NASA

Earth Resources
A Continuing
Bibliography
with Indexes

NASA SP-7041(23)
October 1979

National Aeronautics and
Space Administration

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NASA SP-7041 (23)

EARTH RESOURCES

A Continuing Bibliography With Indexes

Issue 23

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between July 1, 1979 and September 30, 1979

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

NASA Scientific and Technical Information Branch 1979
National Aeronautics and Space Administration
Washington, DC

This Supplement is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, at the price code E05 ($9.00 domestic; $18.00 foreign).

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 instrumention on orbiting spacecraft or on aircraft.

This literature survey lists 226 reports, articles, and other documents announced between July 1 and September 30, 1979 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. This procedure, which saves time and money, accounts for the variation in citation appearance.

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 A79-10,000 in ascending accession number order;

STAR entries identified by accession number series N79-10,000 in ascending accession number order.

After the abstract section, there are five indexes:

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

AVAILABILITY OF CITED PUBLICATIONS

IAA ENTRIES (A79-10000 Series)

All publications abstracted in this Section are available from the Technical Information Service, American Institute of Aeronautics and Astronautics, Inc. (AIAA), as follows: Paper copies of accessions are available at $6.00 per document up to a maximum of 20 pages. The charge for each additional page is $0.25. Microfiche[1] of documents announced in *IAA* are available at the rate of $2.50 per microfiche on demand, and at the rate of $1.10 per microfiche for standing orders for all *IAA* microfiche. The price for the *IAA* microfiche by category is available at the rate of $1.25 per microfiche plus a $1.00 service charge per category per issue. Microfiche of all the current AIAA Meeting Papers are available on a standing order basis at the rate of $1.35 per microfiche.

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NASA ACCESSION NUMBER

N79-10497*# National Academy of Sciences - National Research Council, Washington, D. C. Committee on Remote Sensing Programs for Earth Resource Surveys.

CORPORATE SOURCE

TITLE

MICROWAVE REMOTE SENSING FROM SPACE FOR EARTH RESOURCE SURVEYS

1977 141 p refs

PUBLICATION DATE

CONTRACT OR GRANT

(Contract NASw-3043)

(NASA-CR-157891) Avail: NTIS HC A07/MF A01 CSCL 05B

REPORT NUMBER

AVAILABILITY SOURCE

The concepts of radar remote sensing and microwave radiometry are discussed and their utility in earth resource sensing is examined. The direct relationship between the character of the remotely sensed data and the level of decision making for which the data are appropriate is considered. Applications of active and a passive microwave sensing covered include hydrology, land use, mapping, vegetation classification, environmental monitoring, coastal features and processes, geology, and ice and snow. Approved and proposed microwave sensors are described and the use of space shuttle as a development platform is evaluated. A.R.H.

TYPICAL CITATION AND ABSTRACT FROM *IAA*

NASA SPONSORED DOCUMENT

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AIAA ACCESSION NUMBER

TITLE

A79-11385 * # A comparison of photointerpretive and digital production methods for four key remote sensing-based information products. L. F. Eastwood, Jr., T. R. Hays, R. J. Ballard, and G. G. Crnkovich (Washington University, St. Louis, Mo.). In: Conference on the Economics of Remote Sensing Information Systems, 1st, San Jose, Calif., January 19-21, 1977, Proceedings. San Jose, Calif., San Jose State University, 1977, p. 213-228. 10 refs. Contract No. NAS5-20680.

AUTHORS

AUTHORS AFFILIATION

MEETING

CONTRACT OR GRANT

MEETING DATE

This paper evaluates the costs of producing four remote sensing-based information products: timber volume estimate tables, Level II land use/land cover maps, soil maps, and vegetative cover maps. Two production methods for each product are evaluated, one is based on digital processing of satellite data, and the other on conventional photointerpretation of aircraft data. For each product, a comparison is conducted of the two strategies' production costs (including data acquisition, 'ground truthing', interpretation, compilation, and printing charges) and their performance (as measured by accuracy and timeliness). Each of the production methods reviewed has been demonstrated - either operationally or experimentally - and the costs, timeliness and other performance estimates presented are based on observations made in practice. The results show that for these products, satellite-based production results in significant cost and timeliness improvements at the cost of a loss in accuracy. (Author)

EARTH RESOURCES

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OCTOBER 1979

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AGRICULTURE AND FORESTRY

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

A79-32265 **The radar signature of natural surfaces and its application in active microwave remote sensing.** E. P. W. Attema (Delft, Technische Hogeschool, Delft, Netherlands). In: Surveillance of environmental pollution and resources by electromagnetic waves; Proceedings of the Advanced Study Institute, Spatind, Norway, April 9-19, 1978. Dordrecht, D. Reidel Publishing Co., 1978, p. 227-252. 12 refs.

The general characteristics of the radar echo from natural land surfaces are discussed, and theoretical and experimental evidence on radar signatures is reviewed. Emphasis is on vegetation and bare soil. Radar signature studies provide the basis for the application of active microwave remote sensing using the intensity of the radar echo and facilitate the selection of optimum sensor parameters for a particular application. P.T.H.

A79-32274 **Experiences from applying aircraft and satellite MSS-data to earth resources inventory problems in Sweden.** T. Orhaug, L.-E. Gustafsson, S. I. Akersten (Forsvarets Forskningsanstalt, Linkoping, Sweden), and L. Wastenson (Stockholm, Universitet, Stockholm, Sweden). In: Surveillance of environmental pollution and resources by electromagnetic waves; Proceedings of the Advanced Study Institute, Spatind, Norway, April 9-19, 1978. Dordrecht, D. Reidel Publishing Co., 1978, p. 387-397. 16 refs.

This paper gives a brief report on some of the experience gained using satellite (Landsat, NOAA) as well as aircraft MSS-data. Projects have been carried out in various application fields like forestry, vegetation and land use. The aim of the projects have been both to introduce to the application community the MSS imagery data as well as the digital computer technique for handling, processing and analyzing such data. In a longer perspective, the aim has also been to investigate possible future operational applications of MSS-data. Forest inventorying management seems to be one promising field for more large scale and operational application of MSS-data. (Author)

A79-32656 # **Applying Landsat data in a geographic information system to delineate prime farmlands and evaluate their loss to urban expansion.** R. F. Hyde and C. L. Killpack (Butler University, Indianapolis, Ind.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 5, Oct. 1978, p.5-21. 8 refs.

A79-33045 **Bidirectional reflection of crops and the soil contribution.** V. R. Rao (Indian Space Research Organization, Bangalore, India), E. J. Brach (Department of Agriculture, Engineering and Statistical Research Institute, Ottawa, Canada), and A. R. Mack (Department of Agriculture, Land Resources Research Institute, Ottawa, Canada). *Remote Sensing of Environment,* vol. 8, May 1979, p. 115-125. 10 refs.

Spectra of cereals, grasses, and corn were measured repeatedly from preflowering to early maturity. The bidirectional and angular aspects were more pronounced for a standing crop such as cereals (oats) than for a clipped sod. The contribution of the soil to the total radiance and the amount of the total radiance were reduced by a greater percentage of ground cover. The effect of angular scattering on radiance decreased with maturity. (Author)

A79-33046 * **Red and photographic infrared linear combinations for monitoring vegetation.** C. J. Tucker (NASA, Goddard Space Flight Center, Earth Resources Branch, Greenbelt, Md.). *Remote Sensing of Environment,* vol. 8, May 1979, p. 127-150. 27 refs.

