibilities, procedural mechanisms, and training established for the benefit of the system users are defined.
A.R.H.

THE AKAIKE INFORMATION CRITERION AND ITS APPLICATION TO MIXTURE PROPORTION ESTIMATION Final Report
The theory and applications of the Akaike information criterion (AIC) Mixture model simulations and the application of the AIC to a large portion of a LANDSAT segment are presented.
A.R.H.

N83-12508# Ministere de l'Energie et des Ressources (Quebec).
CONFERENCE ON USING NEXT GENERATION EARTH OBSERVATION SATELLITES: SUMMARY HANDBOOK [COLLOQUE SUR L'UTILISATION DE LA PROCHAINE GENERATION DE SATELLITES D'OBSERVATION DE LA TERRE: MANUEL DE SYNTHESE]
H. AUDET, ed. and K. P. B. THOMSON, ed. (Centre Canadien de Teledetection) 1981 79 p refs In FRENCH and ENGLISH Conf. held in Montreal, 24-25 Mar. 1981
Avail: NTIS HC A05/MF A01
Presentations and discussions of the different techniques needed to process the data to be provided by the high resolution visible sensor on SPOT and the thematic mapper on LANDSAT D are highlighted. Experiments conducted to simulate data from these two instruments are described and results, conclusions, and recommendations from each effort are summarized.
Transl. by A.R.H.

N83-12668*# Lockheed Engineering and Management Services Co., Inc., Houston, Tex.
VOLUME 1: SYSTEM OVERVIEW
A system overview is presented for those interested in the EOD-LARSYS as programmed on the Purdue University IBM 370/148 (recently replaced by the IBM 3031) computer. All processors in the system are described and all control cards are summarized. EOD-LARSYS is the JSC version of an integrated batch system for analysis of multispectral scanner imagery data. The system is operational from remote terminals at Johnson Space Center under the virtual machine/conversational monitor system environment.
A.R.H.

N83-13518 Bayerische Akademie der Wissenschaften, Munich (West Germany).
PASS POINT DETERMINATION AND GEOMETRICAL PRECISION OF THE RELATIVE RECTIFICATION OF SCANNER DATA Ph.D. Thesis - Karlsruhe Univ., West Germany [PASSPUNKTBESTIMMUNG UND GEOMETRISCHE GENAUIGKEIT BEI DER RELATIVEN ENTZERRUNG VON ABTASTDATEN]
W. J. WIESEL 1981 74 p refs In GERMAN (SER-C-266; ISBN-3-7696-93205; ISSN-0065-5325) Avail.: Issuing Activity
An iterative method for the relative geometrical rectification of image scanning data, based on pass points, was developed and tested on three data processing systems of an airborne multispectral scanner. The pass points were determined by means of correlation methods. A testing system using the original image data, for the coordinate measuring accuracy obtained by cross correlation, is proposed. The accuracy limits of 0.10 to 0.25 image elements calculated with this testing system, are nearly obtained with the rectification method. Average coordinate errors of 0.15 to 0.27 image elements are obtained on correlation points. These accuracies are sufficient to fit data of different times and/or different sensors into each other.
Author (ESA)

N83-13522# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.
A different model is being adapted to handle Florida HCMM data and conditions in an effort to overcome difficulties encountered in extracting data from computer compatible tapes.
A.R.H.

N83-13530# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
GEOLOCO INTERPRETATION OF HCMM AND AIRCRAFT THERMAL DATA
Progress on the Heat Capacity Mapping Mission (HCMM) follow-on study is reported. Numerous image products for geologic interpretation of both HCMM and aircraft thermal data were produced. These include, among others, various combinations of the thermal data with LANDSAT and SEASAT data. The combined data sets were displayed using simple color composites, principal component color composites and black and white images, and hue, saturation intensity color composites. Algorithms for incorporating both atmospheric and elevation data simultaneously into the digital processing for creation of quantitatively correct thermal inertia images, are in the final development stage. A field trip to Death Valley was undertaken to field check the aircraft and HCMM data.
M.G.
was evaluated. The considerations involved in making radiometric forecasts and observation of frosts, and observation of ocean television screen. The images are transmitted by telephone from the GOES satellite which are shown on a black and white or color television screen. The GOES satellite provides meteorological information from the prototype UAI-1, which is coupled to the INPE GOES station. Estimated user fees are $1200 (1200 bits/sec) in real time from the master unit (UAI-M) which is broadcasted.

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standardized images are discussed. Commonly available image products do not demonstrate the capabilities and applicability of multispectral satellite remote sensing techniques. They do not motivate potential users to consider remote sensing as anything other than a source of synoptic representations. Application optimized images can be obtained from intensity, hue, saturation systems and quasi-synthetic effects. These data present subtle surface characteristics in a perceivable and understandable way. The processing techniques are suited for the definition of standardized enhancement schemes. Author (ESA)


THE APPLICABILITY OF SATELLITE REMOTE SENSING TO SMALL AND MEDIUM SCALE MAPPING

The usefulness of satellite remote sensing images to the generation and updating of general purpose maps at scales 1: 50,000 to 1:100,000 is considered. It is argued that the needs of conventional medium and small scale mapping will not be satisfied by space imagery, unless attitudes and values in mapping change, or space imagery at geometric resolution of 3 m or better is available. Author (ESA)

N83-14635/# Canada Centre for Remote Sensing, Toronto (Ontario).

A PRACTICAL AUTOMATED MAPPING SYSTEM

A system for the computerized production of maps directly from the digital analysis of LANDSAT data is described. The system is based on the Applicon Color Plotter, a computerized printer which plots lines, curves and polygons at any selected scale on ordinary paper measuring 86 cm by 56 cm. By using three ink jets, each applying a single basic color, the plotter prints map features in up to 256 different shades of color. The system uses a PDP 11/34 computer. It takes 2 hr to process the digital analysis results onto a tape in a format acceptable to the Applicon printer. Printing of the map can then be completed within 15 min. Author (ESA)

N83-14637/# Oslo Univ. (Norway). Dept. of Geography.

DIGITAL ANALYSIS OF LANDSAT SATELLITE IMAGERY IN TURKANA, NORTHERN KENYA

Digital LANDSAT scanner data was enhanced and compared with color infrared air photos. Results show that false color composite (FCC) images made from ratio or principal component bands add little new information to the information contained in the standard FCC. Best is the FCC: PC2=R, MSS5=G, and PC1=B. The FCC: MSS4/5=R, MSS6=G, and MSS5/6=IR is also good. It is easier to obtain good results from the supervised classification technique.

Author (ESA)

N83-14830/# National Science Foundation, Washington, D.C.
Div. of Atmospheric Sciences.

KEY SCIENTIFIC QUESTIONS AND THE ROLE OF SATELLITES

Some of the research opportunities that are available from geostationary satellite data, especially from MONEX during the Global Weather Experiment are described. In addition, the International Cloud Climatology Program is described and the use of satellite imagery in studying mesoscale convection complexes is discussed. Finally, information derived from satellite data on ocean winds is examined. M.G.

N83-15745/# Florida Univ., Gainesville. Inst. of Food and Agricultural Sciences.

USE OF THERMAL INERTIA DETERMINED BY HCM TO PREDICT NOCTURNAL COLD PRONE AREAS IN FLORIDA

Registered data sets were used to develop qualitative temperature and delta T maps of a band across north Florida and across south Florida for use with Carlson's boundary layer energy model balance model. Thermal inertia and moisture availability computations for north Florida are being used to investigate model sensitivity and to evaluate input parameters. Temperature differences of day-night HCM passes clearly define wetlands and uplands areas. A.R.H.

N83-15746/# Agricultural Research Service, Weslaco, Tex.


Practical methods of computer screening cloud-contaminated pixels from data of various satellite systems are proposed. Examples are given of the location of clouds and representative landscape features in HCMC spectral space of reflectance (VIS) vs emission (IR). Methods of screening out cloud affected HCMM are discussed. The character of subvisible absorbing-emitting atmospheric layers (subvisible cirrus or SCI) in HCMC data is considered and radiosonde soundings are examined in relation to the presence of SCI. The statistical characteristics of multispectral meteorological satellite data in clear and SCI affected areas are discussed. Examples in TIROS-N and NOAA-7 data from several states and Mexico are presented. The VIS-IR cluster screening method for removing clouds is applied to a 262, 144 pixel HCMM scene from south Texas and northeast Mexico. The SCI that remain after cluster screening are sited out by applying a statistically determined IR limit. A.R.H.
FITTING SURFACES TO SCATTERED DATA

L. L. SCHUMAKER In its Proc. of the NASA Workshop on Surface Fitting p 9-41 1982 refs ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

A variety of numerical methods for fitting a function to data given at a set of points scattered throughout a domain in the plane are surveyed. Four classes of methods are discussed: (1) global interpolation; (2) local interpolation; (3) global approximation; and (4) local approximation. Also, two-stage methods and combinations are discussed. The surfaces constructed include polynomials, spline functions, and rational functions, among others.

M.G.

C-1 SURFACE INTERPOLATION FOR SCATTERED DATA ON A SPHERE

C. L. LAWSON In Texas A and M Univ. Proc. of the NASA Workshop on Surface Fitting p 95-119 1982 refs ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

An algorithm is described for constructing a smooth computable function, \( f \), defined over the surface of a sphere and interpolating a set of \( n \) data values, \( (x_i, y_i) \), associated with \( n \) locations, \( P_i \), on the surface of the sphere. The interpolation function \( f \) will be continuous and have continuous first partial derivatives. The locations, \( (x_i, y_i) \), are not required to lie on any type of regular grid.

M.G.

SURFACE FITTING WITH BIHARMONIC AND HARMONIC MODELS

R. L. HARDY In Texas A and M Univ. Proc. of the NASA Workshop on Surface Fitting p 135-146 1982 refs ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

The physical and geometric interpretation of a surface fitting technique, multiquadric equations (MQ), is discussed. The relation of this method and its reciprocal form to biharmonic and harmonic techniques respectively, is pointed out. In both forms the solutions may be viewed as being numerical approximations of an integral equation in which an unknown density function is the physical source for disturbing potential (reciprocal-MQ) or elastic displacement (MQ).

M.G.

BSPLASH: A THREE-STAGE SURFACE INTERPOLANT TO SCATTERED DATA

T. A. FOLEY In Texas A and M Univ. Proc. of the NASA Workshop on Surface Fitting p 147-178 1982 refs ERTS

Avail: NTIS HC A10/MF A01 CSCL 05B

Given \( N \) distinct points \( (x_i, y_i) \) and \( N \) real numbers \( z_i \), BSPLASH constructs a function \( G(x, y) \) that satisfies \( G(x, y) = z_i \) for \( i = 1, ..., N \). This \( C(2) \) interpolant consists of a bicubic spline approximation and Shepard's bivariate interpolant.

M.G.

PROCEEDINGS OF THE NASA WORKSHOP ON IMAGE ANALYSIS

L. F. GUSSEMANN, JR., Principal Investigator 1982 149 p refs Workshop held in College Station, Tex., 28-30 Apr. 1982. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS (Contract NAS9-16447)

(E83-10118; NASA-CR-167778; NAS 1.26:167778) Avail: NTIS HC A07/MF A01 CSCL 05B

Three major topics of image analysis are addressed: segmentation, shape and texture analysis, and structural analysis.
weakest possible sense for a single f). There is no intermediate comparisons of density estimates, integral/f(n)-f/ should be used convergence to 0 is possible for E(integral/f(n)-f); (2) In theoretical vectors is critically examined, and some recent results in the field

TOPICS IN GLOBAL CONVERGENCE OF DENSITY ESTIMATES
Avail: NTIS A21/MA A01 CSCL 05B

The problem of estimating a density f on R sup d from a sample X(1),...,X(n) of independent identically distributed random vectors is critically examined, and some recent results in the field are reviewed. The following statements are qualified: (1) For any sequence of density estimates f(n), any arbitrary slow rate of convergence to 0 is possible for E(integral/f(n)-f); (2) In theoretical comparisons of density estimates, integral/f(n)-f/ should be used and not integral/f(n)-f/ sup p, p 1; and (3) For most reasonable nonparametric density estimates, either there is convergence of integral/f(n)-f/ (and then the convergence is in the strongest possible sense for all f), or there is no convergence (even in the weakest possible sense for a single f). There is no intermediate situation.

Author


Initial data screening, data handling and program testing were completed on the four-band Detroit scene and the seven-band northeast Arkansas scene. Data were received in early December for one primary eastern test site (Washington, D.C.) and one secondary eastern test site (Allegheny National Forest). A comprehensive digital data base was built for a portion of the Black Hills test site and is composed of historic LANDSAT MSS data; elevation, slope, and aspect data; land cover data; geologic data; thematic mapper simulator data; and digitized high altitude aircraft data. The thematic mapper and multispectral scanner data of the Washington area were resampled at 25 and 50 meters respectively, with map projection to UTM grid.

A.R.H.
which produced data of value to planners in the San Bernardino geographic information system. Local analyses were developed data sources, and that the LANDSAT component can be effectively users, can be used to identify and rectify discrepancies in various illustrates that a vertically integrated approach can benefit local including LANDSAT data, for local planning purposes in a portion STUDY

HCA14/MFA01 CSCL 05B


User needs, data types, data automation, and preliminary applications are described for an effort to assemble a single data base for San Bernardino County from data bases which exist at several administrative levels. Each of the data bases used was registered and converted to a grid-based data file at a resolution of 4 acres and used to create a multivariable data base for the entire study area. To this data base were added classified LANDSAT data from 1976 and 1979. The resulting data base thus created in a uniform formal all of the separately automated data within the study area. Several possible interactions between existing geocoded data bases and LANDSAT data were tested. The use of LANDSAT to update existing data base is to be tested. A.R.H.


The creation and use of a vertically integrated data base, including LANDSAT data, for local planning purposes in a portion of San Bernardino County, California are described. The project illustrates that a vertically integrated approach can benefit local users, can be used to identify and rectify discrepancies in various data sources, and that the LANDSAT component can be effectively used to identify change, perform initial capability/suitability modeling, update existing data, and refine existing data in a geographic information system. Local analyses were developed which produced data of value to planners in the San Bernardino County Planning Department and the San Bernardino National Forest staff. Author


The conversion of remotely measured surface temperature into maps of surface physical parameters requires the use of a well-constituted thermal model of the energy balance at the earth-atmosphere interface, in order to predict surface temperature across the area of interest. Four well-known models are examined: The Watson (1975) Fourier series model, the Pratt, Ellyett and Price (1979) Fourier series model, the Kahle (1977) thermal model, and the Carlson Boland and Dodd (1976) model. Although each of these begins with the surface energy budget equation, the physical and mathematical treatment of the component fluxes result in models radically different in their structure, accuracy, and applicability to particular remote sensing surveys. The design of each model is compared and the tradeoff between cost of execution and physical sophistication is discussed. All four models are used to simulate surface temperature for two test cases for which accurate surface truth data is available for comparison. Mean temperature errors are computed, and these errors are converted to errors in apparent thermal inertia. (Author)


The fact that a remote sensing satellite orbits the earth with very high stability as long as no local perturbing forces are involved, and the existence of solid state linear array sensors having no moving parts and therefore exerting no perturbing forces on the satellite, are invoked in the proposal of a satellite imaging system designated 'Mapsat'. This system, which incorporates digital data from highly stabilized stereo linear arrays amenable to simplified processing that produces both planimetric imagery and elevation data, is expected to yield automated mapping in near real time. Image maps as large as 1:50,000 scale, with contours as close as a 20-m interval, may be produced from Mapsat data. O.C.


The proposed mapping satellite Mapsat is to consist of fixed fore, vertical, and aft linear detector arrays, any two of which may be used simultaneously to obtain digital images for one-dimensional stereocorrelation. The satellite attitude may be varied according to Fourier series to enable a given detector on one array to follow closely the groundtrack sensed by the corresponding detector on another array throughout the orbit. These tracking errors are negligible for a satellite stable within anticipated ranges. The required computations have been programmed in FORTRAN IV. (Author)
A83-10718

SELECTION OF THE OPTIMUM SPECTRAL BANDS FOR THE SPOT SATELLITE


The choice of the locations and widths of the multispectral and panchromatic bands of the SPOT satellite have been optimized by taking into account both the spectral signature of ground objects and modifications introduced by the atmosphere. The spectral band B3 response has been separated from the water vapor absorption bands, and the width of the panchromatic band, which was initially 0.5-0.8 microns, has been reduced. Attention is given to the ways in which system characteristics influence the measurement of spectral signatures formed by the three optimized bands, as well as to the method of choosing the width of the panchromatic band, which involved a study of contrast over thermally characterized objects.

O.C.

A83-11239

KA-BAND PASSIVE/ACTIVE AIRBORNE RADAR


A multimode Ka-band radiometric imaging system is discussed. The basic operating principles of a conventional imaging radiometer are reviewed and two methods of image enhancement are presented for a typical battlefield scenario. The first enhancement method utilizes a low power bistatic illuminator in conjunction with a conventional radiometer. A passive image is subtracted from a coincident illuminated image to provide better contrast and improved detection of metallic targets. The second enhancement method incorporates an inverse filter algorithm to yield better than real beam resolution in high contrast images. A two dimensional spatial high pass filter is used to counteract the low pass filter effect of the antenna beam. A conceptual multi-mode imaging system is presented along with performance calculations for a typical airborne imaging scenario. A 38 GHz ground based radiometric test bed was developed to demonstrate the passive and illuminated modes. The system hardware and performance parameters are discussed and images from several scenarios are presented. (Author)

A83-11887

THE GDTA - REMOTE SENSING AT THE SERVICE OF USERS (LE GDTA - LA TELEDETECTION AU SERVICE DES UTILISATEURS)


The historical background behind the establishment of the GDTA (Groupement pour le Developpement de la Teledetection Aerospaiale) is briefly reviewed, and the objectives and activities of the GDTA are discussed. The relationship between the GDTA and Earthnet is considered, with attention given to the relationship between the GDTA and users, and prospects of the SPOT program.

B.J.

A83-12605*

Utah State Univ., Logan.

SPECTROSCOPIC IMAGING OF THE THERMOSPHERE FROM THE SPACE SHUTTLE


The design features, performance characteristics, and intended missions for the Imaging Spectrometric Observatory scheduled to fly on the first Spacelab Shuttle mission in 1983 are described. The instrument comprises an array of five imaging spectrometers covering the spectral range 300-1200 A. The spectrometers operate simultaneously, using CCDs as collector elements. Resolution on the first flight will be limited to 3 A, with coverage to containing the dynamic range from nocturnal signals to the bright earth. A minicomputer in the Spacelab will permit crewmember interaction with the measurements, while data will be telemetered in real-time to a ground station. Initial mission objectives include observations of dayglow, nightglow, and twilightglow over the full wavelength range capability.

M.S.K.

A83-12669

ELECTRO-OPTICAL INSTRUMENTATION FOR RESOURCES EVALUATION; PROCEEDINGS OF THE MEETING, WASHINGTON, DC, APRIL 21, 22, 1981


Topics discussed include the monitoring of the eruption of Mount St. Helens, satellite systems for remote sensing, the ground processing of remote sensor data, and mensuration and interpretation equipment. Papers are presented on Landsat observations of Mount St. Helens, solid-state sensors for topographic mapping, a synthetic aperture radar coordinate processing system, and a computer-assisted photointerpretation system. Attention is also given to image enhancement through film recorder response contouring, future ground processing systems, planetary exploration sensor systems, and lidar measurements of Mount St. Helens effluents. C.R.