The relationships between various linear combinations of red and photographic infrared radiances and vegetation parameters are investigated. In situ spectrometers are used to measure the relationships between linear combinations of red and IR radiances, their ratios and square roots, and biomass, leaf water content and chlorophyll content of a grass canopy in June, September and October. Regression analysis shows red-IR combinations to be more significant than green-red combinations. The IR/red ratio, the square root of the IR/red ratio, the vegetation index (IR-red difference divided by their sum) and the transformed vegetation index (the square root of the vegetation index + 0.5) are found to be sensitive to the amount of photosynthetically active vegetation. The accumulation of dead vegetation over the year is found to have a linearizing effect on the various vegetation measures. A.L.W.

A79-36487 # **Forest type mapping from satellites six years after.** J. Beaubien (Department of Fisheries and the Environment, Laurentian Forest Research Centre, Sainte-Foy, Quebec, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 7-15. 9 refs.

Forest classification of two steeply contoured regions of northern Quebec, each about 15,000 sq km in area, was undertaken on the basis of digitally processed Landsat data and 254 ground-truth plots. Hardwood, mixed, and two or three types of softwood stands could be distinguished with unsupervised digital classification. For softwood stands, age and density, as well as the exposure and degree of the slope, played an important role in determining classifications. It proved impossible to discriminate between regenerated and mature hardwood stands. The severest limit on the use of Landsat data for the forest classifications was found to be the rarity of cloud-free imagery for a given date and area. J.M.B.

A79-36488 # **A remote sensing rangeland classification for the Lac-du-Bois grasslands, Kamloops, British Columbia.** E. K. Watson, P. A. Murtha (British Columbia, University, Vancouver, Canada), and A. L. van Ryswyk (Agriculture Canada, Kamloops, British Columbia, Canada). In: Canadian Symposium on Remote

Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 16-28. 12 refs. Research supported by Agriculture Canada.

A79-36489 # **Landsat automatic data processing survey of forest features in South Carolina.** R. D. Dillman (Lockheed Electronics Co., Inc., Houston, Tex.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 29-36. 18 refs.

Automatic classification of an oak-pine and southeastern pine ecosystem in South Carolina was undertaken on the basis of Landsat data. The ecosystem is characterized by small clumps of hardwood, softwood and grassland averaging 1200 ft in width; the scattered classes create many transition and mixed areas. The automatic classification study showed that early spring Landsat data provided the best feature differentiation for softwood, hardwood, grassland and water categories. An accuracy of 70% + or - 5.7% at the 90% confidence level was obtained for this type of feature differentiation. Multi-date data yielded only a two percent increase in classification accuracy over the single-date analysis. J.M.B.

A79-36495 # **An improved image enhancement technique and its application to forest fire management.** P. H. Kourtz (Department of Fisheries and the Environment, Forest Fire Research Institute, Ottawa, Canada) and A. J. Scott (Computing Devices of Canada, Ltd., Bells Corners, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 72-78.

An image enhancement technique based on the Karhunen-Loeve (principal component) transform is described. The transform, employed to reduce the number of features required to carry a specified amount of information, provides a rotation of the axes of the image space so as to align them along the axes of a hyperellipsoid defined by the signature of a training area. Selected classes can be enhanced by use of a given training area to define the Karhunen-Loeve transform. The image enhancement technique discussed in this paper has been applied to the production of large-scale color maps (based on Landsat imagery) for forest fire management. J.M.B.

A79-36496 # **An application of the ARIES system to ground vegetation mapping for forestry.** R. Piirvee (Environment Canada, Forest Management Institute, Ottawa, Canada) and K. N. Braun (Computing Devices Co., Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 79-85. 9 refs. Department of Supply and Services Contract No. OSQ-76-00068.

A79-36500 * # **Remote sensing as a tool for estimating soil erosion potential.** D. R. Morris-Jones, K. M. Morgan, and R. W. Kiefer (Wisconsin, University, Madison, Wis.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 120-126. 5 refs. U.S. Environmental Protection Agency Grant No. G005139-01; Grant No. NGL-50-002-127.

The Universal Soil Loss Equation is a frequently used methodology for estimating soil erosion potential. The Universal Soil Loss Equation requires a variety of types of geographic information (e.g. topographic slope, soil erodibility, land use, crop type, and soil conservation practice) in order to function. This information is traditionally gathered from topographic maps, soil surveys, field surveys, and interviews with farmers. Remote sensing data sources and interpretation techniques provide an alternative method for collecting information regarding land use, crop type, and soil conservation practice. Airphoto interpretation techniques and medium altitude, multi-date color and color infrared positive transparencies (70mm) were utilized in this study to determine their effectiveness for gathering the desired land use/land cover data. Successful results were obtained within the test site, a 6136 hectare watershed in Dane County, Wisconsin. (Author)

A79-36508 # **Assessing the influence of tree hedges on the heat budget at soil level by means of airborne thermography - Preview of Explorer HCMM capabilities (Etude par thermographie aéroportée de l'influences des haies d'arbres sur le bilan thermique au sol - Perspectives d'utilisation de la HCMM d'Explorer).** P. Boissard, P. Valery, P. Belluomo, and Ch. Goillot (Ministère de l'Agriculture, Paris; Institut National de la Recherche Agronomique, Versailles, France). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 192-199. 5 refs. In French.

A79-36511 # **Digital correction of hot spot in aerial visible-infrared photographic remote sensing.** F. E. Bunn, W. Langley, F. W. Thirkettle (Ph.D. Associates, Inc., Rexdale, Ontario, Canada), A. Mack (Agriculture Canada, Ottawa, Canada), and T. Kasvand (National Research Council, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 226-234. 7 refs. Department of Supply and Services Contract No. 07SZ-01525-7-0231.

A software system developed to correct for image quality degradation due to reflected sunlight enhancement in the antisolar direction (hot spots) in high altitude aerial three-color false color infrared photography is outlined. The correction program can utilize a filtering technique, which is found to produce the best uniform intensity results, or curve fitting to atmospheric Rayleigh scattering, which permits detailed understanding of ground surface effects. Classification trials of images corrected in both manners and uncorrected data of several crop types were found to be successful only when uncorrected data was used as the basis of classification. The correction programs have been subsequently modified to account for nonlinearities in the camera, film and digitalizer. A.L.W.

A79-36512 # **Thermal infrared mapping of forest fires.** M. E. Kirby, D. R. Inkster, S. D. McLean, S. Thompson, and H. McKay (Intera Environmental Consultants, Ltd., Calgary, Alberta and Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 235-243. 8 refs.

A thermal infrared system has been developed for Canadian forestry services in order to allow the precise mapping of a large forest fire in the regions often obscured from visual observation by smoke or darkness. The airborne system consists of a dual channel IR line scanner used in conjunction with a signal clipper device in order to prevent signal saturation and inversion problems. Real time data is processed on board and an image of the fire map can be air dropped to the fire boss within two minutes after the overflight. From the imagery generated over fires in 1978, it is found that the infrared fire mapping system produces useful information about the fire edge, fire intensity, spot fires and situational relationships of the fire, achieving its best results over active fire areas and spot fires where little solar heating had taken place during the previous 12 hours. A.L.W.

A79-36516 # **Forests and pyramids - Using image hierarchies to understand Landsat images.** E. Catanzariti and A. Mackworth (British Columbia, University, Vancouver, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 284-291. 16 refs. Research supported by the National Research Council of Canada and University of British Columbia.

The efficiency and feasibility of a pyramidal structure have been extensively tested on a typical Landsat image of a forested area of Vancouver Island. The results of several initial experiments indicate that, compared to a baseline of a traditional supervised maximum-likelihood classifier, the cost of maintaining the pyramid is balanced by a vast reduction in the number of pixel classifications. The spatial homogeneity or readability of the segmented image, as measured by the number of regions, is improved by a factor of three, while an improvement up to 6% in classification accuracy is obtained over the point by point classification. It is concluded that the pyramidal classifier can quickly classify a scene, providing a very clean and readable output with a correctness comparable or markedly better than that of the point by point classifier. Also, in the correctness/readability/efficiency tradeoff, structure parameters can be changed to obtain a fast rough glance at the scene, efficiently classify the image to meet production requirements better than a point by point classifier, or use the pyramid as a fast segmentation component of a more intelligent image understanding system. A.T.

A79-36524 # **Multi-channel synthetic aperture radar sensing of forest tree species.** R. A. Shuchman (Michigan, Environmental Research Institute, Ann Arbor, Mich.), R. Inkster, R. T. Lowry, and M. Wride (Intera Environmental Consultants, Ltd., Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 373-381. 9 refs.

The use of four-channel SAR imagery to distinguish tree species on a forested site was investigated. Imagery was obtained from radar operating at X-band (3.2 cm wavelength) and L-band (23 cm wavelength) with two polarizations in each band. The imagery was processed and interpreted using visual and digital techniques, and results were compared with extensive ground-truthing information. Relative radar backscatter values for different tree species were determined. It was concluded that multi-channel SAR data can be used to distinguish between deciduous trees and long- and short-needle conifers; however, discrimination between different species within these classes appeared risky. C.K.D.

A79-36528 # **Reduction of the uneven luminosity associated with high altitude wide angle aerial colour photographs.** T. Kasvand, C. Merritt (National Research Council, Ottawa, Canada), and A. R. Mack (Agriculture Canada, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 399-407. 6 refs.

The luminosity in high altitude superwide angle aerial colour photographs is highly uneven, which prevents automatic identification of crops and hinders visual interpretation. This paper describes the procedures, measurements and models needed to reduce the uneven luminosity. (Author)

A79-36529 # **Use of panchromatic and colour infrared air photographs to produce a vegetation map for Canadian Forces Base, Shilo, Manitoba.** G. D. Kerr (Canadian Armed Forces, Saint Bruno, Quebec, Canada), R. C. Rounds, and J. E. Welsted (Brandon, University, Brandon, Manitoba, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 408-414. 6 refs.

A79-36530 # **Documenting a 10-year change in land use and waterfowl habitat from digitized aerial photomaps.** G. D. Adams and G. C. Gentle (Canadian Wildlife Service, Praire Migratory Bird Research Centre, Saskatoon, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 415-426. 23 refs.

A79-36531 # **Mapping vegetation at 1:1 million from Landsat imagery.** J. Cihlar (Department of Energy, Mines and Resources, Applications Div., Ottawa, Canada), D. C. Thompson, and G. H. Klassen (Renewable Resources Consulting Services, Ltd., Edmonton, Alberta, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 427-440. 7 refs.

A map of vegetation patterns was prepared for an area of 95,000 sq km in the district of Keewaten, Northwest Territories, using Landsat images and field survey results. Eight summer Landsat scenes covering the study area were selected, and the area was stratified into sampling units by visual interpretation and digital analysis. Regions with similar cover type composition were defined by clustering field transect data collected within individual sampling units. Meaningful mapping units for vegetation mapping and caribou habitat evaluation were obtained with nine and four sampling unit clusters, respectively. Discriminant analysis showed that over three quarters of the individual field transects were correctly assigned at the four-cluster level. C.K.D.

A79-36532 # **Three tests of agricultural remote sensing for crop inventory in eastern Canada - Results, problems and prospects.** R. A. Ryerson (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), P. Mosher (New Brunswick Department of Agriculture, Plant Industry Branch, Fredericton, Canada), V. R. Wallen (Agriculture Canada, Ottawa, Canada), and N. E. Stewart (Prince Edward Island Department of Agriculture and Forestry, Charlottetown, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 441-453. 13 refs.

Landsat digital data and several types of airborne remote sensing imagery have been tested for determining white bean area in Ontario, potato area in New Brunswick, and potato and cropland distribution in Prince Edward Island. White bean area was determined with 85-91% accuracy using 1:104,000 colour IR photography and 91-96% accuracy using Landsat digital data. Potato area was 94% accurate using 1:112,000 true colour imagery and 85% accurate (for the province) using digital Landsat data. Discussed are the importance of ground based expertise in the crop being studied, test site selection, field data collection and its subsequent organization. Simple methods for handling overlap of spectral signatures, and boundary pixels, accuracy assessment, signature extension, and determining geographic positions on output maps are also detailed. (Author)

A79-36533 # **The thermal inertia concept and soil moisture (Le concept d'inertie thermique et l'humidité des sols).** F. Bonn, M. Bernier, R. Brochu, J. Laforest, J. Lévesque, and C. Prévost (Sherbrooke, Université, Sherbrooke, Quebec, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 454-459. 17 refs. In French. Research supported by the National Research Council of Canada and Ministère de l'Education du Québec.

Up to now no reliable and accurate method of mapping soil moisture has been developed. The thermal inertia concept is an approach which uses the thermal properties of soil water in relation to soil texture, by means of sequential thermography. The following problems are faced when establishing a soil moisture map from remote sensing data: the corrections to be done on the thermograms due to vegetation; the combining of day and night images; the integration of the albedo in making the thermal inertia map; and the combining of thermal inertia and texture to obtain soil moisture. The examples shown are from Southern Quebec, and are used as a base to evaluate the potential of HCMM images. (Author)

A79-36534 # **Remote sensing of surface temperature for soil moisture, evapotranspiration and yield estimation.** J. L. Hatfield

(California, University, Davis, Calif.), R. J. Reginato, R. D. Jackson, S. B. Idso, and P. J. Pinter (U.S. Department of Agriculture, Water Conservation Laboratory, Phoenix, Ariz.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 460-465. 12 refs.

The stress-degree-day concept for assessing crop evapotranspiration and yields by comparing midafternoon surface temperatures with air temperatures during the reproductive stage was applied to wheat crops grown at Phoeniz, Ariz. and Davis, Calif. Albedo changes determined the beginning and end of stress-day summation; an inverse relation between albedo and head size was elucidated. The stress-degree-day was found to be applicable to the same variety grown at different locations, although compensation for differences in yield potential is necessary. C.K.D.

A79-36540 * # **The Large Area Crop Inventory Experiment /LACIE/ - A summary of three years' experience.** R. B. Erb (NASA, Johnson Space Center, Houston, Tex.) and B. H. Moore (Lockheed Electronics Co., Inc., Systems and Services Div., Houston, Tex.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 542-554.

Aims, history and schedule of the Large Area Crop Inventory Experiment (LACIE) conducted by NASA, USDA and NOAA from 1974-1977 are described. The LACIE experiment designed to research, develop, apply and evaluate a technology to monitor wheat production in important regions throughout the world (U.S., Canada, USSR, Brasil) utilized quantitative multispectral data collected by Landsat in concert with current weather data and historical information. The experiment successfully exploited computer data and mathematical models to extract timely corp information. A follow-on activities for the early 1980's is planned focusing especially on the early warning of changes affecting production and quality of renewable resources and commodity production forecast. V.T.

A79-36686 * **Microwave backscatter dependence on surface roughness, soil moisture, and soil texture. II - Vegetation-covered soil.** F. T. Ulaby, G. A. Bradley, and M. C. Dobson (Kansas, University, Lawrence, Kan.). *IEEE Transactions on Geoscience Electronics,* vol. GE-17, Apr. 1979, p. 33-40. 6 refs. Contract No. NAS9-14052.