EARTH RESOURCES OBSERVATION WITH THE SHUTTLE IMAGING RADAR

C. ELACHI (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, CA) In: Electro-optical instrumentation for resources evaluation; Proceedings of the Meeting, Washington, DC, April 21, 22, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 73-78. refs (Contract NAS7-100)

To fully understand the radar signature of different surface features and covers, observations must be made in a variety of sensor parameters (that is, frequency, polarization, and incidence angle). This makes it possible to choose those sensor parameters that will provide the greatest amount of information about the surface under study. The Shuttle Imaging Radar (SIR) will be able to obtain surface images at two frequencies (L-band and C-band), at multiple polarizations, and at all incidence angles from near vertical to near grazing. The SIR will operate in the synthetic aperture imaging mode and provide digital images of the surfaces with a resolution of approximately 20 m. As part of the SIR flights, a number of planned large-scale experiments will be carried out in the fields of geologic mapping, vegetation classification, land cover mapping, surface moisture measurements, and ocean surface observation.

A83-13347* National Aeronautics and Space Administration, Washington, D. C.

USE OF THE SPACE SHUTTLE FOR REMOTE SENSING RESEARCH - RECENT RESULTS AND FUTURE PROSPECTS


The successful November 1981 test flight of the Space Shuttle Columbia has demonstrated the Shuttle’s utility and versatility for earth resources-related research. A series of remote sensing experiments is planned for the mid-1980s which will more fully exploit the Shuttle’s earth observation capability. The OSTA-1 experiment package of the mission mentioned incorporated the Shuttle Imaging Radar, a synthetic aperture, side-looking device which artificially illuminated the earth’s surface with horizontally
polarized microwave radiation transmitted at L-band frequency, the
Shuttle Multispectral IR Radiometer, which measured the intensity of
solar radiation reflected from the earth's surface, the
Measurement of Air Pollution from Satellites experiment, which
determined the concentration of CO in the earth's atmosphere, the
proof-of-concept Feature Identification and Location
Experiment, and the Night/Day Optical Survey of Lightning
experiment.

A83-13726
TECHNICAL ISSUES IN FOCAL PLANE DEVELOPMENT;
PROCEEDINGS OF THE MEETING, WASHINGTON, DC, APRIL
21, 22, 1981
E. KRIKORIAN, (ED.) (General Dynamics Corp., Pomona, CA) and
W. C. CHAN (Aerospace Corp., El Segundo, CA) Meeting
sponsored by the SPIE - The International Society for Optical
Engineering Bellingham, WA, SPIE - The International Society for
Optical Engineering (SPIE Proceedings, Volume 282), 1981. 136
p.
MEMBERS, $34.; NONMEMBERS, $40
Papers are presented in the areas of the specifications and
requirements and performance limitations on focal plane imaging
systems, and on the development of visible and infrared focal
planes. Specific topics include the conceptual design of a
pushbroom focal plane, a shutterless design for the correction of
fixed pattern noise in infrared staring arrays, technical aspects of
focal plane development for earth resource observations from
space, signal processing in large focal plane arrays, and substrate
interactions with passivating films on HgCdTe.
A.L.W.

A83-13735*
National Aeronautics and Space Administration.
Goddard Space Flight Center, Greenbelt, Md.
TECHNICAL ISSUES IN FOCAL PLANE DEVELOPMENT FOR
TERRESTRIAL RESOURCE OBSERVATIONS
L. L. THOMPSON (NASA, Goddard Space Flight Center, Greenbelt,
MD) In: Technical issues in focal plane development; Proceedings
of the Meeting, Washington, DC, April 21, 22, 1981. Bellingham,
WA, SPIE - The International Society for Optical Engineering,
Performance goals for solid-state detector arrays operating in
the pushbroom scan mode for the high-resolution, high-accuracy
remote sensing of earth resources from space are discussed and
some of the focal plane and system trades involved are identified.
Issues in the development of solid-state pushbroom arrays with
radiometric calibration to 0.5% precision detector-to-detector over
a dynamic range of 1000:1 are considered, with calibration,
temporal stability and spectral response conditions noted. Factors
influencing the geometric precision of satellite-borne pushbroom
scan mode sensors are then examined, including satellite orbit
track and attitude errors, and geometric and radiometric correlation
between information in the various spectral bands. Approaches to
the alignment of linear arrays of thousands of detectors are then
discussed that take into account tradeoffs between fabrication and
test complexity and ground processing requirements. Continuing science experiments are indicated as necessary to
establish tolerances on performance goals.
A.L.W.

A83-14040*
Kansas Univ., Lawrence.
MICROWAVE REMOTE SENSING: ACTIVE AND PASSIVE.
VOLUME 2 - RADAR REMOTE SENSING AND SURFACE
SCATTERING AND EMISSION THEORY
F. T. ULABY, R. K. MOORE, and A. K. FUNG (Kansas University,
Lawrence, KS) Research supported by NASA, NSF, and U.S.
Department of Defense. Reading, MA, Addison-Wesley Publishing
Co., 1982, 624 p. refs $49.50
The fundamental principles of radar backscattering
measurements are presented, including measurement statistics,
Doppler and pulse discrimination techniques, and associated
ambiguity functions. The operation of real and synthetic aperture
sidelooking airborne radar systems is described, along with the
internal and external calibration techniques employed in scattering
measurements. Attention is given to the physical mechanisms
responsible for the scattering emission behavior of homogeneous
and inhomogeneous media, through a discussion of surface roughness,
dielectric properties and inhomogeneity, and penetration
depth. Simple semiempirical models are presented. Theoretical
models involving greater mathematical sophistication are also given
for extended ocean and bare soil surfaces, and the more general
case of a vegetation canopy over a rough surface.
O.C.

A83-14275#
A FIELD PORTABLE REFLECTANCE SPECTROMETER
J. H. DAVIES, R. DICK, and C. CUMMING (Barringer Research,
Ltd., Rexdale, Ontario, Canada) In: Canadian Symposium on
Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981,
Proceedings. Ottawa, Canadian Aeronautics and Space Institute,
1982, p. 416-422. refs
To permit improved interpretation of aerial photographs and
satellite imagery and to permit improved selection of band pass
filters for future sensors of the earth's reflectance, a field portable
reflectance spectrometer (REFSPEC) has been fabricated. Spectra
from 420 to 2450 nm are recorded in 90 seconds. Spectral
resolution varies from about 1.5 to 4 nm. Unique chopper design and
signal processing gives directly the spectral reflectance of the
target scene. Applications including geobotanical and geological
studies and satellite ground truthing are described, as well as
design and operational features of REFspec.
(Author)

A83-14289#
THE CCRS SAR PROCESSING SYSTEM
D. N. DAVIS and G. J. PRINZCU (Canada Centre for Remote
Sensing, Ottawa, Canada) In: Canadian Symposium on Remote
Sensing, 7th, Winnipeg, Canada, September 8-11, 1981,
Proceedings. Ottawa, Canadian Aeronautics and Space Institute,
1982, p. 520-526. refs
The SHARP (Synthetic Aperture Radar Processing) system is a
recently acquired component of the Canada Centre for Remote
Sensing synthetic aperture radar (SAR) sensor and processing
facility. The SHARP system hardware consists of a minicomputer
with four terminals and with one megabyte of memory, tape and
disk units, array processor and high density tape recorder (HDT).
The software is organized in terms of modular functions and
transcribes, generates images and controls output quality. Each of
these functions is described. The SHARP system product consists of
computer-compatible tapes of both the signal data transcribed from
the HDT tape and the generated SAR image.
C.D.

A83-14290#
THE MICROWAVE PAYLOAD FOR THE ESA REMOTE SENSING
SATELLINE /ERS-1/
G. DIETERLE (ESA, Toulouse, France) In: Canadian Symposium on
Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981,
Proceedings. Ottawa, Canadian Aeronautics and Space Institute,
1982, p. 527-537. refs
The instruments for the plansed first European Remote Sensing
Satellite (ERS-1) are discussed, describing their main specifications,
indicating their measurement principles, and describing their basic
design. The active microwave instrumentation (AMI) is an all C-band
sensor that can be operated in an SAR imaging mode over land,
sea, continental areas, and in a wind scatterometer mode, a wave
scatterometer mode, and an interleaved wind and wave
scatterometer mode over the oceans. Each of these modes is discussed,
giving such specifications as spatial resolution, swath, incidence angle,
frequency, mean RF power, data rate, antenna size, power consumption, and polarization. The radar altimeter (RA)
is also discussed, and its specifications are given. The microwave
payload and the ERS-1 program schedule are presented, block
diagrams of the AMI and the RA are shown, and a possible inflight
configuration for ERS-1 is depicted.
C.D.
08 INSTRUMENTATION AND SENSORS

A83-14293# APPLICATION OF THE AIRBORNE MICROWAVE RAIN-SCATTERED/RADIOMETER SYSTEM TO THE REMOTE SENSING OF OCEANS AND WIND VECTOR MEASUREMENTS OVER THE OCEAN

The airborne microwave scatterometers and radiometers both operated at X-band (wavelength, 3 cm) and Ka-band (wavelength, 8.7 mm) have been applied to the observations of precipitations and microwave scattering and emission characteristics of the ocean. The rain rates are calculated both from the attenuations derived from the Ka-band back-scattered power from the sea surface and from the X-band radar reflectivity factor, Z. The relations between the rainfall rates and the antenna temperatures measured by the dual-wavelength radiometer are estimated. Typical displays of analyzed data are also shown. The differential back-scattering cross section of the sea surface for the X-band and the brightness temperatures of that for the X-band and Ka-band obtained under the wind speed condition of 6 kt are shown as a function of the incident angle (0 to approximately 60 deg), the azimuth angle (0 to approximately 360 deg), and the polarization (H/V). The differential back-scattering cross section is confirmed to be a periodic function of azimuth angle, and the wind vector estimated from the model analysis based on the result is compared with the sea truth data obtained by the meteorological buoy. The brightness temperature map is obtained and the Tsushima Current (warm ocean current) is found on the map. (Author)

A83-14308 THE POSSIBILITY OF MEASURING THE MOISTURE CONTENT OF THE UPPER LAYERS OF THE ATMOSPHERE USING RADIOMETRIC TECHNIQUES [O VOZMOZHNOSTI OPREDELENIIA VLAGOSODERZHANIIA VERKHNIKH SLOEY ATMOSFERY RADIOMETRICHESKIM METODOM]

A method is proposed for extracting the moisture-content profile of the stratosphere and the mesosphere from satellite measurements of thermal radio emission in the narrow band of H2O absorption resonance at 22.23508 and 183.31009 GHz. It is shown that the corresponding inverse problem is reduced to an Abel-type integral equation. The effect of measurement uncertainty on the accuracy of the solution is examined. V.L.

A83-14313 COORDINATE TRANSFORMATION DURING THE GEOMETRIC CORRECTION OF THE SPACE SCANNER IMAGERY OF THE EARTH [PREOBRAZOVANIE KOORDINAT PRI GEOMETRICHESKOI KORREKTSII SKAIMOV ZEMLI]

A previously proposed approximate model for the scanner survey process is further developed and generalized to obtain sufficiently compact, explicit expressions for coordinate transformation in the course of the geometric correction of scanner imagery. Computations are carried out for the case of TV scanner systems used for the remote sensing of earth resources from space. It is shown that the proposed model produces an approximation error that does not exceed one resolution element while reducing the processing time by about 15 times, compared with standard numerical procedures. V.L.

A83-14314 OPERATIONAL PLANNING OF THE PROCESS OF EARTH SURVEY BY SATELLITES [OPERATIVNOE PLANIROVANIE POVRUKHNOSSA ZEMLI IZ KOSMOSA]

A method is proposed for programming the operation of satellite-borne survey instrumentation with allowance for meteorological conditions and constraints imposed by the design limitations of the spaceborne data processing systems. The task of compiling operational schedules is reduced to that of solving a linear programming problem. The proposed method is illustrated by an example. V.L.

A83-14943 INVESTIGATIONS OF INTERPRETABILITY OF IMAGES BY DIFFERENT SENSORS AND PLATFORMS FOR SMALL SCALE MAPPING [UNTERSUCHUNGEN UEBER DIE INTERPRETIERBARKEIT VON BILDERN UNTERSCHIEDLICHER SENSOREN UND PLATTFORMEN FUR DIE KLEINMASSSTAEBIGE KARTIERUNG]

Overlapping High Altitude Photography at scales varying from 1:35,000 to 1:125,000, satellite imagery (Skylab, Landsat) and radar imagery has been used to derive the mapping capability of topographic objects by monocular and, if applicable, stereoscopic observation. The interpretation of digital imagery has been simulated by digitizing the high altitude photographs on the Optronics Scanner using varying pixel sizes between 1 m and 100 m referred to the ground. Pixel sizes of about 3 m are required for monocular observation and 6 m for stereoscopic observation to detect objects to be shown on a 1:50,000 map. (Author)

A83-15458 SPECTORADMIETER MEASUREMENTS IN SUPPORT OF PHOTOVOLTAIC DEVICE TESTING

The spectroradiometer is capable of complete solar spectral measurements approximately 7 min apart in both the global and the direct beam modes, all in the wavelength range 280-2500 nm. Global measurements can be made at any azimuth and altitude position; the field of view of the pyrheliometer comparison tube is 6 deg. Typical spectra show that the resolution is sufficient to identify Fraunhofer absorption bands in the surface of the sun. Data are presented that show the relationship between direct beam spectra and two specific microenvironments. The differences observed are analyzed in terms of the microenvironment haze and pollution to the efficiency of concentrating photovoltaic devices. (Author)

A83-15658# AIRBORNE ATMOSPHERIC TEMPERATURE STRUCTURE MEASUREMENTS OF A PACIFIC COAST MARINE INVERSION

A mobile airborne observation platform has been used to measure the temperature structure of a Pacific coastal marine inversion. Data were collected using thin film and fine wire anemometry. Ground launched weather balloon data complemented the onboard meteorological observations. This technique provides the timely collection of vertical profile samples. The study indicated regions in the inversion where the wide-angle scattering of a propagating electromagnetic wave can be much
more severe than the best propagating bands. There also appears to be an optically quite region immediately above the inversion wherein the moisture level is considerably less than that found from the ocean surface to the top of the inversion. S.C.S.

83-11565 Bayerische Akademie der Wissenschaften, Munich (West Germany).

INVESTIGATION OF THE GEOMETRICAL STABILITY OF A PHOTOGRAMMETRIC RECORDING SYSTEM Ph.D. Thesis - Bonn Univ. [UNTERSUCHUNG ZUR GEOMETRISCHEN STABILITAET EINES PHOTOGRAMMETRISCHEN AUFNAHMESYSTEMS]


System parameters and their effect on the error of a photogrammetric recording system were investigated in order to evaluate the stability with respect to system errors and parameters. The possibilities of determination and separation of system errors is also explained. From the experimental investigations of different flights, the importance of a single system parameter for the photogrammetric result was deduced and requirements for the changes of system parameters in photogrammetric systems with high accuracy were deduced. The results show that the stability of the systems parameters and the possibility to register completely the system errors are closely dependent. Author (ESA)

83-12396# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

AN EVALUATION OF THE NASA/GSFC BARRIES FIELD SPECTRAL REFLECTOMETER MODEL 14-758, USING SIGNAL/NOISE AS A MEASURE OF UTILITY


A Barnes field spectral reflectometer which collected information in 373 channels covering the region from 0.4 to 2.5 micrometers was assessed for signal utility. A band was judged unsatisfactory if the probability was 0.1 or greater than its signal to noise ratio was less than eight to one. For each of the bands the probability of a noisy observation was estimated under a binomial assumption from a set of field crop spectra covering an entire growing season. A 95% confidence interval was calculated above each estimate and bounds whose lower confidence limits were greater than 0.1 were judged unsatisfactory. As a result, 283 channels were deemed statistically satisfactory. Excluded channels correspond to portions of the electromagnetic spectrum (EMS) where high atmospheric absorption and filter wheel overlap occur. In addition, the analyses uncovered intervals of unsatisfactory detection capability within the blue, red and far infrared regions of vegetation spectra. From the results of the analysis it was recommended that 90 channels monitored by the instrument under consideration be eliminated from future studies. These channels are tabulated and discussed. B.W.

83-13547# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE USE OF THE IMAGE INPER SIMULATOR CALIBRATION DATA FOR ASSESSMENT OF DATA QUALITY


In flight calibration data collected from the thematic mapper simulator (TMS) were used to assess the quality of Earth scan data. The following results are indicated: (1) based on limited samples, individual TMS channels have noise which varies from channel to channel, but remains constant within a channel; (2) short term variations of more than 5% in the average values of calibration source responses indicate problems; and (3) absolute radiometric calibration is unlikely to be meaningful in a temporal sense due to single point calibration methods used. E.A.K.

83-13557# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).

A DIGITAL PHOTOGRAMMETRIC SYSTEM (DPS) FOR PRODUCING DIGITAL ELEVATION MODELS (DEM) AND ORTHOPHOTOS BY MEANS OF LINEAR ARRAY SCANNER IMAGERY


A digital procedure for the generation and processing of scanner images is presented. The terrain is scanned by an opto-electronic three-line scan camera from aircraft, missiles or spacecraft. Three linear sensor arrays are arranged in the focal plane of the camera objective perpendicularly to the flight course. Each sensor array produces an image strip of the covered terrain according to the pushbroom principle. Nodes of the DEM to be computed are selected in the middle image strip whose object planes are nearly vertical. The conjugate image points in the other two image strips are determined by area correlation methods. The coordinates of all these image points and a few control points are inserted into a least squares adjustment for computation of the orientation parameters of the camera along its entire flight course and the coordinates of the DEM. Raster plots of ortho and stereo orthophotos are produced after digital rectification of the image strips, utilizing the nodes of the DEM grid. Author (ESA)

83-13750# Maryland Univ., College Park. Dept. of Meteorology.

SPATIAL AND TEMPORAL VARIATIONS OF LARGE-SCALE SUBSIDENCE AND CONVECTION REGIONS DERIVED FROM SATELLITE DATA


Geographical location and horizontal extent of large scale monthly mean subsidence regions and those of convection regions vary during a year and also vary from year to year. Anomalies in variations of subsidence regions over oceans can create anomalies in sea surface temperature and under land they can produce drought conditions. On the other hand, anomalies in variations of convection regions can create anomalies in rainfall patterns and in latent heat released. The variability of these systems from satellite data is determined. The data utilized is not outgoing infrared radiation (IR) at the top of the atmosphere. These data were derived from measurements made on scanning radiometer aboard the NOAA operational satellite. The global distribution of IR fields were available twice daily (9:00 a.m. and 9:00 p.m. local time) for 45 months. S.L.


VALIDATION AND APPLICATION OF THE SEASAT-SMMR GEOPHYSICAL ALGORITHMS Final Report


(A) NASA-CR-169390; NAS 1.15:169390; PB82-237934; CONTRIB-616; NOAA-82051012) Avail: NTIS HC A05/MF A01 CSLC 048

The work was concentrated on verification of the atmospheric water vapor channels on SEASAT’s Scanning Multichannel Microwave Radiometer (SMMR). Data from the Gull of Alaska Experiment (GOASEX), tropical island stations, and particularly from the Joint Air Sea Interaction (JASIN) experiment have been used to compare with the SMMR algorithm predictions. SMMR’s water vapor has been found to be at least as accurate as conventional radiosondes. Liquid water and rain rate have insufficient comparisons for statistical results, but can be said to show promise in a qualitative sense. The SEASAT SMMR maps of the atmospheric water components were found to be very useful in helping to locate fronts and cloudy and rainy areas in the JASIN experiment. Author (GRA)
INSTRUMENTATION AND SENSORS

**N83-14588#** Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).

**COMPARISON OF DIVERSE METHODS FOR THE CORRECTION OF ATMOSPHERIC EFFECTS ON LANDSAT AND SKYLAB IMAGES [COMPARACAO DE DIVERSOS METODOS PARA A CORRECAO DE EFEITO ATMOSFERICO EM IMAGENS LANDSAT E SKYLAB]**


Earth's atmosphere reduces a sensors ability in currently discriminating targets. Using radiometric correction to reduce the atmospheric effects may improve considerably the performance of an automatic image interpreter. Several methods for radiometric correction from the open literature are compared leading to the development of an atmospheric correction system. A.R.H.