Results are presented for an experimental investigation to determine the relationship between radar backscatter coefficient (sigma) and soil moisture for vegetation-covered soil. These results extend a previous report which showed the experimental relationship between sigma and soil moisture for bare soil. It is shown that the highest correlation between sigma and soil moisture is 0.92 for the combined response of four crop types measured at 4.25 GHz, 10 deg incidence angle, and HH polarization. Radar look direction, relative to the crop row direction, is shown to have an insignificant effect on soil-moisture estimation if the radar frequency is higher than 4 GHz. The dependence on soil type can be minimized by expressing soil moisture in units of percent of field capacity. The possibility of using a single radar for measuring soil moisture for both bare and vegetated fields is demonstrated with a linear estimation algorithm having an experimental correlation coefficinet of 0.8. (Author)

A79-38372 **Temperature measurement of cooling water discharged from power plants.** J. R. Schott (Calspan Corp., Buffalo, N.Y.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, June 1979, p. 753-761. 8 refs. Research sponsored by the New York State Energy Research and Development Authority.

The paper discusses an airborne calibration technique for a thermal IR scanner, along with the experimental test program. The technique involves the development of a model relating the signal at the sensor to the surface temperature and the atmospheric effects contributing to the signal at the sensor. It is shown how the radiant energy detected by the sensor at aircraft altitudes of about 600 m is not only a function of temperature but also is functionally dependent on atmospheric and background terms. The calibration technique for temperature measurement of cooling water discharged from powerplants is successfully tested. Future efforts in this field are recommended to be directed at techniques designed to generate thermal maps with appropriate corrections at angles away from the vertical. S.D.

A79-38373 * **Cropping management using color and color infrared aerial photographs.** K. M. Morgan, D. R. Morris-Jones, G. B. Lee, and R. W. Kiefer (Wisconsin, University, Madison, Wis.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, June 1979, p. 769-774. 15 refs. Research supported by the University of Wisconsin; U.S. Environmental Protection Agency Grant No. G-005139-01; Grant No. NGL-50-002-127.

The Universal Soil Loss Equation (USLE) is a widely accepted tool for erosion prediction and conservation planning. Solving this equation yields the long-term average annual soil loss that can be expected from rill and inter-rill erosion. In this study, manual interpretation of color and color infrared 70 mm photography at the scale of 1:60,000 is used to determine the cropping management factor in the USLE. Accurate information was collected about plowing practices and crop residue cover (unharvested vegetation) for the winter season on agricultural land in Pheasant Branch Creek watershed in Dane County, Wisconsin. (Author)

A79-40252 # **Relationship between the soil cover of river valley and its image on an aerial photograph (Zwiazek miedzy pokrywa glebowa doliny rzecznej a jej obrazem na zdjeciu lotniczym).** J. Marcinek and J. Cierniewski (Poznan, Akademia Rolnicza, Poznan, Poland). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 9-25. 21 refs. In Polish.

Samples from the left bank of the Vistula River in the Wloclawek-Plock area were compared with panchromatic-film photographs. The cartographic soils investigated comprised acid brown forest soils, typical black meadow soils, alluvial soils, and alluvial silted muck soils. Detailed analysis of the aerial photographs made it possible to distinguish among the soil types studied. The results of the analysis are diagrammed and tabulated. V.P.

A79-40256 # **Applicability of repeated aerial photography to soil erosion studies (Przydatnosc powtarzanych zdjec lotniczych w badaniach erozji gleb).** E. Kleczewska and A. Kijowski (Poznan, Uniwersytet, Poznan, Poland). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 69-82. In Polish.

In the present study, repeated aerial photography was used to assess the influence of such factors as torrential rains on soil erosion in a high-land area representing a classical example of an area with extended end moraines. Corn, sugar beets, and wheat are grown in this area. Photographs made from 600 meters were used to study the relative effectiveness of the principal factors responsible for erosion. V.P.

A79-40280 **Monitoring the earth's resources from space - Can you really identify crops by satellite.** D. Landgrebe (Purdue University, West Lafayette, Ind.). In: National Computer Conference, New York, N.Y., June 4-7, 1979, Proceedings. Montvale, N.J., AFIPS Press, 1979, p. 233-241. 17 refs.

Review of the Landsat program and a few examples illustrating the cover mapping technology, especially the portion associated with computer processing, are presented. In the land cover examples, the Great Lakes maps (1973), the land use map of the Washington, D.C. urban area (1978), and the demonstration land cover map of the Puget Sound Region, are described. In the example in forestry it is noted that due to management aspects the information is required not in map but in statistical form. In the food commodity production forecast example the Large Area Crop Inventory Experiment (LACIE) is cited. The ability of this system to produce an accurate estimate has been proven by the wheat production forecast for the USSR in 1977. In all three cases an improvement in an existing data source was the objective rather than the production of a wholly new type of data. V.T.

A79-42397 * # **Applications of a high-altitude powered platform /HAPP/.** M. B. Kuhner (Battelle Columbus Laboratories, Columbus, Ohio). In: Lighter-Than-Air Systems Technology Conference, Palo Alto, Calif., July 11-13, 1979, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 146-154. 9 refs. Contract No. NASw-2800. NASA Task 19. (AIAA 79-1603)

The high-altitude powered platform (HAPP) is a conceptual unmanned vehicle which could be either an airship or airplane. It would keep station at an altitude of 70,000 ft above a fixed point on the ground. A microwave power transmission system would beam energy from the ground up to the HAPP to power an electric motor-driven propeller and the payload. A study of the HAPP has shown that it could potentially be a cost-competitive platform for such remote sensing applications as forest fire detection, Great Lakes ice monitoring and Coast Guard law enforcement. It also has significant potential as a communications relay platform for (among other things) direct broadcast to home TVs over a large region. (Author)

N79-22592*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COLOR ENHANCEMENT OF LANDSAT AGRICULTURAL IMAGERY: JPL LACIE IMAGE PROCESSING SUPPORT TASK Final Report
D. P. Madura, James M. Soha, William B. Green, David B. Wherry, and Stanley D. Lewis 15 Dec. 1978 59 p refs
(Contract NAS7-100)
(NASA-CR-158516; JPL-PUB-78-102) Avail: NTIS HC A04/MF A01

Color enhancement techniques were applied to LACIE LANDSAT segments to determine if such enhancement can assist analysis in crop identification. The procedure involved increasing the color range by removing correlation between components. First, a principal component transformation was performed, followed by contrast enhancement to equalize component variances, followed by an inverse transformation to restore familiar color relationships. Filtering was applied to lower order components to reduce color speckle in the enhanced products. Use of single acquisition and multiple acquisition statistics to control the enhancement were compared, and the effects of normalization investigated. Evaluation is left to LACIE personnel. Author

N79-23476*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
DETAILED ANALYSIS OF CAMS PROCEDURES FOR PHASE 3 USING GROUND TRUTH INVENTORIES
J. G. Carnes Apr. 1979 23 p
(Contract NAS9-15800)
(NASA-CR-160169; LEC-13343) Avail: NTIS HC A02/MF A01 CSCL 08B

The results of a study of Procedure 1 as used during LACIE Phase 3 are presented. The study was performed by comparing the Procedure 1 classification results with digitized ground-truth inventories. The proportion estimation accuracy, dot labeling accuracy, and clustering effectiveness are discussed. Author

N79-23479*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF SURFACE MOISTURE VARIATIONS WITHIN LARGE FIELD SITES
K. R. Bell, B. J. Blanchard, M. W. Witczak, and T. J. Schmugge Mar. 1979 39 p refs Submitted for publication
(NASA-TM-80264) Avail: NTIS HC A03/MF A01 CSCL 08H