**N83-14612#** National Aeronautics and Space Administration, Washington, D.C.

**LAND REMOTE SENSING ACTIVITIES IN THE US**


The LANDSAT D system, shuttle imaging radar instruments, the thermal infrared multispectral scanner system, the shuttle multispectral infrared radiometer, and the multispectral linear array program are described. These programs will develop advanced optical and microwave sensor technologies to support a broad spectrum of aircraft, shuttle and free flier missions for research in agriculture, geology, hydrology and geography. A broad based fundamental research effort coupled with the development of improved data acquisition and information extraction techniques is planned to improve fundamental understanding of the remote sensing process and fully exploit its capabilities. Author (ESA)

**N83-14804#** Cologne Univ. (West Germany).

**THE CONICAL SCAN RADIOMETER**


A satellite-borne conical scan radiometer (CSR) is proposed, offering multiangular and multispectral measurements of Earth radiation fields, including the total radiances, which are not available from conventional radiometers. Advantages of the CSR for meteorological studies are discussed. In comparison to conventional cross-track scanning instruments, the CSR is unique with respect to the selected picture element size which is kept constant by means of a specially shaped detector matrix at all scan angles. The conical scan mode offers the chance to improve angular sampling. Angular sampling gaps of previous satellite-borne radiometers can be interpolated and complemented by CSR data. Radiance are measured through 10 radiometric channels which are selected to study cloudiness, water vapor, ozone, surface albedo, ground and mean stratospheric temperature, and aerosols.

Author (ESA)

**N83-14805#** Cologne Univ. (West Germany).

**THE EARTH RADIATION BUDGET SATELLITE SYSTEM (ERBSS) OF THE UNITED STATES**


A plan is presented which is accepted in the US to measure the radiation budget parameters simultaneously with wide field of view medium field of view and a scanning narrow field of view radiometer. The instrument parameters are summarized. Spectral and technical details are given. These instruments are planned to be flown in operational satellites of the NOAA series. A smaller low inclination satellite of the Atmospheric Explorer series can give valuable information sampled over tropical and subtropical regions of the Earth. The contributions of the different ERBSS members are grouped in four categories: modeling of instrumental performance; algorithms for data inversions; averaging of data in space and time; and consideration of the major aspects of most operational data evaluations and distributions to interested data users.

Author (ESA)

**N83-15344#** National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

**DATA ANNOUNCEMENT BULLETIN: SPACE SHUTTLE OSTA 1 PAYLOAD DATA**


Data from the scientific payload, OSTA 1, is available. Images of the Earth's surface taken from the Shuttle Imaging Radar-A were processed, and can be obtained in the form of photographic prints, negatives, or positive transparencies. Magnetic tapes containing data for the ocean color experiment and the Shuttle multispectral infrared radiometer are also available.

S.L.

**N83-15797#** Hughes Aircraft Co., Los Angeles, Calif. Space and Communications Group.


The development and acceptance testing of the 4-band Multispectral Scanners to be flown on LANDSAT D and LANDSAT D Earth resources satellites are summarized. Emphasis is placed on the acceptance test phase of the program. Test history and acceptance test algorithms are discussed. Trend data of all the key performance parameters are included and discussed separately for each of the two multispectral scanner instruments. Anomalies encountered and their resolutions are included.

Author

09

GENERAL

Includes economic analysis.

**A83-10429**

**EARTH OBSERVATION - EVOLUTION OF REQUIREMENTS AND SYSTEMS [OBSERVATION DE LA TERRE - EVOLUTION DES BESOINS ET DES SYSTEMES]**


The applications, operations, and types of space-based platforms for remote viewing of the earth are reviewed, together with projections of future developments. The spacecraft mainly produce imagery for ground-based analyses of scientific, meteorological, cartographical, or oceanographic data. Atmospheric phenomena, geological formations, temperature stratification, and sea-air interactions are monitored. The instrumentation comprises visual bands, SAR, and microwave passive sensing, with data transmission rates of 15 Mbits/sec for the Landsat 3 and a planned 50-100 Mbit/sec for the SPOT satellite. Signal receiving and data processing at ground stations are being continually upgraded in terms of data compression, image manipulation, and treatment in parallel and from storage. Future systems are projected to involve sequentially launched identical systems for keeping relatively continuous watch over a particular region, and also to experiment with spacecraft with newly developed instrumentation. Principal
features of the SPOT and Landsat-D spacecraft are detailed. M.S.K.

A83-11926

SPACELAB, SPACE PLATFORMS AND THE FUTURE; PROCEEDINGS OF THE FOURTH JOINT AAS/DGLR GODDARD MEMORIAL SYMPOSIUM, WASHINGTON, DC, MARCH 17-19, 1982


National and international program goals for the next generation of space missions are discussed. Attention was given to the instrumentation and hardware intended for the Spacelab flights, with specific details of material processing, remote sensing, life sciences, astrophysical, and solar physics experiments. Free-flying space platforms to be launched, serviced, and/or retrieved by the Shuttle are described, together with mission requirements attesting to the need for a permanently manned space station and also constraining its design. Earth-oriented space activities were surveyed, including microwave remote sensing apparatus for the Shuttle and autonomous satellites, data processing systems for earth resources satellites, and solid-state instrumentation concepts. NASA and ESA launch vehicles in the near term are projected, and the history of manned maneuvering units is traced. M.S.K.

A83-11932

ADVANCED OPERATIONAL EARTH RESOURCES SATELLITE SYSTEMS

S. W. MCCANDLES (User Systems Engineering, Annandale, VA) and P. M. MAUGHAN (COMSAT General Corp., Washington, DC)


(AAS 82-128)

Spacecraft instrumentation and design, business objectives, and space technologies being developed and used by various nations in the near term are reviewed. The French are preparing the SPOT satellite for earth resources mapping, while the ERS-1 spacecraft are being developed by both ESA and Japan, with capabilities similar to SEASAT and the GOES satellites. Communications satellites will implement the 30/20 GHz bands, multiple spot beam antennas, and large unmannned multiservice satellite systems. Predicted space missions in the period 1982-1991 are provided, including mention of satellite business communication services, direct broadcast television services, electronic mail, and international information services. At least four U.S. environmental monitoring satellites will be in orbit at any one time. Finally, the use of multisensor platforms is noted to potentially reduce the launch volume demands on the Shuttle and ballistic missile systems. M.S.K.

A83-11933

FUTURE LAND REMOTE SENSING DATA AND SERVICES - A COMMERCIAL PERSPECTIVE

T. M. ALEXANDER and P. M. MAUGHAN (COMSAT General Corp., Washington, DC)


(AAS 82-129)

The development of a market for satellite synoptic, repeat imagery of the earth is traced to the present, and necessities for full-scale commercial remote sensing operations are defined. The Landsat spacecraft produced multispectral imagery of the earth based on technologies developed since World War II primarily for military applications. Rapid dissemination of the data was accomplished, but shortages in trained personnel, data processing, image generation, and interpretive and production hardware became evident. Additionally, government subsidies of the services created an artificially low cost, and foreign nations began to develop remote sensing satellites which offered the same services. It is suggested that the thematic mapper on the Landsat D should be evaluated for its actual use in commercial applications and replaced if it has none. Sensors which respond to commercial demands are recommended for development, together with commercially controlled remote sensing services. M.S.K.

A83-12673* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EARLY 1981 VIEW OF LANDSAT-D PROGRESS

V. V. SALOMONSON (NASA, Goddard Space Flight Center, Earth Survey Applications Div., Greenbelt, MD)


The thematic mapper (TM) will provide a spatial resolution (30 m) higher than the radiometric observations provided from Landsats 1 through 3 (80 m); what is more, observations in new spectral bands (0.45 to 0.52, 0.55 to 0.75, and 2.08 to 2.35 microns) will also be available. These characteristics will aid in identifying and assessing the acreage and condition of crops. Further advantages will be offered in mineral exploration and land resource assessment. In describing the flight segment, it is noted that the high-gain antenna (diameter, 6 ft) will be used to communicate with the Tracking and Data Relay Satellite System in the Ku-band (12 GHz). Direct transmission of TM data will be provided by the X-band antenna. The MSS data will be transmitted directly to foreign stations by the S-band antenna. A figure describing the Multimission Modular spacecraft is included. C.R.

A83-13715* National Aeronautics and Space Administration, Washington, D.C.

OSTA-1 - SHUTTLE'S FIRST SCIENTIFIC AND APPLICATIONS PAYLOAD

L. J. DEMAS (NASA, Office of Space Science, Washington, DC) and J. V. TARANIK (NASA, Office of Space and Terrestrial Applications, Washington, DC)


The Office of Space and Terrestrial Applications’ OSTA-1 scientific and applications payload will be carried by the second Space Shuttle flight and be concerned primarily with the remote sensing of land resources, atmospheric phenomena and ocean currents. Incorporated by the OSTA-1 payload are the Shuttle Multispectral IR Radiometer, the Feature Identification and Location Experiment, the Measurement of Air Pollution from Satellites experiment, the Ocean Color Experiment, the Night/Day Optical Survey of Lightning, and the Heflex Bioengineering Test. O.C.

A83-14226

CANADIAN SYMPOSIUM ON REMOTE SENSING, 7TH, WINNIPEG, CANADA, SEPTEMBER 8-11, 1981, PROCEEDINGS


The overview presentations are provided, taking into account the development of airborne and satellite remote sensing applications, and the importance of remote sensing for Canada with respect to past achievements and future needs. Land use applications are considered, giving attention to renewable resource information needs in Manitoba, satellite remote sensing for domestic crop reporting in the U.S. and Canada, operational land cover type mapping in Ontario by Landsat-based digital analysis and map production, a position-based resource mapping study of the Kanasikis valley using Landsat, and the application of Landsat imagery in flood control and management of agricultural land. Other topics discussed are related to ecological applications, earth science applications, and data management and acquisition. A description is provided of the Canadian synthetic aperture radar
satellite program, and the application of the airborne microwave rain-scatterometer/radiometer system to the remote sensing of rains and wind vector measurements over the ocean. G.R.

A83-14227# THE IMPORTANCE OFREMOTE SENSING FOR CANADA - PAST ACHIEVEMENTS, FUTURE NEEDS E. A. GODBY (Canada Centre for Remote Sensing, Ottawa, Canada) and J. T. walker (Department of the Environment, Canada Lands Directorate, Hull, Quebec, Canada) In Canadian Symposium on Remote Sensing, 7th, Winnipeg, Canada, September 8-11, 1981, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1982, p. 8-19. refs
A survey of remote sensing activities and plans in Canada is presented. Attention is given to Landsat ground stations, computer-assisted data analysis, radar projects such as Canada's participation in the NASA Seasat project, and remote sensing programs in the individual Canadian provinces. Plans for the next decade are outlined. These include participation in projects involving Landsat D, the French SPOT satellite, the Japanese MOS-I satellite and Canada's own Radarsat satellite. S.C.S.

The influence of present and future space activities on the world is discussed. The general topics addressed include space science, communications, and earth resources. Individual subjects considered include: the global implications of space, space science and humanistic concerns; motivations for the U.S. space program; international collaboration and military-civil interactions in space programs; space communications organizations and links; remote sensing programs and applications; institutional arrangements for remote sensing. C.D.

A83-17426# EARTHNET PREPARES FOR LANDSAT-D L. MARELLI (European Space Research Institute, Earthnet Programme Office, Frascati, Italy) ESA Bulletin, no. 32, Nov. 1982, p. 6-10.
Landsat-D incorporates a thematic mapper (TM) in addition to the more conventional multispectral scanner (MSS), thereby offering enhanced capabilities which are attractive in light of European requirements. Efforts are currently underway to upgrade the Earthnet Landsat stations at Fucino, Italy and Kiruna, Sweden, so that, when the Landsat-D payload becomes routinely available to Earthnet stations in mid-1983, European remote sensing data users will be able to employ this new tool for resource management. Four passes of Landsat-D MSS data have been acquired to date, and are undergoing evaluation. The first TM images are to be acquired before the end of 1983. Attention is given to the results of NASA's Landsat Image Data Quality Assessment program with respect to overall Landsat-D performance and especially that of its sensors. O.C.

Activities performed by the cosmonauts on Salyut-7 during June-August 1982 are briefly described. These activities included the unloading of Progress-13, biomedical studies, geophysical experiments, the remote sensing of earth resources, the testing of the Magma-F electric furnace for the Kristall space-manufacturing facility, astroophysical studies, and EVA. B.J.

N83-10468# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. THE LANDSAT TUTORIAL WORKBOOK: BASICS OF SATELLITE REMOTE SENSING N. M. SHORT, Principal Investigator 1982 554 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS (E83-10001; NASA-RP-1078; NAS 1.61-1076; LC-81-600117) Avail: NTIS MF A01; SOD HC $55.00 CSCL 058 Most of the subject matter of a full training course in applying remote sensing is presented in a self-teaching mode in this how-to manual which combines a review of basics, a survey of systems, and a treatment of the principles and mechanics of image analysis by computers, with a laboratory approach for learning to utilize the data through practical experiences. All relevant image products are included.

N83-10467# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. OTHER REMOTE SENSING SYSTEMS: RETROSPECT AND OUTLOOK In its The LANDSAT Tutorial Workbook p 327-367 1982 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS Avail: NTIS MF A01; SOD HC $55.00 CSCL 058 The history of remote sensing is reviewed and the scope and versatility of the several remote sensing systems already in orbit are discussed, especially those with sensors operating in other EM spectral modes. The multisensor approach is examined by interrelating LANDSAT observations with data from other satellite systems. The basic principles and practices underlying the use of thermal infrared and radar sensors are explored and the types of observations and interpretations emanating from the Nimbus, Heat Capacity Mapping Mission, and SEASAT programs are examined. Approved or proposed Earth resources oriented missions for the 1980's previewed include LANDSAT D, Stereosat, Gravsat, the French satellite SPOT-1, and multimission modular spacecraft launched from space shuttle. The pushbroom linear array pushbroom radiometer, the multispectral linear array, and the operational LANDSAT observing system, to be designed the LANDSAT-E series are also envisioned for this decade. A.R.H.

N83-10466# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md. SOME CLOSING THOUGHTS: PRACTICAL PAYOFFS FROM SATELLITE SYSTEMS In its The LANDSAT Tutorial Workbook p 369-407 1982 refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS Avail: NTIS MF A01; SOD HC $55.00 CSCL 058 The benefits-to-cost ratio of satellite remote sensing, both as a substitute for conventional methods of monitoring and assessing resources, and as a supplement to these methods is examined using a model which analyzes the cost of aerial photography versus satellite scanner for producing and interpreting an image of the Earth's surface sized to LANDSAT dimensions. Examples of cost savings are tabulated for ground surveys, aerial photos, and LANDSAT. Possible additional benefits from LANDSAT D are assessed. The way in which satellites fit into more comprehensive models for resources management is discussed. It is shown that remote sensing is but one essential component in a complex system that aggregates technical, Socioeconomics, political, cultural, and other factors in the human decision process. A.R.H.
Tape characteristics, processing modes, and a choice of systems waste disposal are considered. Scientific diving standards and flood forecasting research is discussed. Funding for civil weather instrumented airplanes, and computers were examined. River and sensing in all geographic areas. A.R.H. thematic map to be used in solving drought-related problems in volcano serves to demonstrate the advantages of thermal infrared purchased from the EROS Data Center, Sioux Falls, S.D. 57198. Original contains color imagery. Original photography may be In its The LANDSAT Tutorial Workbook p 455-475 1982 refs APPENDIX A: THE LANDSAT SYSTEM S. C. FREDEN In its The LANDSAT Tutorial Workbook p 409-419 1982 refs ERTS Avail: NTIS MF A01; SOD HC $55.00 CSCL 05B The primary LANDSAT mission and the system requirements are summarized and pertinent parameters of the spacecraft, its orbit, and payload are tabulated. The history acquisition to entry into the archives for storage and product generation and dissemination is recounted. The LANDSAT D data handling plan is discussed showing requirements for both the MSS CCT and the thematic mapper CCT. A.R.H.

A REPORT TO THE PRESIDENT AND THE CONGRESS Annual Report 30 Jun. 1982 58 p refs (AR-11) Avail: NTIS HC A04/MF A01 Atmospheric and marine issues of immediate and long-term consequence are reported. Remote sensing equipment, instrumented airplanes, and computers were examined. River and flood forecasting research is discussed. Funding for civil weather services is also discussed. Marine fisheries, minerals, and transportation are considered. Scientific diving standards and regulations, the Clean Water Act, ocean waste disposal, outer continental shelf revenue sharing, coastal barrier legislation, the Coast Guard, global oceanic processes, acid rain, and radioactive waste disposal are considered. Author

APPENDIX C: LANDSAT: A WORLDWIDE PERSPECTIVE In its The LANDSAT Tutorial Workbook p 455-475 1982 refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198. ERTS Avail: NTIS MF A01; SOD HC $55.00 CSCL 05B

- Computer processing facilitates extraction of information from every pixel by executing a variety of functional operations, called processed algorithms, in general or specialized routines. The best results are obtained when data from more than one multispectral band are used together. Multivariate statistical analysis, computer tape characteristics, processing modes, and a choice of systems (batch or interactive) are discussed. The major operations in computer processing elaborated include: preprocessing, enhancement, effects of rationing, and classification. Techniques for multisource data correlation are considered with emphasis on geobased systems. A.R.H.

APPENDIX B: PRINCIPLES OF COMPUTER PROCESSING OF LANDSAT DATA

- Images characteristics of geographic regions other than the northeastern part of the United States are presented for interpretation. Pre- and post-eruption imagery of Mt. St. Helens volcano serves to demonstrate the advantages of thermal infrared sensing, and the potential for developing a timely, decision oriented thematic map to be used in solving drought-related problems in Upper Volta is examined to show the applicability of satellite remote sensing in all geographic areas. A.R.H.

APPENDIX A: THE LANDSAT SYSTEM

- Applications of remote sensing, and the role of ESA others cooperation programs recognize the importance of improving the capabilities of the developing nations. In agriculture, the Community is studying the benefits of land use mapping for rice production in the Sahel. Mineral exploration and meteorological projects are also underway. Author

APPENDIX C: LANDSAT: A WORLDWIDE PERSPECTIVE

- Remote sensing technology transfer to developing nations was discussed. Data processing, particularly of LANDSAT data, was considered. Applications of remote sensing, and the role of ESA in meeting the remote sensing requirements of the Third World were examined. For individual titles, see NOO-00001 through N00-00029.

APPENDIX A: THE LANDSAT SYSTEM

- European Community scientific and technical cooperation with developing nations, particularly in remote sensing technology, is discussed. Cooperation programs recognize the importance of improving the capabilities of the developing nations. In agriculture, the Community is studying the benefits of land use mapping for rice production in the Sahel. Mineral exploration and meteorological projects are also underway. Author (ESA)

APPENDIX B: PRINCIPLES OF COMPUTER PROCESSING OF LANDSAT DATA

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- Remote sensing technology transfer to developing nations was discussed. Data processing, particularly of LANDSAT data, was considered. Applications of remote sensing, and the role of ESA in meeting the remote sensing requirements of the Third World were examined. For individual titles, see NOO-00001 through N00-00029.

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- Remote sensing technology transfer to developing nations was discussed. Data processing, particularly of LANDSAT data, was considered. Applications of remote sensing, and the role of ESA in meeting the remote sensing requirements of the Third World were examined. For individual titles, see NOO-00001 through N00-00029.
monitor water vapor absorption. Sirio 2 should have disseminated meteorological information to Africa and synchronized atomic clocks. Earthnet will disseminate LANDSAT, heat capacity mapping mission, Nimbus 7 and Seasat data. Spacelab experiments include photographic mapping and microwave remote sensing. The first ERS-1 mission is oriented towards ice and ocean monitoring.

Author (ESA)

N83-14611# Centre National de la Recherche Scientifique, Paris (France).

SPOT IN THE 1980'S


Avail: NTIS HC A11/MF A01

The SPOT development program is outlined, and information transfer, storage, and management are discussed. The SPOT satellite is programmable and is designed for continuous remote sensing activities. The first satellite should operate from 1984 until 1986, when the launching of SPOT-2 is planned. Author (ESA)

N83-14614# Food and Agriculture Organization of the United Nations, Rome (Italy).

REMOTE SENSING IN DEVELOPING COUNTRIES. FAO'S INTERNATIONAL EXPERIENCE


Avail: NTIS HC A11/MF A01

The FAO remote sensing training scheme, assistance in establishing national remote sensing centers, experience of transfer of remote sensing technology to developing countries, and remote sensing of renewable resources are described. The FAO uses satellite imagery for land resources, water resources and soil surveys, forestry and wildlife monitoring, and fish location. Other projects include disaster forecasting, thematic mapping, agricultural statistics, and pasture and rangeland development. Author (ESA)

N83-14616# Eidgenoessische Technische Hochschule, Zurich (Switzerland). Dept. of Geography.

REMOTE SENSING OF RENEWABLE NATURAL RESOURCES IN DEVELOPING COUNTRIES FOR NATIONAL PLANNING PURPOSES


Avail: NTIS HC A11/MF A01

The basic needs of a developing country regarding its renewable natural resources, exploitation of remote sensing technology as an aid to resource evaluation, planning and development, applications for which remote sensing techniques are of particular use, and the most appropriate approach to solving a defined application are considered. Case studies in the Yemen Arab Republic (inventory of land use acreage, monitoring seasonal and annual changes in renewable resources, forecasting agricultural yield) are reviewed. Experience suggests that systematic, accurate, synoptic, up to date information on renewable natural resources is indispensable for development planning. Only Earth resource satellites in combination with collateral data can provide this information. Low to intermediate level technology is recommended. Author (ESA)

N83-14631# International Inst. for Aerial Survey and Earth Sciences, Delft (Netherlands).

SATELLITE REMOTE SENSING FOR DEVELOPING COUNTRIES: PROSPECTS AND CONSTRAINTS


Avail: NTIS HC A11/MF A01

Prospects and constraints of satellite remote sensing are discussed, focusing on the socioeconomic conditions and development objectives of the Third World and the necessity of preserving a sociocultural identity and pluralism. It is concluded that endogenous adaptation of remote sensing techniques and methodologies should be promoted rather than a transfer of technology. This requires normative research in addition to application and technology oriented research. Author (ESA)

N83-14632# European Space Agency, Paris (France).

SATELLITE REMOTE SENSING: ESA'S EXPERIENCE WITH DEVELOPING COUNTRIES

V. A. HOOD In its Satellite Remote Sensing for Developing Countries p 201-204 Jun. 1982 refs

Avail: NTIS HC A11/MF A01

The data needs of developing nations, problems associated with remote sensing in Africa, Southeast Asia, and Latin America, and ESA satellite missions are discussed. METEOSAT, SPOT, the Spacelab metric camera, and ERS-1 all disseminate, or will disseminate, information to developing nations. Training programs are offered by ESA to these nations. A major criticism of cooperation projects is that the developing nations do not have enough time to assimilate and fully exploit a given program before it is replaced by a technologically more advanced one. Author (ESA)

N83-14633# Bristol Univ. (England).

THE ROLE OF EARSEL AND EARSEL MEMBER LABORATORIES


Avail: NTIS HC A11/MF A01

The role of EARSeL in method directory publication, data pooling, task force projects (especially in model testing and development), technical advice, education and training, and definition studies for future satellite products, sensors and systems is discussed. The establishment of an EARSeL Action Group to pursue such possibilities is urged. The advantages to the European Remote Sensing Community through greater exposure to and involvement in the pragmatic problem solving which situations in developing countries particularly demand are pointed out. Author (ESA)

N83-15349# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

TERRESTRIAL APPLICATIONS: AN INTELLIGENT EARTH-SENSING INFORMATION SYSTEM

In its Advan. Automation for Space Missions p 11-38 Nov. 1982 refs Document previously announced as A82-22149

Avail: NTIS HC A17/MF A01 CSCL 22B

For Abstract see A82-22149

N83-15739# General Electric Co., Fairfield, Conn.

LANDSAT-D: THE NEW ERA OF EARTH RESOURCES SURVEY

1982 12 p Sponsored by NASA Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S.D. 57198 ERTS

(E83-10125; NASA-CR-169727; NAS 1.26:169727) Avail: NTIS HC A02 CSCL 22B

The history of the development and utilization of LANDSAT satellites is summarized. Objectives of the LANDSAT D mission are listed and the capabilities of the 4-channel multispectral band scanner and the 7-channel radiometer (thematic mapper) to be carried on the satellite are described. Satellite components are illustrated and diagrams show the ground segment data management system, the data assessment system, and the operations control center. The flight segment of the mission and flight segment specifications are also described. Examples of digitally analyzed and enhanced imagery are included. A.R.H.
**EARTH RESOURCES / A Continuing Bibliography (Issue 37)**

**APRIL 1983**

### Typical Subject Index Listing

<table>
<thead>
<tr>
<th>SUBJECT HEADING</th>
<th>TITLE EXTENSION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGRISTARS PROJECT</td>
<td>Winter wheat stand density determination and yield estimates from handheld and airborne scanners — Montana</td>
</tr>
</tbody>
</table>

The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section (of this supplement). If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

### A

**ASSORTIVITY**
Optical parameters of leaves of seven weed species [E83-10010] p 9 N83-12489

**ACCURACY**
Theoretical and experimental investigations on the accuracy of close-range photogrammetry [SER-C-266] p 25 N83-11564

The applicability of satellite remote sensing to small and medium-scale mapping p 64 N83-14618

**ACID RAIN**
A report to the President and the Congress [AR-11] p 75 N83-11532

**ADAPTIVE CONTROL**
Scene classification of Landsat multispectral scanner data by means of the Adaptive Learning Network methodology p 55 A83-11458

**AERIAL PHOTOGRAPHY**
Analyzing and mapping regional land use trends by combining Landsat and topographic data p 2 A83-10119

The utilization of infrared /IR/ aerial and space observations of Arctic seas in navigation and during the solution of other national-economic problems p 40 A83-10836

A relational image data base system for remote sensing /LAND DBMS/ p 55 A83-11462

Mount St. Helens quick response damage assessment using high-altitude infrared photographs p 19 A83-12682

Relaxation matching applied to aerial images p 58 A83-12689

Use of aerial photography with Loran C positioning to map offshore surface currents p 41 A83-14093

Monitoring revision requirements for Canadian maps p 24 A83-14237

Environmental monitoring of the Athabasca Oil Sands Region p 19 A83-14238

### AEROSPACE SCIENCES

**Global implications of space activities; Proceedings of the Conference, Aspen, CO, August 30-September 4, 1981** p 74 A83-17349

**AEROSPACE TECHNOLOGY TRANSFER**
**Global implications of space activities; Proceedings of the Conference, Aspen, CO, August 30-September 4, 1981** p 74 A83-17349

**AFRICA**
An investigation of MAGSAT and complementary data emphasizing Precambrian shields and adjacent areas of West Africa and South America [E83-10085] p 36 N83-14593

Multitemporal soil and vegetation observations by METEOSAT over Central Africa p 15 N83-14619

The determination of soil moisture balances in tropical Africa by satellite infrared remote sensing: The atmospheric problem p 53 N83-14621

**AGRICULTURE**
Action plan for remote sensing applications forrice production — Book [IFAFOS-207] p 5 A83-14121

A procedure to overlook thematic map and domain land survey system data to geographically-corrected Landsat images and its application to agricultural land use studies in western Canada p 3 A83-14231

Potential of LANDSAT-D and SPOT-1 for crop identification in the maritime pl p 4 A83-14240

Landsat for delineation and mapping of saline soils in dryland areas in southern Alberta p 5 A83-14251

Office automation in resource-management - The future is now — agricultural land use map dissemination. p 6 A83-14269

A system for the complex processing of aerial and space data for agriculture p 6 A83-14301

The possible modifications of the HISSE model for pure LANDSAT agricultural data p 10 N83-12497

Development, implementation and evaluation of satellite-aided agricultural monitoring systems [E83-10017] p 10 N83-12500

Multitemporal analysis of Landsat data for investigations of agricultural land use: Problems and potentials p 15 N83-14624

**AGRISTARS PROJECT**
AGRI-PEX - Plans and first-year achievements — Agriculture and Resources Inventory Surveys Through Aeroplane Remote Sensing p 1 A83-10095

Influence of environmental factors during seed development and after full-ripeness on pre-harvest sprouting in wheat [E83-10002] p 7 A83-14292

Second generation crop yield models review [E83-10003] p 7 A83-14283

Performance comparison for Barnes model 12-1000, Excelco model 100, and ideas Inc. Biometric Mark 2 [E83-10004] p 8 A83-14284

A three-part geometrical model to predict the radar backscatter from wheat, corn, and sorghum [E83-10005] p 8 A83-14285

Agristars. Seminar program review presentation to level 1, interagency Coordination Committee [E83-10006] p 8 A83-14286

Evaluation of small area crop estimation techniques using LANDSAT- and ground-derived data — South Dakota [E83-10008] p 8 A83-14287

Disagreement of growth and water stress in wheat by various vegetation indices through a clear turbulent atmosphere [E83-10009] p 8 A83-14288

Optical parameters of leaves of seven weed species [E83-10010] p 8 A83-14289

Measurement of soil moisture using remote sensing multitemporal vegetation techniques [E83-10012] p 8 A83-12941

Winter wheat stand density determination and yield estimates from handheld and airborne scanners — Montana [E83-10013] p 8 A83-12942

Development of a corn and soybean sensing procedure for use with profile parameter classification [E83-10014] p 8 A83-12943

**SUBJECT INDEX**
AGROCLIMATOLOGY

homogeneous subregions: The agroclimatological point

meteorological predictors

factors for atmospheric path radiance and absorption on

and four-dimensional vegetation indices

reflectance signatures of south Texas rangeland plant

importance in the assessment of canopy parameters from

conditions

North Dakota and Minnesota

methods

The Group Agromet Monitoring Project (GAMP) — using

An application of cluster analysis for determining

Automated segment matching algorithm-theory, test,

Adjusting the tasseled cap brightness and greenness

diurnal patterns of wheat spectral reflectances and their

Investigation of remote sensing techniques of measuring

Estimating total standing herbaceous biomass

models for North Dakota and Minnesota

Remote sensing/ of agricultural crops and soils

Development of thematic mapper vegetation indices for

assessment of biomass in corn, soybeans and wheat

Evaluation of the Williams-type spring wheat model in North Dakota and Minnesota

Estimating total standing herbaceous biomass production using LANDSAT MSS digital data

Monitoring global vegetation

Investigation of remote sensing techniques of measuring soil moisture

Diurnal patterns of wheat spectral reflectances and their importance in the assessment of canopy parameters from remotely sensed observations — Phoenix, Arizona

Construction of a remotely sensed area sampling frame for Southern Brazil

Adjusting the tasseled cap brightness and greenness factors for atmospheric path radiance and absorption on a pixel by pixel basis

Crop weather models of corn and soybeans for Agrophysical Units (APUs) in Iowa using monthly meteorological predictors

Comparison of LANDSAT-2 and field spectrometer reflectance signatures of south Texas rangeland plant communities

Comparison of the CES and Williams-type barley yield models for North Dakota and Minnesota

Comparisons among a new soil index and other two- and four-dimensional vegetation indices

Crop weather models of barley and spring wheat yield for agrophysical units in North Dakota

Evaluation of the Williams-type model for barley yields in North Dakota and Minnesota

Annual segment matching algorithm-theory, test, and evaluation

Continuous program documentation for the pasture/range condition assessment program

For the implementation of Friedman's test for several related samples

AGROMETEOROLOGY

An application of cluster analysis for determining homogeneous subregions: The agrometeorological point of view — Giraud Grande do Sul, Brazil

Crop weather models of corn and soybeans for Agrophysical Units (APUs) in Iowa using monthly meteorological predictors

The Group Agromet Monitoring Project (GAMP) — using METEOSAT for rangeland management in Mali
Tectonics of west central Mexico and adjacent Arizona: A remote sensing and field study in arid and semi-arid areas [DE82-002939] p. 37 N83-14767

ARIZONA


Tectonics of west central Mexico and adjacent Arizona: A remote sensing and field study in arid and semi-arid areas [DE82-002939] p. 37 N83-14767

ARTIFICIAL INTELLIGENCE

Terrestrial applications: An intelligent Earth-sensing automated system [AD-A118736] p. 45 N83-12511

ASTRONOMICAL COORDINATES

Concerning a method for the determination of initial geodetic data [E83-10050] p. 42 A83-17679

ATLANTIC OCEAN


ATMOSPHERIC RADIATION

Methods of estimating airmass and atmospheric radiation affecting pixels from satellite data [E83-10103] p. 64 N83-15746

ATMOSPHERIC SCATTERING

Application of the airborne microwave rain-scattered/radiometer system to the remote sensing of rains and wind vectors over measurement areas [E83-10628] p. 70 A83-14290

ATMOSPHERIC TEMPERATURE


ATMOSPHERIC TIDES

The role of cross-equatorial tropical cyclones in the southern oscillation [E83-10059] p. 21 A83-13057

ATMOSPHERIC WORLD WINDS

Concerning the determination of the temperature of the ocean surface from multispectral satellite measurements of radiation in infrared atmospheric windows [Australasia] [E83-10109] p. 42 A83-14316

AUTOMATION


AUTOMATION

Office automation in resource-management: The future — agricultural land use map dissemination [E83-10089] p. 28 N83-14597

BANDWIDTH


BARLEY

Comparison of the CEAS and Williams-type barley yield models for North Dakota and Minnesota [E83-10056] p. 13 N83-15465

Crop weather models of barley and spring wheat yield for agrophysical units in North Dakota [E83-10059] p. 14 N83-15468


BAROCLINIC INSTABILITY

Drift buoy component, NORPAX anomaly dynamics study [INPE-2435-NTE/186] p. 22 N83-10346

BASALT

Extension of laboratory-measured soil spectra to field conditions [E83-10025] p. 13 N83-14603

Crop weather models of barley and spring wheat yield for agrophysical units in North Dakota [E83-10059] p. 14 N83-15468


BAY

Drift buoy component, NORPAX anomaly dynamics study [INPE-2435-NTE/186] p. 22 N83-10346

BAY ISLANDS

Extension of laboratory-measured soil spectra to field conditions [E83-10021] p. 11 N83-12504

BAY RAYS

Drift buoy component, NORPAX anomaly dynamics study [INPE-2435-NTE/186] p. 22 N83-10346

BAY OCEANS

Evaluation of the Williams-type model for barley yields for Southern Brazil [E83-10029] p. 34 N83-15325

Belgium

An introduction to project Freeze — the location and intensity of freezing temperatures using infrared satellite imagery [INPE-2435-NTE/186] p. 22 N83-17303

Use of LANDSAT images to study cerrado vegetation — Mato Grosso Sul, Brazil [E83-10052] p. 15 N83-14651

BIOGRAPHIES

Automatic interpretation of MSS-LANDSAT data applied to coal refuse site studies in southern South Carolina, State, Brazil [E83-10066] p. 25 N83-14575


Spectral discrimination of lithologic facies in the granite of the Pedra Branca Gola using LANDSAT 1 digital imagery [E83-10069] p. 36 N83-14397

ANIDADES

Multitemporal and geobotanical approach in the remote detection of Georestation areas in the Serra da Pedra Branca Granite, Goias State, Brazil [E83-10071] p. 25 N83-14580

LANDSAT and radar mapping of intrusive rocks in SE-Brazil [E83-10073] p. 36 N83-14582
CROP INVENTORIES

An automatic agricultural zone classification procedure for crop inventory satellite images

Computer program documentation for the pasture/range condition assessment processor

CROP VIGOR

CROP INVENTORIES

A review of crop canopy reflectance models

How to... a review of crop canopy characteristics

Cooperative processes in image segmentation

Aerial survey of crop losses due to grasshoppers

CROP INVENTORIES

Agricultural - Plans and first-year achievements

Agricultural and Resources Inventory Surveys Through Airborne Remote Sensing

Development of advanced acreage estimation methods

Development, implementation and evaluation of satellite-based agricultural monitoring systems

Missing observations in multivariation rotation sampling designs

Evaluation of the Williams-type spring wheat model in North Dakota and Minnesota

Evaluation of the Williams-type barley model for fields in North Dakota and Minnesota

Development of mathematical techniques for the evaluation of geophysical satellite products

Remote sensing, a tool for managing the marine environment. Eight case studies

Operation plan for the data 100/LARS terminal

CROP PROCESSING

Use of reflectance spectra of native plant species for interpreting airborne multispectral scanner data in the East Tintic Mountains, Utah

Evaluation of geographic information systems for remote sensing data

Use of thermal inertia determined by HCMM to predict nocturnal cold prone areas in Florida

Development of multiparameter models for investigations of agricultural land use. Problems and potentials

Evaluation of the nocturnal cold region

CROP INVENTORIES

CROP INVENTORIES

Agricultural Remote Sensing

Agricultural Remote Sensing

CROP VIGOR

CROP INVENTORIES

Agricultural - Plans and first-year achievements

Agricultural and Resources Inventory Surveys Through Airborne Remote Sensing

Development of advanced acreage estimation methods

Development, implementation and evaluation of satellite-based agricultural monitoring systems

Missing observations in multivariation rotation sampling designs

Evaluation of the Williams-type spring wheat model in North Dakota and Minnesota

Evaluation of the Williams-type barley model for fields in North Dakota and Minnesota

Development of mathematical techniques for the evaluation of geophysical satellite products

Remote sensing, a tool for managing the marine environment. Eight case studies

Operation plan for the data 100/LARS terminal

CROP PROCESSING

Use of reflectance spectra of native plant species for interpreting airborne multispectral scanner data in the East Tintic Mountains, Utah

Evaluation of geographic information systems for remote sensing data

Use of thermal inertia determined by HCMM to predict nocturnal cold prone areas in Florida

Development of multiparameter models for investigations of agricultural land use. Problems and potentials

Evaluation of the nocturnal cold region

CROP INVENTORIES

Agricultural - Plans and first-year achievements

Agricultural and Resources Inventory Surveys Through Airborne Remote Sensing

Development of advanced acreage estimation methods

Development, implementation and evaluation of satellite-based agricultural monitoring systems

Missing observations in multivariation rotation sampling designs

Evaluation of the Williams-type spring wheat model in North Dakota and Minnesota

Evaluation of the Williams-type barley model for fields in North Dakota and Minnesota

Development of mathematical techniques for the evaluation of geophysical satellite products