A statistical analysis was made on ground soils to define the general relationship and ranges of values of the field moisture relative to both the variance and coefficient of variation for a given test site and depth increment. The results of the variability study show that: (1) moisture variations within any given large field area are inherent and can either be controlled nor reduced; (2) neither a single value of the standard deviation nor coefficient of variation uniquely define the variability over the complete range of mean field moisture contents examined; and (3) using an upper bound standard deviation parameter clearly defines the maximum range of anticipated moisture variability. 87 percent of all large field moisture content standard deviations were less than 3 percent while about 96 percent of all the computed values had an upper bound of sigma=4 percent for these intensively sampled fields. The limit of accuracy curves of mean soil moisture measurements for large field sites relative to the required number of samples were determined. Author

N79-24407 Texas A&M Univ., College Station.
EVALUATION OF LANDSAT MSS DATA FOR CLASSIFYING AND CHARACTERIZING NATURAL VEGETATION ON A REGIONAL BASIS Ph.D. Thesis
Kirk Cole McDaniel 1978 200 p
Avail: Univ. Microfilms Order No. 7909220

Landsat imagery was used to map and classify natural vegetation throughout northcentral Texas and southcentral Oklahoma. Computer compatible Landsat digital data were analyzed to determine the relationship between spectral reflectance and different vegetation parameters measured on the ground. Three contributions in remote sensing of natural vegetation from satellite data products are (1) a natural vegetation classification suitable for remote sensing use, (2) the evaluation of different dates of imagery for relative information content, and (3) information relating LANDSAT multispectral scanner digital data to quantitative vegetation measurements. Results provide guidelines for employing a Landsat image/data analysis approach to be used in natural resource management programs. The results are particularly appropriate for use and application in regional vegetation survey programs. Dissert. Abstr.

N79-24410*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
STRATIFICATION AND SAMPLE SELECTION FOR MULTICROP EXPERIMENTS
D. A. Landgrebe, Principal Investigator, M. M. Hixson, B. J. Davis, and M. E. Bauer Nov. 1978 53 p EREP
(Contract NAS9-15466)
(E79-10190; NASA-CR-160154; LARS-CR-112278) Avail: NTIS HC A04/MF A01 CSCL 02C

The author has identified the following significant results. A stratification was performed and sample segments were selected for an initial investigation of multicrop problems in order to support development and evaluation of procedures for using LACIE and other technologies for the classification of corn and soybeans, to identify factors likely to affect classification performance, and to evaluate problems encountered and techniques which are applicable to the crop estimation problem in foreign countries. Two types of samples, low density and high density, supporting these requirements were selected as research data set for an initial evaluation of technical issues. Looking at the geographic location of the strata, the system appears to be logical and the various segments seem to represent different conditions. This result is supportive not only of the variables and the methodology employed in the stratification, but also of the validity of the data sets employed.

N79-24411*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
NATIONWIDE FORESTRY APPLICATIONS PROGRAM. TEN-ECOSYSTEM STUDY (TES) SITE 8, GRAYS HARBOR COUNTY, WASHINGTON Final Report
J. C. Prill, Principal Investigator Mar. 1979 95 p refs Sponsored in part by US Forest Service Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(Contract NAS9-15800)

(E79-10191; NASA-CR-160152; LEC-12911; JSC-14777) Avail: NTIS HC A05/MF A01 CSCL 13B

The author has identified the following significant results. Level 2 forest features (softwood, hardwood, clear-cut, and water) can be classified with an overall accuracy of 71.6 percent plus or minus 6.7 percent at the 90 percent confidence level for the particular data and conditions existing at the time of the study. Signatures derived from training fields taken from only 10 percent of the site are not sufficient to adequately classify the site. The level 3 softwood age group classification appears reasonable, although no statistical evaluation was performed.

N79-24413*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). AN OVERVIEW OF THE LARGE AREA CROP INVENTORY EXPERIMENT AND THE OUTLOOK FOR A SATELLITE CROP INVENTORY

R. Bryan Erb, Principal Investigator Mar. 1979 14 p Presented at 1st Brazilian Remote Sensing Symp., Sao Jose Dos Campos, Brazil, 27-29 Nov. 1978 Sponsored by NASA, NOAA, and USDA EREP

(E79-10193; NASA-TM-80431; JSC-13761) Avail: NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results. The most important LACIE finding was that the technology worked very well in estimating wheat production in important geographic locations. Based on working through the many successes and shortcomings of LACIE, it can be stated with confidence that: (1) the current technology can successfully monitor what production in regions having similar characteristics to those of the U.S.S.R. wheat areas and the U.S. hard red winter wheat areas; (2) with additional applied research, significant improvements in capabilities to monitor wheat in these and other important production regions can be expected in the near future; (3) the remote sensing and weather effects modeling technology approached used by LACIE is generally applicable to other major crops and crop-producing regions of the world; and (4) with suitable effort, this technology can now advance rapidly and could be widespread use in the late 1980's.

N79-24414*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). METHODOLOGY FOR AREA, YIELD AND PRODUCTION ESTIMATION, RESULTS AND PERSPECTIVE

R. Bryan Erb, Principal Investigator 1977 14 p refs Presented at Advanced Seminar on Remote Sensing Applications in Agriculture and Hydrology, Ispra, Italy, 21 Nov. - 2 Dec. 1977 Sponsored by NASA, NOAA, and USDA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP

(E79-10194; NASA-CR-158485; JSC-13760) Avail: NTIS HC A02/MF A01 CSCL 02C

N79-24415*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.

RESEARCH IN REMOTE SENSING OF AGRICULTURE, EARTH RESOURCES, AND MAN'S ENVIRONMENT Quarterly Report, 1 Dec. 1978 - 28 Feb. 1979

D. A. Landgrebe 28 Feb. 1979 65 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP

(Contract NAS9-15466)

(E79-10195; NASA-CR-160143; LARS-CR-022879) Avail: NTIS HC A04/MF A01 CSCL 05B

N79-24416*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). DEVELOPMENT OF PROCEDURE M FOR MULTICROP INVENTORY, WITH TESTS OF A SPRING-WHEAT CONFIGURATION Final Report, 15 May 1977 - 14 Nov. 1978

Robert Horvath, Principal Investigator, R. Cicone, E. Crist, R. Kauth, P. Lambeck, W. Malila, and W. Richardson Mar. 1979 142 p refs Sponsored by NASA, NOAA, and USDA EREP

(Contract NAS9-15476)

(E79-10197; NASA-CR-160140; ERIM-132400-16-F) Avail: NTIS HC A07/MF A01 CSCL 02C

The author has identified the following significant results. An outgrowth of research and development activities in support of LACIE was a multicrop area estimation procedure, Procedure M. This procedure was a flexible, modular system that could be operated within the LACIE framework. Its distinctive features were refined preprocessing (including spatially varying correction for atmospheric haze), definition of field like spatial features for labeling, spectral stratification, and unbiased selection of samples to label and crop area estimation without conventional maximum likelihood classification.

N79-25447*# Ecosystems International, Inc., Gambrills, Md.

GLOBAL CROP PRODUCTION FORECASTING DATA SYSTEM ANALYSIS Final Report

Peter A. Castruccio, Principal Investigator, Harry L. Loats, and Donald G. Lloyd Jan. 1978 192 p refs ERTS

(Contract NAS8-32408)

(E79-10198; NASA-CR-161199; ECO-1979-3) Avail: NTIS HC A09/MF A01 CSCL 02C

The author has identified the following significant results. Findings led to the development of a theory of radiometric discrimination employing the mathematical framework of the theory of discrimination between scintillating radar targets. The theory indicated that the functions which drive accuracy of discrimination are the contrast ratio between targets, and the number of samples, or pixels, observed. Theoretical results led to three primary consequences, as regards the data system: (1) agricultural targets must be imaged at correctly chosen times, when the relative evolution of the crop's development is such as to maximize their contrast; (2) under these favorable conditions, the number of observed pixels can be significantly reduced with respect to wall-to-wall measurements; and (3) remotely sensed radiometric data must be suitably mixed with other auxiliary data, derived from external sources.