Remote sensing, a tool for managing the marine environment. Eight case studies

Operation plan for the data 100/LARS terminal

CROP PROCESSING

Use of reflectance spectra of native plant species for interpreting airborne multispectral scanner data in the East Tintic Mountains, Utah

Evaluation of geographic information systems for remote sensing data

Use of thermal inertia determined by HCMM to predict nocturnal cold prone areas in Florida

Development of multiparameter models for investigations of agricultural land use. Problems and potentials

Evaluation of the nocturnal cold region
EARTH ORBITS

Preliminary study of GPS orbit determination accuracy achievable from worldwide tracking networks
[NASA-NSRER-76-200] (1612-1346)

EARTH ORBIT TRACKING Systems

Global implications of precise space-vehicle tracking of the Conference, Aspen, CO, August 30-September 4, 1981
[1981-8089-5] (1612-1346)

Appendix C. LANDSAT: A worldwide perspective on
[1981-8089-5] (1612-1346)

Appendix D. LANDSAT: A worldwide perspective on
[1981-8089-5] (1612-1346)

CONTINENTAL-SCALE Remote sensing data and services: A commercial perspective
[AAS 82-129] (1612-1346)

ECOSYSTEMS

Remote sensing techniques for conservation and monitoring of natural vegetation ecosystems
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

EDITING

Methods of editing cloud and atmospheric layer affected pixels from satellite data
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

ELEVATION

An analysis of a relaxation scheme to improve terrain elevation data
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

ELLIPTOIDS

Mean Earth ellipsoid determined from SEASAT altimeter observations
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

EMISSIONS

Microwave radiance of early fall sea ice at 1.55 cm wavelength
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

Remote sensing measurements of earth terrain
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

ENERGY BUDGETS

An evaluation of four thermal models used in thermal inertia analysis — for thermal mapping from remotely sensed data
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

ENERGY CONVERSION EFFICIENCY

Spectroradiometer measurements in support of photovoltaic device testing
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

ENERGY POLICY

Determination of the radiation budget at the Earth's surface from satellite data
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

ENVIRONMENT EFFECTS

Ice distribution and winter surface circulation patterns, Kachemak Bay, Alaska
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

ENVIRONMENTAL POLLUTION

On the Development of Multimedia Monitoring of Environmental Pollution — conferences
[1983-10305] (1612-1346)

Monitoring of meteorological elements in a composite program for environmental pollution studies
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

Environmental monitoring of the Athabasca Oil Sands region
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

Remote sensing and waste management
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

Remote and passive microwave monitoring of coal refuse site studies in southern Santa Catarina State, Brazil
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

Microwave remote sensing measurements of oil pollution on the ocean
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

An experimental Landsat Quicklook System for remote sensing and management of environmental quality programs in Kansas
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

The application of remote sensing technology to resource management and environmental quality programs in Kansas
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

EQUATORIAL ATMOSPHERE

The role of equatorial and tropical cyclogenesis in the Southern Hemisphere
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

EQUATORIAL ELECTROJET

LIDAG for geophysical studies over Indian region
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

EQUINOXES

Basic research for the geodynamics program
[NASA-NSRER-76-200] (1612-1346)

EQUIPMENT SPECIFICATIONS

MSS D Multispectral Scanner System
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)

ERS-1 (ESA SATELLITE)

The microwave payload for the ESA Remote Sensing Satellite
[Earth Resources Observation and Science Act: 1986-20107] (1612-1346)
Investigation of MAGSAT and TRIAD magnetometer data to provide corrective information on high-latitude external fields
[MAGSAT-1003] p 28 N83-14600
Equivalent source modeling of the main field using
[MAGSAT-1005] p 28 N83-14601
Data use investigation for the magnetic field satellite (MAGSAT) mission: Geomagnetic field forecasting and fluid dynamics of the core
[MAGSAT-1009] p 29 N83-15742
The reduction, verification and interpretation of MAGSAT magnetic data over Canada
[MAGSAT-1011] p 29 N83-15744
Geomorphic perception from Seasat radar images
[MAGSAT-1022] p 29 N83-15748
GEOMETRIC ACCURACY
LANDSAT-4 image data quality analysis
[EBR-10039] p 63 N83-13533
GEOMETRIC RECTIFICATION (IMAGERY)
Some effects on the GCP success rate — Ground Control Points for satellite image rectification
[MAGSAT-1026] p 56 N83-14285
Coordinate transformation during the geomagnetic connection of the space scanner imagery of the earth
[MAGSAT-1027] p 70 N83-14313
The digital image processing system MFLOAH
[MAGSAT-1031] p 59 N83-14944
Rectification of Seasat radar on Landsat MSS with the aid of digital images from remote sensing satellite MSS
[MAGSAT-1032] p 59 N83-14945
Familiarization with LANDSAT imagery
[MAGSAT-1034] p 60 N83-10460
GEOMICROPHYSICS
Drumlin fields and glaciated mountains - A contrast in geomorphic perception from Seasat radar images
[MAGSAT-1038] p 23 N83-10078
Imaging radar observations of volcanic features in Medicine Lake, California, USA
[MAGSAT-1041] p 23 N83-10079
Application of Landsat imagery to flood control and management of agricultural land - A case study of northern India
[MAGSAT-1042] p 23 N83-12423
The geology of Europe
[MAGSAT-1043] p 24 N83-16239
Super high altitude photography for coastal geomorphology from approximately 20 km altitude
[MAGSAT-1044] p 43 N83-17840
Geomorphological mapping using LANDSAT imagery - A case study in Argentina
[MAGSAT-1046] p 33 N83-17841
Some comparative aspects of SLAR and airphoto images for geomorphologic and geographic study
[MAGSAT-1047] p 33 N83-17842
Verification of LANDSAT imagery for morphometric and topological studies of drainage basins in a section of the western plateau of Sao Paulo State: Tiete-Aguapei watershed, Brazil
[MAGSAT-1048] p 54 N83-15754
GEOPHYSICAL FLUIDS
Data use investigation for the magnetic field satellite (MAGSAT) mission: Geomagnetic field forecasting and fluid dynamics of the core
[MAGSAT-1050] p 29 N83-15742
GEOPHYSICAL SATELLITES
Preliminary study of GPS orbit determination achievable from worldwide tracking data
[MAGSAT-1052] p 20 N83-14227
TOPEX orbital determination using GPS signals plus a sidetone ranging system
[MAGSAT-1053] p 29 N83-14606
GEOS SATELLITES (ESA)
The use of satellite information in weather forecasting at the Pacific Weather Centre
[MAGSAT-1057] p 20 N83-14277
GEOSTROPHIC WIND
Some features of the spatial structure of the Arctic Ocean ice cover in connection with turbulent friction and geostrophic capture of tide waves
[MAGSAT-1058] p 40 N83-10833
GEOTHERMAL RESOURCES
Radar and infrared remote sensing of geothermal features at Pilgrim Springs, Alaska
[MAGSAT-1059] p 23 N83-12036
Low- to moderate-temperature thermal resource assessment for Nevada: Area specific studies, Pumpernickel Valley, Carlin and Moana
[MAGSAT-1060] p 23 N83-12037
Remote sensing of the granites of Southeast Asia
[MAGSAT-1061] p 23 N83-12038
Detecting and mapping of saline soils in dryland areas in southern Alberta
[MAGSAT-1062] p 23 N83-12039
Application of Landsat imagery to flood control and management of agricultural land - A case study of northern India
[MAGSAT-1063] p 23 N83-12040
Rangeland biomass estimation demonstration — Texas Medicine Lake Highland, California
[MAGSAT-1064] p 23 N83-12041
Application of LANDSAT imagery to flood control and management of agricultural land - A case study of northern India
[MAGSAT-1065] p 23 N83-12042
Aerial survey of crop losses due to grasshoppers
[MAGSAT-1066] p 23 N83-12043
Low- to moderate-temperature geothermal resource assessment for Nevada: Area specific studies, Pumpernickel Valley, Carlin and Moana
[MAGSAT-1067] p 23 N83-12044
Aerial geologic log from Livermore, California to the Nevada Test Site, Nye County, Nevada
[MAGSAT-1068] p 23 N83-12045
Low- to moderate-temperature geothermal resource assessment for Nevada: Area specific studies, Pumpernickel Valley, Carlin and Moana
[MAGSAT-1069] p 23 N83-12046
Low- to moderate-temperature geothermal resource assessment for Nevada: Area specific studies, Pumpernickel Valley, Carlin and Moana
[MAGSAT-1070] p 23 N83-12047
Low- to moderate-temperature geothermal resource assessment for Nevada: Area specific studies, Pumpernickel Valley, Carlin and Moana
[MAGSAT-1071] p 23 N83-12048
MULTISPECTRAL PHOTOGRAPHY

Assessment of spouce budworm defoliation using digital airborne MSS data p 5 A83-14248

Definition and potential of geoded satellite sensors to detect forest products p 58 A83-14272

A refined destriping procedure for Landsat MSS data products p 58 A83-14281

Some effects on the GCP success rate — Ground Control Points for satellite image rectification p 58 A83-14285

Spectral characterization of the LANDSAT-D multispectral scanner subsystems [E83-10128] p 17 N83-15750

MSS D Multispectral Scanner System [E83-10128] p 72 N83-15797

MULTISPECTRAL PHOTOGRAPHY

Derivation of compositional information from multispectral images — for use in remote and aerial sensing p 30 A83-10059

Automatic multitemporal segmentation for diachronic analysis of remotely sensed images p 55 A83-11461

The accuracy of a component analysis in space studies of natural environments — for thematic mapping of earth resources and photointerpretation p 59 A83-14304

A multispectral approach to remote detection of deer p 6 A83-14666

Estimation of context for statistical classification of multispectral image data p 59 A83-14853

Some spectral and spatial characteristics of LANDSAT data p 61 N83-10461

Contextual classification of multispectral image data: An unbiased estimator for the context distribution p 63 N83-14595

MULTISPECTRAL RESOURCE SAMPLER

A means for utilizing ancillary information in multispectral classification — of remotely sensed data p 60 A83-16905

Polarized visible light as an aid to vegetation classification p 7 A83-16908

MULTIVARIATE STATISTICAL ANALYSIS

The Askale information criterion and its application to mixture proportion estimation p 62 N83-12498

NASA PROGRAMS

Land remote sensing activities in the US p 72 N83-14612

NATURAL GAS EXPLORATION

Landsat for resource evaluation and management in the Alberta foothills p 32 A83-14256

Remote sensing applications to the development of an integrated data base for oil and gas exploration p 37 N83-14628


NAVIGATION SATELLITES

Operation and maintenance of geoslelatic satellite observatory, McMurdo, Antarctica [FS92-17692] p 25 N83-12107

NEAR EARTH WATER

Use of aerial photography with Loran C positioning to map offshore surface currents p 41 A83-14093

NEW MEXICO

A case study in the practical use of LANDSAT data p 52 N83-10466

NEW MEXICO

Tectonics of west central Mexico and adjacent Arizona: A remote sensing and field study in and near and-areas [DE82-00239] p 37 N83-14797

NEW YORK


NIGER

Application of satellite data to hydrogeological investigation in Damagaram-Mounio, Niger p 53 N83-14630

NIMBUS 6 SATELLITE


NIMBUS 7 SATELLITE

An algorithm to interface Nimbus-7 SMMR data with the AES ice modelling grid for the Beaufort Sea p 58 A83-14854

Snow-cover parameters retrieved from Nimbus-7 scanning multichannel microwave radiometer /SMMR/ data p 51 A83-14854

Observations of oceanic surface-wind fields from the Nimbus-7 microwave radiometer p 42 A83-14861

The Boreal Sea ice cover during March 1979: Comparison of surface and satellite data with the Nimbus-7 SMMR [NASA-CR-169923] p 47 N83-13572

OCEAN BOTTOM

Analyses of oceanic subsurface features using space based radar imagery [AD-118411] p 45 N83-11692

OCEAN COLOR SCANNER

OSTA-1/Ocean Color Experiment [AIAA PAPER 83-0415] p 42 A83-16701


OCEAN CURRENTS

Use of aerial photography with Loran C positioning to map offshore surface currents p 41 A83-14093

A comparison data set for the evaluation of remote sensing systems ability for ocean wave data collection p 48 N83-14503

The RAMS collection of meteorological and position data in the Norwegian Sea p 49 N83-14845

Drift buoy component, NORPAX anomaly dynamics study p 49 N83-14846

OCEAN DATA ACQUISITION SYSTEMS

A comparison data set for the evaluation of remote sensing systems ability for ocean wave data collection p 48 N83-14503

Feasibility of mapping ocean surface currents using delta k-microwave radars mounted on geostationary satellite platforms p 49 N83-14845

OSTA-1/Ocean Color Experiment [AIAA PAPER 83-0415] p 42 A83-16701

Spectral signal to clutter and thermal noise properties of ocean wave imaging synthetic aperture radars p 43 A83-17112


Main achievements of GARP Atlantic Tropical Experiment (GATE) and its impact on FGGE — first GARP Global Experiment (FGGE) p 45 N83-12705

OCEAN DYNAMICS

On the use of laser profilometry for ocean wave studies p 40 A83-14502

Flight path design issues for the TOPEX mission — Ocean Topography Experiment [NASA PAPER 83-1917] p 42 A83-16581

OCEAN SURFACE

A comparison data set for the evaluation of remote sensing systems ability for ocean wave data collection p 38 A83-10071

Feasibility of mapping ocean surface currents using delta k-microwave radars mounted on geostationary satellite platforms p 39 A83-10094

Microwave remote sensing measurements of oil pollution on the ocean p 39 A83-10104

Estimating wind speed from HF skywave radar sea backscatter p 40 A83-11322

Remote sensing of sea state using Landsat data p 40 A83-11322

The role of cross-equatorial tropical cyclone pairs in the southern oscillation p 41 A83-13270

Effects of mesoscale atmospheric convection cells on the waters of the East China Sea p 41 A83-13270

Concerning the determination of the temperature of the ocean surface from multichannel satellite measurements of radiation in infrared atmospheric windows p 42 A83-14316

Observations of oceanic surface-wind fields from the Nimbus-7 microwave radiometer p 42 A83-14861

Measurements of ocean surface spectrum from an aircraft using the two-frequency microwave resonance technique p 43 A83-17710

The effect of monomolecular surface films on the microwave brightness temperature of the sea surface p 43 A83-17714

Experimental feasibility of the airborne measurement of absolute oil fluorescence spectral conversion efficiency p 44 A83-18561

Collinear-track altimetry in the Gulf of Mexico from SEASAT: Measurements, models and surface truth [AD-A118160] p 45 N83-11568

Mean Earth ellipsoid determined from SEASAT altimeter observations [AD-A117910] p 45 N83-11570

Analyses of oceanic subsurface features using space based radar imagery [AD-A118411] p 45 N83-11692

Comparison of multichannel and two-satellite methods for remote measurement of sea surface temperature [AD-A118736] p 45 N83-12511


Aircraft and satellite measurement of ocean wave directional spectra using scanning-beam microwave radars [NASA-TM-84008] p 47 N83-13544

The intermediate wavelength magnetic anomaly field of the north Pacific and possible source distributions [E83-10088] p 27 N83-14596


Evaluation of the potential of one to three SEASAT-SMMR channels in retrieving sea surface temperature [NASA-CR-169660] p 48 N83-14604

GRAVSAT error analysis by means of global spectral analyses of the marine geoid from SEASAT altimeter data [E83-10072] p 29 N83-15748

OCEAN TEMPERATURE


Satellite estimates of ocean-air heat fluxes during cold air outbreaks p 41 A83-13059
SUBJECT INDEX

ORGANIC MATERIALS

- Determination of humus in soil on the basis of spectral measurements
  p 6 A93-14310

PHOTOGEOLOGY

- Photogeology of the Himalaya and their role in the distribution of endogenous mineralization
  p 31 A93-11950

OTHER

- The Global Weather Experiment. First GARP Global Oceans (FGGE) operations report: Volume 5, summer
  data collected 5 July - December 1979
  [GARP-FOR-5] p 45 N83-12808
- Space truth in oceanography
  p 48 N83-14583
- Airborne drifting buoy
  p 64 N83-13251
- Infrared satellite data from the first coastal ocean dynamics experiment, March - July 1981

OCEANOGRAPHIC PARAMETERS

- The 100 days of SeaSat-A
  p 39 N83-10115

OCEANOGRAPHY

- Investigations of the Arctic, the Antarctic and the world ocean; Conference-Seminar, Moscow, USSR, September 9-13, 1981, Reports
  p 39 A83-10826

OCEANS

- Monitoring for remote measurement of sea surface temperature
  p 6 A83-14306

P-3 AIRCRAFT

- Passive microwave detection of river-plume fronts in the German Bight
  p 52 A93-17713

PACIFIC OCEAN

- Applicability of satellite-derived sea-surface temperature data in the Fiji region
  p 40 A83-12002
- The role of cross-equatorial tropical cyclone pairs in the southern oscillation
  p 40 A83-13057

POLLUTION

- Remote sensing applications to the development of an integrated data base for oil and gas exploration
  p 37 N83-14628

POLLUTION 4

- Remote sensing of water quality for estuarine environments
  p 50 A83-10073
- Microcomputer remote sensing measurements of oil pollution on the ocean
  p 39 A83-10104
- On detection of oil pollution in ice environments
  p 41 N83-14239

POLLUTANTS

- The effect of monocellular surface films on the microwave brightness temperature of the sea surface
  p 43 A83-17714

POZENTURC

- Experimental feasibility of the airborne measurement of absolute oil fluorescence spectral conversion efficiency
  p 44 A83-15851

OKLAHOMA

- Microwave remote sensing of soil moisture, volume 1
  Guyon, Oklahoma and Dallhart, Texas
  [E83-10106] p 17 N83-15751

OPTICAL DENSITY

- Remote measurement of biomass
  p 6 A83-14306

OPTICAL MEASUREMENT INSTRUMENTS

  p 68 A83-12609

OPTICAL PROPERTIES

- Performance comparison for Barnes model 12-1000, Earthstar model 100, and Idex Inc. Biometer Mark 7
  [E82-10004] p 19 N83-12484

OPTICAL RADAR

- Dynamic weather correlation measurements with an airborne pulsed carbon dioxide lidar system
  p 60 A83-16831

OSCAR

- Experimental feasibility of the airborne measurement of absolute oil fluorescence spectral conversion efficiency
  p 44 A83-15851

OPTIMIZATION

- Geometric modeling by optimal recursive filtering
  [E82-10112] p 29 N83-15755

ORBITAL ROTATION

- Flight path design issues for the TOPEX mission
  [NASA-FR-90377] p 42 A83-13581

ORBITAL MECHANICS

- Preliminary study of GPS orbit determination accuracy achievable from worldwide tracking data
  [NASA-CR-169623] p 29 N83-14605
- TOPEX orbit determination using GPS signals plus a lidar ranging system

PHOTOGEOLOGY

- Near surface observations
  p 61 N83-10484

PENNSYLVANIA

- Development of a data management front end for use with a LANDSAT-D based information system for assessing gypsy moth defoliation damage in Pennsylvania
  [E83-10104] p 17 N83-15747

PERFORMANCE

- Competition study of future SPOT and LANDSAT-D satellite products from a simulation flight — for determining performance and spectral resolution
  p 57 A83-14243

PERFORMANCE PREDICTION

- Satellite remote sensing for domestic crop reporting in the United States and Canada - A look to the future
  p 3 A83-14229

PERIODIC VARIATIONS

- Vegetation change detection in an agricultural area - A simple approach for use with geo-data bases
  p 4 A83-14236

PERIODICALS

- Naval Research Reviews, volume 34, no. 1
  [AD-A117981] p 45 N83-12037

PERMAFROST

- Precipitation on permafrost conditions with infrared sensing techniques
  p 6 A83-14284

PESTICIDES

- Reflectance differences between untreated and Mecoprop-Potato-treated, field-grown potatoes during a growing season
  p 7 A83-16099

PHENOLOGY

- Analysis of the profile characteristics of corn and soybeans using field reflectance data
  [E83-10016] p 10 N83-12501
- Crop-phenology and LANDSAT-based infrared land inventory in the high plains — Texas, New Mexico, Oklahoma, Kansas, Colorado, Nebraska, Wyoming, and South Dakota
  [E83-10115] p 18 N83-15758

PHOTOGEOTECHNOLOGY

- Remote sensing techniques using Landsat and Seaimage data
  p 30 A83-10057
- Derivation of compositional information from multispectral images — for use in geologic remote sensing
  p 20 A83-10059
- Geologic terrain models
  p 31 A83-10080
- Some examples of the utility of HCM data in geologic remote sensing — Heat Capacity Mapping Missions
  p 31 A83-10999
- Cosmogeophysical studies of the Hissar Alai and their role in the distribution of endogenous mineralization
  p 31 A83-11959
- Contribution of LANDSAT imagery to the study of volcanic structure
  p 31 A83-12641
- Subsurface valleys and geochronology of the eastern Sahara revealed by Shuttle radar
  p 22 A83-13349
- Mineral identification from orbit - initial results from the Shuttle multispectral infrared radiometer
  p 23 A83-13550
- Measurements of the characteristic reflectance spectra of surficial deposits
  p 23 A83-14566
- Surficial geology mapping from LANDSAT-Kaminak Lake, N.W.T.
  p 22 A83-14268
- A method for the quantitative evaluation of the results of space imagery interpretation in prospecting applications
  p 33 A83-14302
- Lineaments and ring structures on the territory of Poland
  p 24 A83-14303
- An example of a statistical analysis of the results of space imagery interpretation for the eastern part of the Fergana Valley
  p 24 A83-14303
- Evaluating the effectiveness of LANDSAT data as a tool for locating buried pre-glacial valleys in eastern South Dakota
  p 24 A83-14867
- Some comparative aspects of SLAR and airphoto images for geomorphologic and geologic interpretation
  p 23 A83-17842
- Geological-structural interpretation using products of remote sensing in the region of Carrancas, Minas Gerais, Brazil
  [E83-10029] p 24 A83-13523
- An investigation into the utilization of HCMM thermal data for the discrimination of volcanic and Eolian geological units — Craters of the Moon volcanic field, Idaho; San Francisco volcanic field, Arizona; and Joshuatree, California; and the Cascade Range, California and Oregon
  [E83-10047] p 23 A83-14556
- Spectral discrimination of lithologic facies in the granite of the Pedra Branca Goias using LANDSAT 1 digital imagery
  [E83-10069] p 23 A83-14578

PHOTOGEOGRAPHY

- Viewpoint on permafrost conditions with infrared sensing techniques
  p 6 A83-14284
Effects of adopting new precission, nutation, and equinox corrections on the terrestrial reference frame.  

Utilization of range-difference observations in geodynamics.  

Geometric adjustment of simultaneous Doppler-derived range differences.  

RANGELANDS  

The relationships between reflectance in the Landsat wavebands and the composition of an Australian semi-arid shrub rangeland.  

Optical characteristics of Alberta rangeland as related to remote sensing.  

Use of LANDSAT images to study cattle pasture vegetation — Mato Grosso Sul, Brazil.  

Estimating total standing herbage biomass production with LANDSAT MSS digital data.  

Comparison of LANDSAT-2 and field spectrometer reflectance signatures of South Texas rangeland plant communities.  

The Group Agromet Monitoring Project (GAMP) — using METEOSAT for rangeland management in Mali.  

Computer program documentation for the pasture/range condition assessment processor.  

An evaluation of the NOAA/GSFC Barnes field spectral reflectometer model 14-758, using signal/noise as a measure of utility.  

Performance comparison for Barnes model 12-1000, Exotech model 100, and Ideas Inc. Biometer Mark 2.  

Statistical Techniques Applied to Aerial Radiometric Surveys (STARRS): Discriminant-analysis methods applied to aerial radiometric data and their application to uranium favorability in South Texas.  

Atmospheric effects on LANDSAT and SKYLAB images.  

Evaluation of reforestation using remote sensing.  

Remote determination of surface evaporation using thermal IR measurements.  

Remote measurement of surface temperatures in geothermal systems.  

Remote determination of surface evaporation using thermal IR measurements.  

Remote measurement of surface temperatures in geothermal systems.  

A comparison data set for the evaluation of remote sensing systems ability for ocean wave data collection.  

Remote sensing of water quality for estuarine environments.  

Saturation of computer compatible tape formats for remote sensing data.  

Imaging radar observations of volcanic features in Medicine Lake Highland, California.  

Geological terrain models.  

Ongoing microwave remote sensing-activities for land applications in Germany.  

The application of microwave remote sensing for snow and ice mapping.  

Ag/ISTARS — Plans and first-year results.  

Agriculture and Resources Inventory Surveys Through Aerospace Remote Sensing.  

Land monitoring of Desert Locust breeding grounds in Africa, the Near East and Southwest Asia.  

An evaluation of four thermal instruments used in thermal inertia analysis — for thermal mapping from remotely sensed data.  

Some examples of the utility of HCMM data in geologic remote sensing — Heat Capacity Mapping Mission.  

Remote determination of surface evaporation using thermal IR measurements.  

Remote sensing of dielstic media with periodic rough surfaces — microwave scattering from farmfields.  

Remote sensing of biophysical parameters from passive microwave observations of semi-arid land.  

Pattern recognition and digital image processing as a commercial perspective.  

Potential for change detection using SEASAT synthetic aperture radar data.  

Earth observation — Evolution of requirements and systems.  

An automated mapping system: /Mapsat/.  

Selection of the optimum spectral bands for the SPOT satellite.  

Pattern recognition and digital image processing as applied to remote sensing in India.  

Automatic multitemporal segmentation for diachronic analysis of remotely sensed images.  

A relational image data base system for remote sensing /LAND DBMS/.  

The GDTA - Remote sensing at the service of civil.  

Advanced operational earth resources satellite systems.  

Future land remote sensing data and services - A commercial perspective.  

Radar and infrared remote sensing of geothermal features at Palm Springs, Alaska.  

A comparison of unsupervised classification procedures on LANDSAT MSS data for an area of complex surface conditions in Basilcata, Southern Italy.  

Remote sensing of sea state using laser altimeters.  

Background reflectance effects in LANDSAT images.  

Reflectance of a vegetation canopy using the Adding method.  

A relational image data base system for remote sensing /LAND DBMS/.  

Remote sensing of sea state using laser altimeters.  

Reflectance of a vegetation canopy using the Adding method.
Development, implementation, and evaluation of satellite-derived agricultural monitoring systems

SPECTRAL SENSITIVITY

SPECTRAL RESOLUTION

SPECTRAL SIGNATURES

LANDSAT agricultural data in conditions

methods

soil moisture

visible-near infra red spectral signatures

factors for atmospheric path radiance and absorption on remote sensing for calendar year 1981

importance in the assessment of canopy parameters from various vegetation indices through a clear and turbid growing season

ultraviolet radiation stress on cotton leaves of surfitia deposits

shrub rangeland

Experimenta Ranch

Selection of the optimum spectral bands for the SPOT multispectral image data

Agricultural Research Service research highlights in the use of large-area spectral data in wheat yield estimation

Diurnal patterns of wheat spectral reflectances and their importance in the assessment of canopy parameters from remotely sensed observations — Phoenix, Arizona

Earth observation - Evolution of requirements and systems

Selection of the optimum spectral bands for the SPOT satellite

Potential of Landsat-D and SPOT-1 for crop identification in the rainfed areas

Comparison of future SPOT and Landsat-D satellite products from a simulation flight -- for determining spatial and spectral resolution

SPOT's role in analysis by means of global spectral analyses of the marine geoid from SEASAT altimeter data

SPHERICAL COORDINATES

Earth Remote sensing of agricultural crops and soils

Comparing the adjusted tapping brightness and greenness factors for atmospheric path radiance and absorption on a pixel by pixel basis

Comparison of LANDSAT-2 and field spectrometer reflectance signatures of south Texas rangeland plant communities

Comparison of LANDSAT and ground cover and leaf area on the spectral reflectance of vegetation-soil target

Landsat reflectance estimation demonstration — Texas Experimental Ranch

SPECTRAL RESOLUTION

SPECTRAL SENSITIVITY

Microwave remote sensing of soil moisture, volume 1 — Gunn, Oklahoma and Dahitur, Texas

Microwave backscatter model for a randomly perturbed periodic sphere

Development of compositional information from multispectral images — for use in geologic remote sensing

Microwave emission signatures of snow in Finland

Imaging radar observations of volcanic features in Medicina Lake, Idaho, California

Soil spectral characterization

Selection of the optimum spectral bands for the SPOT satellite

Probabilistic class labeling of imaging data

Effects of vegetation cover on the radar reflectivity to soil moisture

Some fundamental concepts in remote sensing

Some spectral and spatial characteristics of LANDSAT data

Near surface observations

Evaluation of small area crop estimation techniques using LANDSAT- and ground-derived data — South Dakota

Development of advanced aeroimage estimation methodology

Rice scene radiation research plan

The possible modifications of the Hiss model for pure LANDSAT agricultural data

Surface water

Structural properties (geology)

Cosmogeological structures of the Hissar Alai and their role in the distribution of endogenic mineralization

Contribution of Landsat imagery to the study of volcanic structures

Lineaments and ring structures on the territory of Poland

Geological-structural interpretation using products of remote sensing in the region of Cerranias, Minas Gerais, Brazil

Crustal and upper mantle structure data analysis

Use of MAGSAT anomaly data for crustal structure and mineral resources in the US midcontinent

Digital methods for line analysis

Analysis of the characteristics appearing in LANDSAT multispectral images in the geologic mapping of the midwestern portion of the Rio Grande do Sul shield — Brazil

Digital colour enhancement of Landsat data for mapping vegetation of a bare-ground caribou winter range in northern Manitoba

SUBARCTIC REGIONS

Digital colour enhancement of Landsat data for mapping vegetation of a bare-ground caribou winter range in northern Manitoba

SUBMILLIMETER WAVES

Investigations of the apparent temperature of snow cover in the submillimeter wavelength range

SUGAR CANE

Estimation of the sugar cane cultivated area from LANDSAT images using the two phase imaging method

SUNFLOWERS

Optical parameters of leaves of seven woody species

SURFACE ROUGHNESS

Measurements of soil moisture using remote sensing multisensor radiation techniques

SURFACE ROUGHNESS EFFECTS

Remote sensing of dielectric media with periodic rough surfaces — microwave scattering from farmfields

SURFACE TEMPERATURE

An evaluation of four thermal models used in thermal inertia analysis — for thermal mapping from remotely sensed data

Remote determination of surface evaporation using thermal IR measurements

Applicability of satellite-derived sea surface temperatures in the Fiji region

HCM hydrological analysis in Utah

Use of thermal inertia determined by HCM to predict nocturnal cold prone areas in Florida

A parametric study of time lag effects on radar backscatter

A backscatter model for a randomly perturbed periodic surface — radar imagery of earth soil surface roughness

Surface temperature

An evaluation of four thermal models used in thermal inertia analysis — for thermal mapping from remotely sensed data

Development of methods for detecting surface evaporation using thermal IR measurements

HCM hydrological analysis in Utah

Use of thermal inertia determined by HCM to predict nocturnal cold prone areas in Florida

A comparison of HCM surface temperatures with in situ temperature data — Nantucket shoals and the Gulf of Mexico regions

A comparison of surfaces temperatures from HCM infrared data with field measurements

Investigation of remote sensing techniques of measuring soil moisture

Use of thermal inertia determined by HCM to predict nocturnal cold prone areas in Florida

Infrared satellite data from the first coastal ocean dynamics experiment, March - July 1981

Surface water

DISTRIBUTION and winter surface circulation patterns, Kachemak Bay, Alaska
A comparison of surfaces temperatures from HCMM infrared data with field measurements [EES-10046] - p 47 N83-14555

An investigation into the utilization of HCMM thermal data for the desiccation of volcanic and Eolian geological units — Craters of the Moon volcanic field, Idaho; San Francisco volcanic field, in California; and the Cascade Range, California and Oregon. [EIS-10047] - p 35 N83-14556

Investigation of remote sensing techniques of measuring soil moisture [EES-10048] - p 12 N83-14557

Agricultural Research Service research highlights in remote sensing for calendar year 1981 [EES-10051] - p 75 N83-14560

The determination of soil moisture balances in tropical Africa by satellite infrared remote sensing. The atmospheric problem. [EIS-10052] - p 64 N83-15745


THERMAL NOISE

Spectral signal to clutter and thermal noise properties of ocean wave imaging synthetic aperture radars [43] - A-17712

TIDAL WAVES

Total phenomina in Arctic Ocean ice according to space data/ [40] - A83-10981

Some features of the spatial structure of the Arctic Ocean ice cover in connection with turbulent friction and geostrophic capture of tide waves 40 - A83-10833

TIMBER IDENTIFICATION

Seasat L-band radar response to forest vegetation in eastern Virginia [1] - A83-10061

Detection of aspen-forest forest mixtures from LANDSAT digital data — Utah-Ideho Bear River Range [EIS-10106] - p 17 N83-15749

TIMBER INVENTORY


Combined analysis of the characteristics appearing in LANDSAT multispectral images in the geological structural mapping of the midwestern portion of the Rio Grande do Sul state - Brazil [EIS-10126] - p 37 N83-15795

THERMAL MAPPING

An evaluation of four thermal models used in thermal inertia analysis — for thermal mapping from remotely sensed data [A-29] - A83-10096


Environmental monitoring of the Athabasca Oil Sands Region. [A-30] - A83-14226


HCMHC hydrological analysis in Utah. [EIS-10048] - p 53 N83-15520

Use of thermal inertia determined by HCMM to predict nocturnal cold prone areas in Florida. [EIS-10049] - p 62 N83-15522

Geologic interpretation of HCMM and aircraft thermal data [EIS-10050] - p 62 N83-15530

A comparison of HCMM surface temperatures with in situ temperature data — Nantucket shoals and the Gulf of Maine regions [EIS-10040] - p 46 N83-13534

TOPEX orbit determination using GPS signals plus a sidetone ranging system [NASA-CR-169694] - p 29 N83-14606

Verification of HCMM imagery for morphometric and topological studies of drainage basins in a section of the western plateau of Sao Paulo State: Tiete-Aguapei watershed — Brazil [EIS-10111] - p 54 N83-15754

TOPOLOGY

Feedbacks of the NASA Workshop on Surface Fitting [EIS-10117] - p 64 N83-15759


Surface fitting with bimorphic and harmonic models [65] - N83-15704

BSPLASH: A three-stage surface intersection to scattered data [65] - N83-15795

TRACKING (POSITION)


Lagrangian drifter measurements of sea surface currents and iceberg tracking [49] - N83-14842

Orbit busy component, NORPAX anomaly dynamics study [49] - N83-14848

Determining 3-D motion and structure from image sequences [66] - N83-15773

TRACKING NETWORKS


TRADEOFFS

Some closing thoughts: Practical payoffs from satellite systems [74] - N83-10468

TRAJECTORY ANALYSIS


TOPEX orbit determination using GPS signals plus a sidetone ranging system [NASA-CR-169694] - p 29 N83-14606

TRACKING NETWORKS


TOPEX orbit determination using GPS signals plus a sidetone ranging system [NASA-CR-169694] - p 29 N83-14606

TOPOGRAPHIC (HEIGHTS AND GEODETICS)

Drift buoy component, NORPAX anomaly dynamics study [AD-A119444] - p 29 N83-14566

TRACKING MISIONS

Gates to Gregg high voltage transmission line study — California [EIS-10097] - p 16 N83-15741

TRANSMISSIONS

Concerning the determination of the temperature of the ocean surface from multifractal satellite measurements of radiation in infrared atmospheric windows. [42] - A83-14316

TREES (PLANTS)

Evaluation of reforestation using remote sensing techniques [EIS-10076] - p 15 N83-15485

TRIANGULATION

Results of phototriangulation on the basis of space photographs [60] - A83-17299

TROPICAL METEOROLOGY


TROPICAL REGIONS

An introduction to project Freeze — the location and intensity of freezing temperatures using infrared satellite imagery. [INPE-2435-NTE/186] - p 22 N83-17303

The determination of soil moisture balances in tropical Africa by satellite infrared remote sensing. The atmospheric problem. [53] - N83-14621

TROPOSPHERE


TURBULENT FLOW

Some features of the spatial structure of the Arctic Ocean ice cover in connection with turbulent friction and geostrophic capture of tide waves [40] - A83-10833

U.S.S.R. SPACE PROGRAM


U.S.S.R. SPACE PROGRAM

Salyut-7 from June to August [74] - A83-17775
**ULTRAVIOLET RADIATION**

An optimum statistical technique for ozone profile retrieval from backscattered UV radiance p 21 A83-14632

Reflectance measurement of artificially induced ultraviolet radiation stress on cotton leaves p 7 A83-19607

**UNITED NATIONS**

Remote sensing in developing countries. FAO’s international experience p 76 N83-14514

**UNITED STATES OF AMERICA**

MAGSAT and aerometric data of the continental US [E83-10003] p 26 N83-13527

MAGSAT anomaly field inversion and interpretation for the U.S. [E83-10007] p 27 N83-14566

Use of MAGSAT anomaly data for crustal structure and magnetic resources in the US midcontinent [E83-10008] p 36 N83-14590

**UPPER ATMOSPHERE**

The possibility of measuring the moisture content of the upper layers of the atmosphere using radiometric techniques p 70 A83-14308

Technology needs assessment of an atmospheric observation system for multidisciplinary air quality/meteorology missions, part 2 (AGRF-FGGE) [E83-10024] p 21 N83-10646


**URANIUM**

Statistical Techniques Applied to Aerial Radiometric Surveys (STARRS): Discriminant-analysis methods applied to aerial radiometric data and their application to uranium favorability in South Texas. Nation uranium resource evaluation [E83-10006] p 34 N83-12512

**USER MANUALS (COMPUTER PROGRAMS)**


**USER REQUIREMENTS**

CIRSS/San Bernardino County project study phases 1-A, 1-B [E83-10024] p 35 N83-14556

Comparisons among a new soil index and other two- and four-dimensional vegetation indices [E83-10058] p 14 N83-14567

Vegetation survey in Amazon using LANDSAT data — Brazil [E83-10068] p 14 N83-14577

Remote sensing techniques for conservation and management of natural vegetation ecosystems p 77 A83-14667

Multitemporal and geobotanical approach in the remote detection of Gleiserization areas in the Serra da Pedra Branca Granite, Goias State, Brazil [E83-10071] p 35 N83-14580

Contextual classification of multispectral image data: An unbiased estimator for the context distribution [E83-10087] p 63 N83-14595

Multitemporal soil and vegetation observations by METEOSAT over Central Africa p 15 N83-14619

A geobotanical classification by remote sensing techniques p 23 N83-14622

Effects of ground cover and leaf area on the spectral reflectance of vegetation-soil target [AD-1981714] p 16 N83-14653

Microwave remote sensing of soil moisture, volume 1 — Guyon, Oklahoma and Dalhart, Texas [E83-10108] p 17 N83-15751

Rangeland biomass estimation demonstration — Texas Experiments Ranch [E83-10113] p 17 N83-15756