N79-25450*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). AN EARLY ESTIMATE OF SMALL GRAINS ACREAGE

Robert N. Lea and Dennis M. Kern, Principal Investigators (NRC) Mar. 1979 48 p refs Sponsored by NASA, NOAA, and USDA EREP

(E79-10201; NASA-TM-80418; Rept-79-FM-13; JSC-14782) Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. A major advantage of this scheme is that it needs minimal human intervention. The entire scheme, with the exception of the choice of dates, can be computerized and the results obtained in minutes. The decision to limit the number of acquisitions processed to four was made to facilitate operation on the particular computer being used. Some earlier runs on another computer system were based on as many as seven biophase-1 acquisitions.

N79-25457*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.

NATURAL RESOURCES INVENTORY SYSTEM ASVT PROJECT Final Report

Armond T. Joyce, Principal Investigator Apr. 1978 129 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D., 57198 ERTS

(E79-10208; NASA-TM-80416; Rept-174) Avail: NTIS HC A07/MF A01 CSCL 05B

The author has identified the following significant results. One of the main advantages, both cost-wise and time-wise, of the natural resource inventory system involved the use of

LANDSAT-acquired digital data for the land cover information component; thereby, eliminating the need to digitize such dynamic information from a map or aerial photo base. It was thought that the utility and the cost of information as derived from LANDSAT data for the various applications justified the operational use of data generated by LANDSAT.

N79-25461*# General Electric Co., Huntsville, Ala. Space Div.
SWATH WIDTH STUDY. A SIMULATION ASSESSMENT OF COSTS AND BENEFITS OF A SENSOR SYSTEM FOR AGRICULTURAL APPLICATION Final Report
Apr. 1979 59 p refs
(Contract NAS8-32491)
(NASA-CR-161232; Rept-79HV001) Avail: NTIS HC A04/MF A01 CSCL 02C

Satellites provide an excellent platform from which to observe crops on the scale and frequency required to provide accurate crop production estimates on a worldwide basis. Multispectral imaging sensors aboard these platforms are capable of providing data from which to derive acreage and production estimates. The issue of sensor swath width was examined. The quantitative trade trade necessary to resolve the combined issue of sensor swath width, number of platforms, and their orbits was generated and are included. Problems with different swath width sensors were analyzed and an assessment of system trade-offs of swath width versus number of satellites was made for achieving Global Crop Production Forecasting. Author

N79-26442*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
SUMMARY OF NASA AIRCRAFT (NC-130) DATA COLLECTED FOR THE AGRICULTURAL SOIL MOISTURE EXPERIMENT (ASME) DURING 1978
F. R. Brumbaugh, Principal Investigator Mar. 1979 31 p EREP
(Contract NAS9-15800)
(E79-10215; NASA-CR-160163; LEC-12892; JSC-14815)
Avail: NTIS HC A03/MF A01 CSCL 08M

N79-26443*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
A SIMULATION STUDY OF LARGE AREA CROP INVENTORY EXPERIMENT (LACIE) TECHNOLOGY
L. Ziegler, Principal Investigator and J. Potter May 1979 31 p ref Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10216; NASA-CR-160182; JSC-14547; LEC-12180)
Avail: NTIS HC A03/MF A01 CSCL 02C

The author has identified the following significant results. The LACIE performance predictor (LPP) was used to replicate LACIE phase 2 for a 15 year period, using accuracy assessment results for phase 2 error components. Results indicated that the (LPP) simulated the LACIE phase 2 procedures reasonably well. For the 15 year simulation, only 7 of the 15 production estimates were within 10 percent of the true production. The simulations indicated that the acreage estimator, based on CAMS phase 2 procedures, has a negative bias. This bias was too large to support the 90/90 criterion with the CV observed and simulated for the phase 2 production estimator. Results of this simulation study validate the theory that the acreage variance estimator in LACIE was conservative.

N79-26444*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
BRIEFING MATERIALS FOR PLENARY PRESENTATIONS: THE LACIE SYMPOSIUM
Oct. 1978 216 p refs Symp. held at Houston, Tex., Oct. 1978 Sponsored by NASA, NOAA, and USDA Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 EREP
(E79-10217; NASA-TM-80444; JSC-14700) Avail: NTIS HC A10/MF A01 CSCL 02C

N79-26445*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
TEN-ECOSYSTEM STUDY (TES) SITE 9, WASHINGTON COUNTY, MISSOURI Final Report
W. H. Echert, Principal Investigator Mar. 1979 84 p refs EREP
(Contract NAS9-15800)
(E79-10218; NASA-CR-160165; LEC-13000; JSC-14657)
Avail: NTIS HC A05/MF A01 CSCL 02F

The author has identified the following significant results. Sufficient spectral separability exists among softwood, hardwood, grassland, and water to develop a level 2 classification and inventory. Using the tested automatic data processing technology, softwood and grassland signatures can be extended across the county with acceptable accuracy; with more dense sampling, the hardwood signature probably could also be extended. Fall was found to be the best season for mapping this ecosystem.

N79-26446*# Lockheed Electronics Co., Houston, Tex. Systems and Services Div.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). SIGNATURE EXTENSION IN REMOTE SENSING
C. B. Chittineni, Principal Investigator Apr. 1979 24 p refs Sponsored by NASA, NOAA, and USDA EREP
(Contract NAS9-15800)
(E79-10219; NASA-CR-160166; JSC-14825; LEC-13189)
Avail: NTIS HC A02/MF A01 CSCL 12A

N79-27629*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). AN EARLY ESTIMATE OF SMALL GRAINS ACREAGE
Robert N. Lea and Dennis M. Kern, Principal Investigators (NRC) Mar. 1979 48 p refs Sponsored by NASA, NOAA, and USDA EREP
(E79-10212; NASA-TM-80446; JSC-14782; Rept-79-FM-13)
Avail: NTIS HC A03/MF A01 CSCL 02C

N79-27637*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RADIOMETRIC RESOLUTION FOR MONITORING VEGETATION: HOW MANY BITS ARE NEEDED?
Compton J. Tucker May 1979 32 p refs Submitted for publication
(NASA-TM-80293) Avail: NTIS HC A03/MF A01 CSCL 02F

The significance of the various number of radiometric quantizing levels required for satellite monitoring of vegetation resources was evaluated by using in situ collected spectral reflectance data, an atmospheric radiative transfer simulation model, and a satellite sensor simulation model. Reflectance data were converted to radiance data; passed through a model atmosphere to an altitude of 706 km; and subsequently quantized at 16, 32, 64, 128, 256, and 512 digital count levels for Thematic Mapper bands TM3(0.63 - 0.69 microns) and TM4(0.76 - 0.90 microns). The simulated digital count data were regressed against the in situ biological data to quantify the relationship between quantizing levels. Author

N79-27639*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF LEAF WATER CONTENT IN THE NEAR INFRARED
C. J. Tucker May 1979 23 p refs Submitted for publication
(NASA-TM-80291) Avail: NTIS HC A03/MF A01 CSCL 02F

A stochastic leaf radiation model was used to predict leaf spectral reflectance as a function of leaf water content for a dicot leaf. Simulated spectral reflectances, corresponding to different leaf water contents or equivalent water thicknesses, were analyzed to quantify reflectance differences between different equivalent water thicknesses. Simulation results coupled with consideration of atmospheric transmission properties and the incident solar spectral irradiance at the earth's surface resulted in the conclusion that the approximately 1.55 - 1.75 microns region was the best suited wavelength interval for satellite-platform remote sensing of plant canopy water status in the 0.7 - 2.5 microns region of the spectrum. Author

N79-27645# Instituut voor Culturrtechniek en Waterhuishouding, Wageningen (Netherlands).

THE TERGRA MODEL: A MATHEMATICAL MODEL FOR THE SIMULATION OF THE DAILY BEHAVIOR OF CROP SURFACE TEMPERATURE AND ACTUAL EVAPOTRANSPIRATION

G. J. R. Soer Nov. 1977 53 p refs

(Rept-1014) Avail: NTIS HC A04/MF A01

The TERGRA model was developed as an aid for the interpretation of IRL images of cropped surfaces, with particular emphasis on grasslands. It is based on the transport equations for one-dimensional vertical heat and moisture flow in the soil-plant-atmosphere continum. Boundary conditions are the temperature and soil moisture pressure at a reference level in the soil, the energy balance equation of the crop surface, and the temperature and water vapor pressure at a reference level in the atmosphere. Some relations between model parameters are introduced in the model. A numerical algorithm to solve the transport equation completes the model. Model test results show good agreement with actual measurements done at the Losser study area. Author (ESA)

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.

A79-32253 **Surveillance of environmental pollution and resources by electromagnetic waves; Proceedings of the Advanced Study Institute, Spatind, Norway, April 9-19, 1978.** Institute sponsored by NATO. Edited by T. Lund (Norges Teknisk-Naturvitenskapelige Forskningsrad, Kjeller, Norway). Dordrecht, D. Reidel Publishing Co. (NATO Advanced Study Institutes Series. Volume C45), 1978. 417 p. $39.

The papers report on advances in instrumental techniques and analytical methods of atmospheric, ocean, and land monitoring of pollution and resources. Topics studied include signal-to-noise ratio of heterodyne lidar systems in the presence of atmospheric turbulence, infrared laser automated field instrumentation for monitoring the atmosphere, holographic real time seeing through moving scattering media, scattering of electromagnetic waves from the ocean, correction of airborne IR-scanner data, digital analysis of multichannel radar data, and laser-induced fluorescence techniques for hydrosphere sounding. P.T.H.

A79-32254 **Fundamentals of remote sensing methodology.** D. T. Gjessing (Norges Teknisk-Naturvitenskapelige Forskningsrad, Kjeller, Norway). In: Surveillance of environmental pollution and resources by electromagnetic waves; Proceedings of the Advanced Study Institute, Spatind, Norway, April 9-19, 1978. Dordrecht, D. Reidel Publishing Co., 1978, p. 13-34. 7 refs.

The paper discusses some general principles of optimum detection, identification, and evaluation of an object or chemical agent by remote sensing methods. The basic concept is that, knowing the geometrical shape of the target of interest and its molecular surface structure, an illumination function can be structured (matched filter concept) which gives optimum system sensitivity (minimum receiver bandwidth) to the object of interest. The matched illumination concept can be used to obtain data on the chemical surface composition of an object, gas emitted from an object, chemical composition of the atmosphere, and the distribution of various algae populations in water. Another concept is the determination of target distribution in space by spatial correlation measurements of field strength. P.T.H.

A79-35500 **Land-use/land-cover mapping from aerial photographs.** R. D. Baker, J. E. DeSteiguer, D. E. Grant, and M. J. Newton (Texas A & M University, College Station, Tex.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, May 1979, p. 661-668. 7 refs.

Land-use or land-cover mapping is currently very popular. Land-use maps provide an information source for sound land resource management decisions. If aerial photographs are to provide data for land-use/land-cover mapping, they must be suited for the job, must be interpreted in a professional manner, and the map product must be usable. A routine set of techniques should be developed. The key for a successful project is trained and trainable photo interpreters, organized procedures, written category descriptions, and an accuracy determination. Several illustrations of category definitions and pictorial elements for category recognition are presented. (Author)

A79-36092 # **Satellite data collection.** A. F. Flanders (NOAA, Silver Spring, Md.). In: PLANS 1978; Position Location and Navigation Symposium, San Diego, Calif., November 6-9, 1978, Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1978, p. 355-358.

The Data Collection System (DCS) of the two GOES satellites provides for constant viewing of the same earth surface area, near continuous detection and tracking of hurricanes and storms over the U.S. and adjacent ocean areas, and real-time collection and relay of data from observing platforms and remote stations. The DCS is designed to accommodate 10,000 observing platforms within each 6-hour period and it will accommodate interrogated and self-timed types of Data Collection Platform radio sets (DCPRS). User costs are for the purchase and installation of the DCPRS and for the line charges from NOAA's National Environmental Satellite Service to the user facility. It is concluded that DCS provides much needed observations from remote areas for the environmental monitoring and prediction field, essentially upon demand. The text of the NOAA-user agreement for the acquisition of environmental observations via GOES DCS is appended. A.T.

A79-36501 # **Automated land classification in the boreal zone using Landsat digital data.** C. D. Rubec (Environment Canada, Lands Directorate, Ottawa, Canada) and G. M. Wickware (Environment Canada, Lands Directorate, Burlington, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 127-135. 22 refs.

In the present paper, it is shown that Landsat digital data are well suited for synoptic land use/cover mapping, but are poorly suited for ecological land classification on a Canadian Shield landscape characterized by heavy logging, windthrow, and forest fire. Automatically produced Image-100 maps of a 1200 sq km area near Kenora, Ontario, provide a satisfactory description of cover types in this physiographically complex region, but not the detailed data that are present on traditional forest cover maps or ecological land maps. V.P.

A79-36502 # **Land use monitoring with Lansat digital data in southwestern Manitoba.** C. D. Rubec and J. Thie (Environment Canada, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 136-149. 15 refs.

Landsat digital data interpretation for a 500 sq km Manitoba region, using the Image 100 system is shown to be effective for detailed 1:50,000 scale land use monitoring. It is believed that automated monitoring using satellite data of some land use classifications such as wooded cover, agricultural land and open water, where accuracy reaches up to 95%, will form an important component in a national land use monitoring program. Other classes of land use and specific areas will require auxiliary data and other interpretation approaches. V.T.

A79-36503 # **Wetland mapping and environmental monitoring using digital Landsat data.** G. M. Wickware (Environment Canada, Environmental Management Service, Burlington, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 150-157. 18 refs. Research supported by Parks Canada.

Supervised and unsupervised analyses of Landsat digital data were employed in mapping a 1,175 sq km wetland area of the Peace-Athabasca Delta region of northern Alberta. A combination of supervised and migrating means unsupervised classifications provided a record of eight major habitat types. An unsupervised four-dimensional histogram algorithm yielded a record of five habitat types. The results of the classifications were in good agreement with photointerpretation techniques on 1:100,000 scale color infrared photographs, and with available habitat maps of the area. In particular, the Landsat digital data provided effective classifications of hydrologic-vegetation units sensitive to environmental change. J.M.B.

A79-36504 # **The potential of remotely sensed data for air quality forecasts.** E. F. LeDrew, R. Douglas, and J. MacGillivray (Waterloo, University, Waterloo, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 158-164. 10 refs. Research supported by the University of Waterloo; Department of the Environment Contract No. TOX-77-9030/1.

Albedo and surface roughness values derived from remote sensing data have been adopted for prognostic air quality models that involve surface energy exchanges. Maps of surface cover characteristics based on interpretation of 1:120,000 color and color infrared imagery were used in deriving the albedo and roughness values. The air quality model, which was applied to an industrial development on the north shore of Lake Erie, provided a simulation of mesoscale flow directed inland from the industrial zone. It is concluded that remote sensing data with a sufficient degree of accuracy have potential for updating the energy balance parameters in air quality forecasts. J.M.B.

A79-36526 # **Supplementary aerial photography in the planning and management of national parks.** D. W. Dalman (Ontario Ministry of the Environment, Environmental Approvals Branch, Toronto, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 391-395. Research supported by Parks Canada.