**VEGETATION GROWTH**

Radiative transfer model for heterogeneous P-D scenarios p 3 A83-12604

Visual analysis of 1,250,000 LANDSAT data for forest assessment during the 1980 drought in western Manitoba p 3 A83-14225

Vegetation change detection in an agricultural area — A simple approach for use with geo-data base p 4 A83-14236

**VERY LONG BASE INTERFEROMETRY**

Basic research for the geodynamics program [NASA-CR-169470] p 26 N83-13537

VIDEO DATA

Automation of the search for and recognition of reference zones for precise coordinate control of space structure p 3 A83-12605


VIDEO EQUIPMENT

Use of near-infrared video recording system for the detection of freeze-damaged citrus leaves [E83-10049] p 12 N83-14558

VEINYARDS


VISIBILITY

Automated measurements of atmospheric visibility [AAIA PAPER 83-0436] p 21 A83-16713

**VISIBILITY SPECTRUM**

Comparisons among a new soil index and other two- and four-dimensional vegetation indices [E83-10058] p 14 N83-14567

**VOLCANOES**

Imaging radar observations of volcanic features in Medicine Lake Highland, California p 30 A83-10079

LANDSAT observations of Mount St. Helens p 31 A83-12867

Mount St. Helens quick response damage assessment using high-altitude infrared photography p 19 A83-12672

An investigation into the utilization of HCM? thermal data for the discrimination of volcanic and Eolian geological units — Craters of the Moon volcanic field, Idaho; San Francisco volcanic field, Arizona; High Desert, California; and the Cascade Range, California and Oregon [E83-10047] p 35 N83-14556

**VOLCANOLOGY**

Contributions of LANDSAT imagery to the study of volcanic structures p 31 A83-12641

**WARTIES**

Western Boundary Eddies of the Gulf Stream p 49 N83-14847

**WASTE DISPOSAL**

Remote sensing and waste management p 20 A83-14263

A report to the President and the Congress [E12] p 75 N83-11552

**WATER CIRCULATION**

On the circulation of the western Gulf of Mexico - A satellite view p 39 A83-11011

Ice distribution and winter surface circulation patterns, Kachemak Bay, Alaska p 50 A83-12038

**WATER COLOR**

Phytoplankton pigment concentrations in the Middle Atlantic Bight - Comparison of ship determinations and CZCS estimates — Coastal Zone Color Scanner p 43 A83-18580

**WATER DEPTH**

Mineralogical, textural and bathymetric features of the Indian Ocean using MAGSAT magnetic anomaly data [E83-10095] p 28 A83-14602

**WATER POLLUTION**

Experimental feasibility of the airborne measurement of absolute of fluorescence spectral conversion efficiency p 7 A83-14681

Ocean pollution research, development and monitoring [PB92-210409] p 45 N83-14704

Interpretation of remotely sensed data and its applications in oceanography [E83-10074] p 48 N83-15463

**WATER QUALITY**

Remote sensing of water quality for estuarine environments p 50 A83-13007

A case study in the practical use of LANDSAT data [E83-10068] p 52 N83-10466


Identification environmental features for land management decisions [E83-10109] p 23 N83-15752

**WATER RESOURCES**

Action plan for remote sensing applications for rice production — Book [IPAFORS-207] p 0 A83-14121

A survey of Canada’s experience with data acquisition and telemetry systems p 51 A83-12487

Terrain analysis procedural guide for drainage and water resources (ETL series on guides for Army terrain analysts) [AD-1181683] p 52 N83-11569

**WATER RUNOFF**

Long-range water supply forecasting [WMO-587] p 53 N83-12516

Snowmelt runoff modeling in simulation and forecasting models with the Martinez-Mango model [E83-10063] p 53 N83-14572

**WATER TEMPERATURE**

Comparison of infrared temperatures from HCM? infrared data with field measurements [E83-10046] p 47 A83-14556

**WATER TREATMENT**

A report to the President and the Congress [AR-11] p 75 N83-11552

**WATER VAPOUR**

Validation and application of the SEASAT-SMMR geophysical algorithms [NASA-CR-169600] p 71 N83-13767

**WATER WAVES**

A comparison data set for the evaluation of remote sensing systems ability for ocean wave data collection p 38 A83-10071

On the use of laser profilometry for ocean wave studies p 21 A83-14622

Spectral signal to clutter and thermal noise properties of ocean wave imaging synthetic aperture radars p 43 A83-17112

Airborne and satellite measurement of ocean wave directional spectra using scanning-beam microwave radars [NASA-TM-84008] p 47 N83-13544

Further SEASAT SAR coastal ocean wave analysis [NASA-CR-169862] p 47 N83-13776

**WATERFOWL**

Waterfowl habitat inventory of Alberta, Saskatchewan and Manitoba by remote sensing p 4 A83-14244

**WATERSHEDS**

Terrain analysis procedural guide for drainage and water resources (ETL series on guides for Army terrain analysts) [AD-1181683] p 52 N83-11569
Subject Index

Snowmelt runoff modeling in simulation and forecasting modes with the Martinec-Mango model
[E83-10003] p 53 N83-14572
Verification of LANDSAT imagery for morphometric and topological studies of drainage basins in a section of the western plateau of Sao Paulo State: Tiete-Aguapecu watershed — Brazil
[E83-10111] p 54 N83-15754
Wave propagation
Some fundamental concepts in remote sensing
p 60 N83-10459
Wavelengths
An evaluation of the NASA/GSFC Barnes spectral radiometer model 14-75B, using signal/noise as a measure of utility
Weather
Weather constraints on airborne laser hydrography operations
[PB82-189754] p 52 N83-10745
The Global Weather Experiment, First GARP Global Experiment (FGGE) operations report series: Volume 5, summary of data collected 5 July - December 1979
[GARP-FOR-5] p 46 N83-12808
Crop weather models of corn and soybeans for Agrophysical Units (APU's) in Iowa using monthly meteorological predictors
[E83-10054] p 13 N83-14563
Weather forecasting
The use of satellite information in weather forecasting at the Pacific Weather Centre
p 20 A83-14277
A report to the President and the Congress
[AR-11] p 75 N83-11532
Weather stations
[WMO-544-VOL-1-ANNEX] p 46 N83-12801
Wetlands
Wetland mapping with imaging radar
p 50 A83-10072
Toward an operational, satellite-based, wetland monitoring program for the Fraser River Estuary, British Columbia
p 51 A83-14234
Remote sensing applications for British Columbia wetlands using 35 mm aerial photography
p 51 A83-14251
Identifying environmental features for land management decisions
[E83-10109] p 23 N83-15752
Wetting
Influence of environmental factors during seed development and after full-ripeness on pre-harvest sprouting in wheat
[E83-10002] p 7 N83-12482
Wheat
The use of large-area spectral data in wheat yield estimation
p 7 A83-16910
Influence of environmental factors during seed development and after full-ripeness on pre-harvest sprouting in wheat
[E83-10002] p 7 N83-12482
A three-part geometric model to predict the radar backscatter from wheat, corn, and sorghum
[E83-10055] p 8 N83-12485
Discrimination of growth and water stress in wheat by various vegetation indices through a clear a turbid atmosphere
[E83-10009] p 8 N83-12488
Winter wheat stand density determination and yield estimates from handheld and airborne scanners — Montana
[E83-10013] p 9 N83-12482
Data documentation for the 1981 summer vegetation experiment — Kansas River floodplain
[E83-10018] p 10 N83-12499
Development of thematic mapper vegetation indices for assessing biomass in corn, soybeans and wheat
[E83-10025] p 11 N83-13529
Evaluation of the Williams-type spring wheat model in North Dakota and Minnesota
[E83-10041] p 12 N83-13535
Diurnal patterns of wheat spectral reflectances and their importance in the assessment of canopy parameters from remotely sensed observations — Phoenix, Arizona
[E83-10050] p 13 N83-14559
Crop weather models of barley and spring wheat yield for agrophysical units in North Dakota
[E83-10059] p 14 N83-14568
Wildlife
Aerial thermal infrared census of Canada geese in South Dakota
p 6 A83-14665
A multispectral approach to remote detection of deer
p 6 A83-14666

Wind (Meteorology)
The Global Weather Experiment, First GARP Global Experiment (FGGE) operations report series: Volume 5, summary of data collected 5 July - December 1979
[GARP-FOR-5] p 46 N83-12808
Wind direction
SEASAT-A SASS wind processing
Wind measurement
Application of the airborne microwave rain-scattered/radiometer system to the remote sensing of rains and wind vector measurements over the ocean
p 70 A83-14263
The measurement of the synoptic scale wind over the ocean
p 47 N83-13773
Wind velocity
SEASAT-A SASS wind processing
Wind velocity measurement
Estimating wind speed from HF skywave radar sea backscatter
p 40 A83-11352
Observations of oceanic surface-wind fields from the Nimbus-7 microwave radiometer
p 42 A83-14681
World data centers
World Integrated Oceanic Services System: General plan and operational program for 1982-1985
[WMO-582] p 46 N83-12802
World meteorological organization
Commission for Marine Technology: Abridged report of the 8th Session — resolutions and recommendations for ocean exploration and exploitation
[WMO-584] p 46 N83-12803

Zambia
Multitemporal analysis of Landsat data for investigations of agricultural land use: Problems and potentials
p 15 N83-14624
DAILY, M. D

DAILY, M.

DAILY, M. I.

DANA, R. W.

DANIEL-DANIELSKIAI, B.

DANIELS, J. H.

DAVIES, D. N.

DAVIES, J. R.

DAVIS, R. E.

DAVIS, J. L.

DAVIS, G. R.

DAVIS, G. S.

DAVIES, G. R.

DAVIES, L. S.

DBY, I.

DEBAYLA, E.

DEBRI, L. J.

DEBOER, G. B.

DEBOY, I.

DEDE, L. J.

DEELEY, D.

DEELEKSE, B.

DEELEKSE, B.

DEELEKSE, B.

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DEELEKSE, B.

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DEELEKSE, B.
KRAIMAN, H. E.
KOOPMANS, B. N.
KRITIKOS, H.
KOVSHOV, V. A.
KOREN, U.
KUNZ, H. J. H.
KUKLA, G.
KUKULNIA, K. M.
KWAMI, T. K.
KWAMIENTE, G. D.
KUYATREY, K. A.
KONYCYC, G.
KONG, J. A.
KONECNY, G.
KOLM, K. E.
KUX, H. J. H.
KUYFET, F.
KOVSHOV, V. A.
KRIMORLYOVA, N. A.
KOVAYE, F.
KOVICH, D. G.
KRAINMAA, H.
KRAINMAN, H.
KRIEGER, H.
KRIEGER, H.
KRIKORIAN, E.
KRITIKOS, H.
KUVAYE, F.
KUZNETSOV, I. V.
KUZUK, I. V.
KUZNECOV, V. A.
KZIWINA, K. M.
KZIWINA, K. M.
L.
LABOVITZ, M. L.
LABOR, A.
LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
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LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
LABOR, L.
NEWITT, R. W.

A simple relation between active and passive microwave remote sensing measurements of earth terrain [E83-10046] p 24 N83-14857

Aim of the investigation was to verify with experimental data the potential for the development of algorithms for remote sensing measurements of earth terrain [E83-10046] p 12 N83-14557

Rangeland biomass estimation demonstration [E83-10114] p 27 N83-15756

NIEBER, J. L.

Investigation of remote sensing techniques of measuring soil moisture [E83-10046] p 12 N83-14557

NIERD, M.

Method of interpretation of remotely sensed data and applications to land use [E83-10037] p 23 N83-14561

NIXON, R. M.

Applicability of satellite-derived sea-surface temperatures in the Fijii region p 40 A83-12032

Methods of editing cloud and atmospheric layer affected pixels from satellite data [E83-10169] p 64 N83-15746

NORDO, J.

The RAMS collection of meteorological and position data in the Norwegian Sea p 48 N83-14845

NUESCH, D.

Development, implementation and evaluation of satellite-aided agricultural monitoring systems [E83-10017] p 10 N83-12500

OHARTA, T.

Analysis of the characteristics appearing in LANDSAT multispectral images in the geological structural mapping of the midwestern portion of the Rio Grande do Sul [E83-10126] p 37 N83-15795

OLHRSTORF, C. W.


QUIMI, T.

Application of the airborne microwave rain-scatterer/radiometer system to the remote sensing of rains and wind vector measurements over the ocean p 70 A83-14293

OKAMOTO, K.

Application of the airborne microwave rain-scatterer/radiometer system to the remote sensing of rains and wind vector measurements over the ocean p 70 A83-14293

OLFERT, O.

Aerial survey of crop losses due to grasshoppers /Orthoptera - Acrididae/ in Saskatchewan p 5 A83-14255

OSLUND, L.

Remote sensing of temperature profiles in the atmosphere of Manitoba by remote sensing p 4 N83-14244

OSWALD, E. T.

Ecological land classification in the Yukon p 20 A83-14250

OTTEN, L. J., III

Airborne atmospheric temperature structure measurements of a Pacific coast marine inversion [AIAA PAPER 83-0278] p 70 A83-19585

PAREY, P. C.

Evaluation of the potential of one to three SEASAT-SMMR channels in retrieving sea surface temperature [NASA-CR-169660] p 48 N83-14604

PAOA, M. D. J.

Use of LANDSAT images to study cerrado vegetation [E85-10025] p 11 N83-13519

Geological-structural interpretation of LANDSAT images in remote sensing of the region of Carancas, Minas Gerais, Brazil [E85-10026] p 34 N83-13523

ChNP-INPE-LANDSAT system report of activities [E83-10064] p 63 N83-14573

An automatic agricultural zone classification procedure for crop inventory satellite images [E83-10065] p 14 N83-14574

Automatic interpretation of MSS-LANDSAT data applied to coastal site studies in southern Santa Catarina State, Brazil [E83-10066] p 35 N83-14575

Satellite discrimination of lithologic facies in the granite of the Piedra Branca Group using LANDSAT digital imagery [E83-10069] p 35 N83-14578

Remote sensing techniques for conservation and management of natural vegetation ecosystems [E83-10070] p 15 N83-14579

Multitemporal and geobotanical approach in the specific detection of other national-economic problems [E83-10076] p 35 N83-14580

Method of interpretation of remotely sensed data and applications to land use [E83-10072] p 23 N83-14581

LANDSAT and radar mapping of intrusive rocks in SE-Brazil [E83-10073] p 36 N83-14582

Interpretation of remotely sensed data and its applications in oceanography [E83-10074] p 48 N83-14563

INPE LANDSAT-D thematic mapper computer compatible tape format specification [E83-10075] p 43 N83-14584

Evaluation of reforestation using remote sensing techniques [E83-10076] p 15 N83-14585

Estimation of the sugar cane cultivated area from LANDSAT images using the two phase sampling method [E83-10077] p 15 N83-14586

The computer treatment of remotely sensed data: An introduction to techniques which have geologic applications [E83-10078] p 36 N83-14587

Comparison of diverse methods for the correction of atmospheric effects on LANDSAT and SKYLAB images [E83-10079] p 72 N83-14588

Verification of LANDSAT imagery for morphametric and topographic studies of drainage basins in a section of the western plateau of Sao Paulo State: Tiete-Aguapei watershed p 54 N83-15754

Analysis of the characteristics appearing in LANDSAT multispectral images in the geological structural mapping of the midwestern portion of the Rio Grande do Sul shield [E83-10126] p 37 N83-15795

PASCELLA, W. R.


The computer treatment of remotely sensed data: An introduction to techniques which have geologic applications [E83-10078] p 36 N83-14587

PATTERSON, A. L.

The utilization of infrared /IR/ aerial and space observations of Arctic seas in navigation and during the solution of other national-economic problems [E83-10065] p 40 A83-10836

PARASHAR, S.

On detection of oil pollution in ice environment p 41 A83-13429

PARKS, A. D.

An upper bound on errors in the mean-of-date/instantaneous Earth-fixed vector transformation induced by interpolated nutation angles [AD-A119444] p 29 N83-14568
RYERSON, R. A.
Satellite remote sensing for domestic crop reporting in the Unites States and Canada - A look to the future
p 3 A83-14239

Vegetation change detection in an agricultural area - A simple approach for use with geo-data base
p 4 A83-14236

S

SAILOR, R. V.
Investigating tectonic and bathymetric features of the Indian Ocean using MAGSAT magnetic anomaly data
[EB8-10095] p 28 N83-14602

SALMOND, V. Y.
The early 1881 view of Landsat-D progress
p 73 A83-12673

SANDBOM, W. A.
Sky-wave radar sea-state sensing - Effects of ionospheric movement and propagation geometry
p 43 A83-17709

SATO, H.
Reference quicklook Images for monitor of Landsat image data acquisition
p 58 A83-14296

SATTERWHITE, M. B.
Effects of ground cover and leaf area on the spectral reflectance of soil and non-soil
[AD-A119714] p 16 N83-14653

Special reflectance of some plant indicators of saline and non-saline soils
[AD-A119727] p 16 N83-14655

SAUNDERS, R. S.
Shuttle imaging radar experiment
p 32 A83-13348

SAVEY, B. L.
Results of photointerpretation on the basis of space photographs
p 60 A83-17299

SAZONOV, N. V.
Application for the complex processing of aerial and space data for agriculture
p 4 A83-14301

SCHAEFER, G. G.
Subarctic valleys and geoarcheology of the eastern Sahara revealed by Shuttle radar
p 32 A83-13497

SCHLIEDEL, J. P.
Examples of the utility of HCM4 data in geologic remote sensing
p 31 A83-13099

SCHMIDT, R.
Wetland habitat inventory of Alberta, Saskatchewan and Manitoba by remote sensing
p 4 A83-14244

SCHNEIDER, M.
Report on the special project 78 satellite geodesy of the technical university of Munich [ASTRON-GEODAET-ARB-41] p 25 N83-11563

SCHINDLER, W. H.
An optimum statistical technique for ozone profile retrieval from backscattered UV radiances
p 41 A83-14652

SCHNELL, R. C.
Arctic haze and the Arctic gas and aerosol sampling program [AGASP] [AIAA PAPER 83-0439] p 21 A83-16714

SCOTT, R.
Remote sensing of renewable natural resources in developing countries for national planning purposes
p 76 N83-14516

SCHREIER, H.
Predicting permastatus conditions with infrared sensing techniques
p 6 A83-14264

SCHNUHR, I.
Investigations of interpretability of images by different sensors and platforms for small scale mapping
p 70 A83-14943

SCHUMAKER, L. L.
Firing sites to scattered data
p 65 N83-15761

SCOTT, R.
Weather constraints on airborne laser hydography operations
[PB82-189754] p 52 N83-10745

SEELEY-HUELE, L.
An algorithm to interface Nimbus-7 SMMR data with the AES imaging model for the Beaufort Sea
p 41 A83-14284

SEGAL, D.
Seasat L-band radar to response forest vegetation in eastern Virginia
p 1 A83-10061

SEINFELD, C. V.
Development of mathematical techniques for the assimilation of remote sensing data into atmospheric models
[EB8-10002] p 22 N83-14571

SEIBER, R.
Predicting permastatus conditions with infrared sensing techniques
p 6 A83-14294

SERAPHINAS, B. B.
The accuracy of a component analysis in space studies of natural environments
p 59 A83-14304

SETTLE, M.
Use of the Space Shuttle for remote sensing research - Recent results and future prospects
p 68 A83-13347

SHAFER, B.
Snowment runoff modeling in simulation and forecasting models with the Martinez-Mango models
[EB8-10063] p 53 N83-14572

SHANMUGAM, K. S.
An analysis of four land-typel models for determination of optimum SAR sensor configuration and optimum information extraction for exploration of global non-renewable resources. Pilot study: Arkansas Remote Sensing Laboratory, part 1, part 2, and part 3 [EB8-10001] p 35 N83-14570

SHAPIRO, L. G.
Structural analysis techniques for remote sensing
p 66 N83-15772

SHAW, E.
Definition and potential of geocoded satellite imagery products
p 58 A83-14272

SHAW, G. E.
Evidence for a central Eurasian source area of arctic haze in Alaska
p 18 A83-11626

SHEARMA, E. R.
Sky-wave radar sea-state sensing - Effects of ionospheric movement and propagation geometry
p 43 A83-17709

SHEN, S. S.
Evaluation of small area crop estimation techniques using LANDSAT- and ground-derived data
[EB8-10098] p 8 N83-12487

SHEREMET', O. A.
A method for the quantitative evaluation of the results of space imagery interpretation in prospecting applications
p 33 A83-14302

SHIELDS, J. A.
A procedure to overtype thematic map and domain land survey system data to geometrically-corrected Landsat images and its application to agricultural land use studies in western Canada p 3 A83-14251

SHILINA, A.
Instruments and methods for monitoring background soil pollution
p 22 N83-12650

SHULTS, W. W.
Surface geology mapping from Landsat-Kaminak Lake, N.W.T.
p 32 A83-14268

SHIMABUKURO, Y. E.
Vegetation survey in Amazonia using LANDSAT-3 data
[EB8-10068] p 14 N83-14577

Evaluation of reforestation using remote sensing techniques
[EB8-10076] p 15 N83-14585

Estimation of the sugar cane cultivated area from LANDSAT images using the two phase sampling method
[EB8-10077] p 15 N83-14586

SHINDE, J. A.
An analysis of a relaxation scheme to improve terrain elevation data
[AD-A119257] p 27 N83-13550

SHORT, N. L.
The LANDSAT tutorial workbook: Basics of satellite remote sensing
p 74 N83-10458

SHUCHAR, R.
Evaluation of ERIM optically processed SEASAT SAR data
[EB8-10037] p 63 N83-13531

SHUCHAR, R. A.
Detection of coastal zone environmental conditions using synthetic aperture radar
p 38 A83-10068

Further SEASAT SAR coastal ocean wave analysis [NASA-CR-186882] p 47 N83-13778

SHEVTSOV, A. A.
Investigations of the apparent temperature of snow as measured by orbital sensors using various scanning directions
p 3 A83-12315

Adjusting the tessellated cap brightness and greenness factors for atmospheric path radiance and absorption on a pixel by pixel basis
[EB8-10050] p 13 N83-14562

SMIL, V.
Land use/land cover mapping from enhanced Landsat imagery of the eastern provinces of the People's Republic of China p 4 A83-14241

SMIRNOVA, L. P.
Using new methods in monitoring the thermal regime of the Arctic p 39 N83-10828

SMITH, A. F.
Determination of the contribution of side-looking airborne radar to structural geologic mapping [PB82-185042] p 32 N83-12713

SMITH, J. A.
Reflection of a vegetation canopy using the Adding method
p 3 A83-12603

SMITH, S. A.
Remote sensing of geometric terrain models for determination of optimum SAR sensor configuration and optimum information extraction for exploration of global non-renewable resources. Pilot study: Arkansas Remote Sensing Laboratory, part 1, part 2, and part 3 [EB8-10061] p 35 N83-14570

SMITH, B. L.
Evaluation of geodetic products produced by the NSWC elevation data
[AD-A119737] p 25 N83-11571

SNOELEN, J.
On detection of oil pollution in ice environment p 41 A83-14229

SPENCER, J. P.
Geometric of a mapping satellite p 67 A83-10716

SODERBLOM, L. A.
The geology of Europe p 24 A83-16299

SOMMER, F.
Multistage land use mapping and change monitoring in Sri Lanka p 15 N83-14625

SOMMER, S. E.
The role of geological surfaces in determining visible-near infra red spectral signatures p 30 A83-10058

SOMMERFELDT, T. G.
Landsat for delineation and mapping of saline soils in desert areas in southern Alberta p 5 A83-14261

SPENCER, J. P.
Evaluation of photographic enhancements of Landsat imagery p 55 A83-12035

SPERANSKAI, N. A.
Using new methods in monitoring the thermal regime of the Arctic p 39 N83-12629

STABLEIN, N. K.
Statistical Techniques Applied to Aerial Radiometric Survey Data (STARRS): Discriminant-analysis methods applied to aerial radiometric data and their application to uranium favorability in South Texas. Nation uranium resource evaluation [CE82-020961] p 34 N83-12512

STARK, K.
Optical characteristics of Alberta rangeland as related to remote sensing p 4 A83-14245
The typical corporate source index listing includes a brief description of the abstract section. If applicable, a report number entry to assist the user in locating the abstract in the document. As an aid in identifying the document, a report number is also included as an aid in the abstract section. If applicable, a report number entry to assist the user in locating the abstract in the document.

Agricultural Research Service, Phoenix, Ariz.

Determination of growth and water stress in wheat by various vegetation indices through a clear turbid atmosphere.[E83-10009] p 8 N83-12488

Adjusting the tasseled cap brightness and greenness factors for atmospheric path radiance and absorption on a pixel by pixel basis.[E83-10003] p 13 N83-14562

Agricultural Research Service, Pullman, Wash.

Influence of environmental factors during seed development and after full-ripeness on pre-harvest sprouting in wheat.[E83-10002] p 7 N83-12482

Agricultural Research Service, Weslaco, Tex.

Estimating total standing herbaceous biomass production with LANDSAT MSS digital data.[E83-10045] p 12 N83-13556

Use of near-infrared video recording system for the detection of freeze damaged citrus leaves.[E83-10040] p 12 N83-14558

Comparison of LANDSAT-2 and field spectrometer reflectance signatures of south Texas rangeland plant communities.[E83-10055] p 13 N83-14564

Comparisons among a new soil index and other two-and four-dimensional vegetation indices.[E83-10056] p 14 N83-14567

Methods ofdicating cloudy and atmospheric layer affected pixels from satellite data.[E83-10103] p 64 N83-15746

Agricultural Research Services, Beltville, Md.

Agricultural Research Service research highlights in remote sensing for calendar year 1981.[E83-10051] p 75 N83-14560

Alaska Univ., Fairbanks.

Evaluation of photographic enhancements of Landsat imagery.[E83-12003] p 55 N83-12035

Radial and infrared remote sensing of geothermal features at Pilgrim Springs, Alaska.[E83-12003] p 31 N83-12035

Analytic Sciences Corp., Reading, Mass.


A tutorial assessment of atmospheric height uncertainties for high-precision satellite altimeter missions to monitor ocean currents.[E83-10093] p 28 N83-14600

Arizona Univ., Tucson.

Atmospheric effects on radiation reflected from soil and vegetation as measured by orbital sensors using various scanning directions.[P83-123-12003] p 3 A83-12315

Subsurface valleys and geomorphology of the eastern Sahara revealed by Shuttle radar.[E83-123349] p 32 A83-13349

Arkansas Univ., Fayetteville.

Wetland mapping with imaging radar.[E83-10072] p 50 N83-11569

Geological terrain models.[E83-10080] p 31 A83-12035

Measurement of soil moisture using remote sensing multisensor radiation techniques.[E83-10012] p 9 N83-12491

Analysis of geologic terrain models for determination of optimum SAR sensor configuration and optimum information extraction for exploration of global non-renewable resources. Pilot study: Arkansas Remote Sensing Laboratory, part 1, part 2, and part 3.[E83-10001] p 35 N83-14570

Army Engineer Topographic Labs., Fort Belvoir, Va.

Terrain analysis procedural guide for drainage and water resources (ETL series on guides for Army terrain analysts).[A-D-A118318] p 52 N83-11569

An analysis of a relaxation scheme to improve terrain elevation data.[E83-119257] p 27 N83-13550

Effects of ground cover and leaf area on the spectral reflectance of vegetation-soil target.[E83-119714] p 16 N83-14553

Special reflectance of some plant indicators of saline and non saline soils.[A-D-A119727] p 16 N83-14555

Aster Consulting Associates, Binghamton, N.Y.

A review of crop canopy reflectance models.[E83-119257] p 17 N83-15753

Automatic Corp., Inc., Falls Church, Va.

Determination of the contribution of side-looking airborne radar to structural geologic mapping.[P982-185042] p 34 N83-12713

Bayerlsche Akademle der Wlssenschaften, Munich (West Germany).

Report on the special program 78 satellite geodesy of the technical university of Munich.[ASTRON-GEOGAT-ARB-41] p 25 N83-11563

Theoretical and experimental investigations on the accuracy of close-range photogrammetry.[S-C-R-266] p 25 N83-11564

Investigation of the geometrical stability of a photogrammetric recording system.[S-C-R-267] p 71 N83-11565

Pass point determination and geometrical precision of the relative rectification of scanner data.[S-C-R-268] p 62 N83-13518

Bendix Field Engineering Corp., Columbia, Md.

Dial-wave-length correlation measurements with an airborne pulsed carbon dioxide lidar system.[E83-12035] p 60 N83-12035

Bendix Field Engineering Corp., Grand Junction, Colo.

Statistical Techniques Applied to Aerial Radiometric Surveys (STARRS): Discriminant-analysis methods applied to aerial radiometric data and their application to uranium favorability in South Texas. National uranium resource evaluation.[E83-102005] p 34 N83-12512

Bingham Young Univ., Provo, Utah.

HCM hydrological analysis in Utah.[E83-10026] p 53 N83-13520

Bristol Univ., (England).

The role of EARSeI and EARSeI member laboratories.[E83-10036] p 76 N83-14630

Brown Univ., Providence, R. I.

An investigation into the utilization of HCM thermal data for the determination of volcanic and Eolian geological units.[E83-10047] p 35 N83-14556

Cross-validation for densities and regressions.[E83-10055] p 56 N83-15756

Characterization of a maximum-likelihood nonparametric density estimator of kernel type.[E83-10055] p 56 N83-15757

Bureau of Land Management, Anchorage, Alaska.

Evaluation of photographic enhancements of Landsat imagery.[E83-10058] p 27 N83-14566

Bureau of Meteorology, Melbourne (Australia).

Astronomical and technological systems, Inc., Seabrook, Md.

MAGSAT anomaly field inversion and interpretation for the US.[E83-10057] p 27 N83-14566

Equivalent source modeling of the main field using MAGSAT data.[E83-10094] p 28 N83-14601

Geomagnetic modeling by optimal recursive filtering.[E83-10112] p 29 N83-15755

California Inst. of Tech., Pasadena.

Development of mathematical techniques for the assimilation of remote sensing data into atmospheric models.[E83-10062] p 22 N83-14571

California Polytechnic State Univ., San Luis Obispo.

A three-stage surface interpolant to scattered data.[E83-10075] p 85 N83-15765

California Univ., Livermore. Lawrence Livermore Lab.

Aerial geolocig clog from Livermore, California to the Nevada Test Site, Nye County, Nevada.[E83-10192] p 25 N83-16090

California Univ., Santa Barbara.

Monitoring global vegetation.[E83-10044] p 12 N83-14554

Neotectonic of the San Andreas Fault System: Basin and range province juncture.[E83-10061] p 36 N83-14588

Canada Centre for Remote Sensing, Ottawa (Ontario).

Standardization of computer compatible tape formats for remote sensing data.[E83-10075] p 54 A91-10057

Canada Centre for Remote Sensing, Toronto (Ontario).

A practical automated mapping system.[E83-10075] p 64 N83-14635

Center for Remote Sensing, Colombo (Sri Lanka).

Multistage land use mapping and change monitoring in Sri Lanka.[E83-10075] p 15 N83-14625

Centre National de la Recherche Scientifique, Paris (France).

SPOT in the 1980's.[E83-10075] p 78 N83-14611
On the use of laser profilometry for ocean wave studies p 42  [NASA-14502]

Scripps Institution of Oceanography, La Jolla, Calif.  
Inferred satellite data from the first coastal ocean dynamics experiment, March - July 1981 [AD-A120068]

Rhode Island Univ., Narragansett  
Snowmelt runoff modeling in simulation and forecasting modes with the Martinez-Mango model  
[E83-10003] p 53  [NASA-14572]

South Dakota State Univ., Brookings  
Contriving land use data acquired from Landsat with soil map data  
2 South Dakota State Univ.  
Aerial thermal infrared census of Canada geese in South Dakota  
[E83-10065] Evaluating depth to shallow groundwater using heat capacity mapping mission /HCM/ data  
Survey of India, Dehra Dun.  
Analysis of MAGSAT data of the Indian region  

Technicolor Government Services, Inc., Moffett Field, Calif.  
Gates to Gregg high voltage transmission line study  
[E83-10003] Remote sensing crop canopy geometry  
[E83-10096] Soil spectral characterization  
[E83-10089] Geometric adjustment of simultaneous Doppler-derived digital data  
[AMOEBA] p 9  [NASA-13494]

Remote sensing systems and applications, Inc., Lanham, Md.  
On the use of laser profilometry for ocean wave studies p 42  [NASA-14502]

Southern Illinois University, Carbondale  
Estimation of crop area and crop growth using LANDSAT data  
[E83-10003] p 52  [NASA-13497]

Survey of India, Dehra Dun.  
Analysis of MAGSAT data of the Indian region  

Technology Corporation, Inc., Moffett Field, Calif.  
Gates to Gregg high voltage transmission line study  
[E83-10003] Remote sensing crop canopy geometry  
[E83-10096] Soil spectral characterization  
[E83-10089] Geometric adjustment of simultaneous Doppler-derived digital data  
[AMOEBA] p 9  [NASA-13494]

Remote sensing systems and applications, Inc., Lanham, Md.  
On the use of laser profilometry for ocean wave studies p 42  [NASA-14502]

Development of advanced acreage estimation methods  
Remote system development: ID/EMS FUNCTION  
AMOEBA  
Rice remote radiation research plan  
Missing observations in multiyear rotation sampling designs  
Investigation of remote sensing techniques of measuring soil moisture  
[AMOEBA] p 9  [NASA-13494]  
Drift buoy component, NOPRAX anomaly dynamics study  
Microwave remote sensing of soil moisture, volume 1  

Rangeland biomass estimation demonstration  
Proceedings of the NASA Workshop on Surface Fitting  
[NASA-10113] p 17  [NASA-13576]

Proceedings of the NASA Workshop on Surface Fitting  
Fitting surfaces to scattered data  
Proceedings of the NASA Workshop on Image Analysis  
[NASA-10118] p 65  [NASA-13576]

Proceedings of the NASA Workshop on Density Estimation and Function Smoothing  
Commission for Marine Technology: Abridged report of the 8th Session  

Commission for Marine Technology: Abridged report of the 8th Session  


<table>
<thead>
<tr>
<th>CONTRACT NUMBER</th>
<th>INDEX LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAS-2647</td>
<td>p 53</td>
</tr>
<tr>
<td>NASA-15350</td>
<td>p 37</td>
</tr>
</tbody>
</table>

**Typical Contract Number Index Listing**

Listings in this index are arranged alphanumerically by contract number. Under each contract number, the accession numbers denoting documents that have been produced as a result of research done under that contract are arranged in ascending order with the AIAA accession numbers appearing first. The accession number denotes the number of the citation in which the citation is identified in the abstract section. Preceding the accession number is the page number on which the citation may be found.

<table>
<thead>
<tr>
<th>CONTRACT NUMBER</th>
<th>INDEX LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASS-16312</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-15345</td>
<td>p 21</td>
</tr>
<tr>
<td>NASS-10741</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-15394</td>
<td>p 21</td>
</tr>
<tr>
<td>NASS-11101</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-15494</td>
<td>p 21</td>
</tr>
<tr>
<td>NASS-22963</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-24206</td>
<td>p 21</td>
</tr>
<tr>
<td>NASS-24316</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-25050</td>
<td>p 21</td>
</tr>
<tr>
<td>NASS-25868</td>
<td>p 21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTRACT NUMBER</th>
<th>INDEX LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA-25691</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-25587</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26025</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26032</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26047</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26123</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26157</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26250</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26268</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26414</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26424</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26453</td>
<td>p 21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTRACT NUMBER</th>
<th>INDEX LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA-26548</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26573</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26728</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26859</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-26863</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-100</td>
<td>p 21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTRACT NUMBER</th>
<th>INDEX LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA-32992</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-36191</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-14689</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-100</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-100</td>
<td>p 21</td>
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<td>NASA-100</td>
<td>p 21</td>
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</table>

<table>
<thead>
<tr>
<th>CONTRACT NUMBER</th>
<th>INDEX LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA-15421</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-15466</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-15466</td>
<td>p 21</td>
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<td>NASA-15466</td>
<td>p 21</td>
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</table>

<table>
<thead>
<tr>
<th>CONTRACT NUMBER</th>
<th>INDEX LISTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASA-16500</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-16500</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-16500</td>
<td>p 21</td>
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<td>NASA-16500</td>
<td>p 21</td>
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<table>
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<tr>
<th>CONTRACT NUMBER</th>
<th>INDEX LISTING</th>
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<tbody>
<tr>
<td>NASA-16500</td>
<td>p 21</td>
</tr>
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<td>NASA-16500</td>
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<td>NASA-16500</td>
<td>p 21</td>
</tr>
<tr>
<td>NASA-16500</td>
<td>p 21</td>
</tr>
</tbody>
</table>

---

**CONTRACT NUMBER INDEX**

**EARTH RESOURCES / A Continuing Bibliography (Issue 37)**

**APRIL 1983**

---

**CONTRACT NUMBER INDEX**

**EARTH RESOURCES / A Continuing Bibliography (Issue 37)**

**APRIL 1983**
<table>
<thead>
<tr>
<th>Contract Number</th>
<th>Page</th>
<th>Contract Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>146-40-15-07</td>
<td>44</td>
<td>N83-10647</td>
</tr>
<tr>
<td>658-70-04</td>
<td>16</td>
<td>N83-15741</td>
</tr>
<tr>
<td>658-80-05</td>
<td>67</td>
<td>N83-15794</td>
</tr>
<tr>
<td>677-16-15</td>
<td>22</td>
<td>N83-12507</td>
</tr>
</tbody>
</table>
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E83-10002
E83-10003
E83-10006
E83-10007
E83-10008
E83-10010
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E83-10012
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E83-10032
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E83-10035
E83-10036
E83-10038
E83-10039
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E83-10043
E83-10045
E83-10046
E83-10047
E83-10048
E83-10049
E83-10050
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E83-10052
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E83-10054
E83-10055
E83-10056
E83-10057
E83-10058
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E83-10060
E83-10061
E83-10062
E83-10063
E83-10064
E83-10065
E83-10066
E83-10067
E83-10068
E83-10069
E83-10070
E83-10071
E83-10072
E83-10073
E83-10074
E83-10075
E83-10076
E83-10077
E83-10078
E83-10079
E83-10080
E83-10081
E83-10082
E83-10083
E83-10084
E83-10085
E83-10086
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E83-10088
E83-10089
E83-10090
E83-10091
E83-10092
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E83-10122
E83-10123
E83-10124
E83-10125
E83-10126
E83-10127
E83-10128
GARP-FOR-5
GARP-PUB-SER-25
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<table>
<thead>
<tr>
<th>Accession Number</th>
<th>Page</th>
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<tbody>
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<td>p 71</td>
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<td>p 94</td>
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<td>N83-14646</td>
<td>p 48</td>
</tr>
</tbody>
</table>
**Abstract**

This bibliography lists 512 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1 and March 31, 1983. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.

**Key Words (Suggested by Author(s))**

- Bibliographies
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