Several applications of supplementary aerial photography (SAP) in planning and management of national parks are discussed. Color infrared SAP at a large contact scale (1:3,000) can be effectively used to detect manifestations of environmental stress (disease, erosion, changes in the water table and in insect population levels) in the forest canopy. Satisfactory estimates of the rate and direction of changes in the littoral zone can be made if appropriate ground control targets are selected. If used repetitively, SAP can provide a useful monitoring technique to identify changes in user patterns. C.K.D.

A79-36527 # **The use of low-level oblique aerial photography for environmental management in Elliot Lake area.** R. E. Johnson and J. N. Mulvaney (Ministry of the Environment, Toronto, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 396-398.

A79-40227 **Remote sensing sensors for environmental studies.** B. S. Mathur (Ministry of Transporation and Communications, Downsview, Ontario, Canada). *(American Society of Civil Engineers, Convention and Exposition and Continuing Education Program, Chicago, Ill., Oct. 16-20, 1978.) ASCE, Transportation Engineering Journal,* vol. 105, July 1979, p. 439-455. 7 refs.

The application of multispectral photography and thermal IR line scanner imagery to data collection procedure for highway environmental impact studies is evaluated. A brief description is given of the data acquisition procedures and sensors used. It is shown that the key to realizing the full potential of multispectral photography and thermal IR line scanner imagery lies in developing spectral and thermal signatures for relevant parameters in an environmental impact study. Once these signatures are developed and verified, multispectral photography and thermal IR imagery are likely to become operational tools. S.D.

A79-40255 # **Experience with the application of multispectral space photography to geographic studies and thematic mapping (Opyt primeneniia mnogozonal'noi kosmicheskoi s'emki v geograficheskikh issledovaniiakh i tematicheskom kartografirovanii).** V. I. Kravtsova (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 48-68. 8 refs. In Russian.

The present paper deals with the interpretation of multispectral photographs of the earth surface obtained onboard the Soyuz 12 spacecraft with the narrow-band LKSA camera. The geographic interpretation and interpretation for special purpose mapping of 1:8,000,000 photographs obtained in six spectral bands is discussed and illustrated by examples. V.P.

A79-40260 # **Extraction of information on landscape elements detected by balloon photography (Traitement informatique des unités de paysage détectées par photographies-ballon).** M. C. Girard (Paris-Grignon, Institut National Agronomique, Paris, France). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 111-123. 9 refs. In French.

Because aerial photographs and satellite images are not capable to meet each of the conditions required for obtaining a synthetic picture of a landscape, balloon photography was used in France to obtain 1:400,000 black-and-white spectral-filter photographs. A programmed processing technique which yields (magnetic- and perforated-tape) information for landscape classification purposes is described. V.P.

A79-40261 # **Radar imaging in studies of the geographical environment (Teledetekcja radarowa w badaniach srodowiska geograficznego).** S. Morawski (Wroclaw, Uniwersytet, Wroclaw, Poland). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 124-132. 7 refs. In Polish.

The characteristics of the side-looking airborne radar are reviewed, along with the factors which affect the quality of SLAR images. Methods of interpreting SLAR images are outlined. V.P.

A79-40263 # **Multiband acquisition and processing of data on the geographic environment (Wielopasmowe zbieranie i przetwarzanie informacji o srodowisku geograficznym).** J. Butowtt and J. Sanecki (Wojskowa Akademia Techniczna, Warsaw, Poland). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 143-151. In Polish.

The present paper deals with such issues as the factors affecting the recording of information by detectors, the utilization of data recorded with a multiband system, and the characteristics of multiband data acquisition. Particular attention is given to the application of computers to multiband data analysis. V.P.

A79-40264 # **Remote sensing of a geographical environment with a spectrophotometer (Zdalne badanie srodowiska geograficznego za pomoca spektrofotometru).** J. Sanecki (Wojskowa Akademia Techniczna, Warsaw, Poland). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 152-160. In Polish.

The physical aspects of spectrophotometry are discussed, and a spectrophotometric technique suitable for use both in the laboratory and for remote sensing is outlined. The design and principle of an airborne remote sensing spectrophotometer are examined, along with the instrument's optical system. V.P.

N79-22586*# Ohio Dept. of Economic and Community Development, Columbus.
DEVELOPMENT OF A MULTI-DISCIPLINARY ERTS USER PROGRAM IN THE STATE OF OHIO. VOLUME 1: EXECUTIVE SUMMARY Final Report
Paul E. Baldridge, Charles Weber, Gary Schaal (Ohio Dept. of Natural Resources), Carl Wilhelm (EPA), G. E. Wurelic (Battelle Columbus Labs.), J. G. Stephan (Battelle Columbus Labs.), T. F. Ebbert (Battelle Columbus Labs.), H. E. Smail (Battelle Columbus Labs.), J. McKeon (Ben Dix Aerospace Systems Div.), and N. Schmidt, Principal Investigators (Bendix Aerospace Systems Div.) 5 Feb. 1977 430 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Contract NAS2-2399)

(E79-10187; NASA-CR-158447) Avail: NTIS HC A19/MF A01 CSCL 05B

The author has identified the following significant results. A current uniform land inventory was derived, in part, from LANDSAT data. The State has the ability to convert processed land information from LANDSAT to Ohio Capability Analysis Program (OCAP). The OCAP is a computer information and mapping system comprised of various programs used to digitally store, analyze, and display land capability information. More accurate processing of LANDSAT data could lead to reasonably accurate, useful land allocations models. It was feasible to use LANDSAT data to investigate minerals, pollution, land use, and resource inventory.

N79-27641# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
DETERMINATION OF HOMOGENEOUS ZONES BY REMOTE SENSORS [DETERMINACAO DE ZONAS HOMOGENEAS ATRAVES DE SENSORIAMENTO REMOTO]
Adalton Paes Manso, Maria de Lourdes Neves deOliveira, and Maria Suelena Santiago Barros Apr. 1979 36 p refs In PORTUGUESE; ENGLISH summary
(INPE-1470-RPE/021) Avail: NTIS HC A03/MF A01

The urban community is neither an undefined and undifferentiated grouping, nor a casual reunion of buildings and people. From the standpoint of residential differentiation, a city presents areas which, with the consideration of their occupation, have acquired the character, culture and the qualities imposed by their inhabitants. An attempt was made to define a methodology which will allow a concise and objective identification of such groups. The technique is used is that of visual interpretation of low altitude images, obtained by remote sensing devices on panchromatic films. The cities of Sao dos Campos (1973 and 1977) and Cachoeira Paulista (1975) were used as test areas.
G.Y.

03
GEODESY AND CARTOGRAPHY

Includes mapping and topography.

A79-33029 # **Polar motion determinations by the use of new observational techniques.** B. Kolaczek (Polish Academy of Sciences, Space Research Centre, Warsaw, Poland) and W. Jaks (Astronomiczna Stacja Szerokosciowa, Borowiec, Poland). *Artificial Satellites,* vol. 13, Dec. 1978, p. 31-48. 37 refs. Research supported by the Polska Akademia Nauk.

The paper discusses some of the main satellite techniques being used to measure the motion of the earth's poles. The methods of determining the polar coordinates from satellite observations can be divided into kinematic and dynamic methods. The kinematic methods depend on investigating the periodic perturbations of orbital elements and the topocentric radius of satellites, while the dynamic methods analyze changes of the harmonic coefficients of the geopotential as a function of time. The basic relations used in satellite Doppler observations for polar coordinate determination, laser ranging to satellites for polar motion determination, and lunar laser ranging for determining certain earth rotation parameters are reviewed. P.T.H.

A79-33047 **The thermal inertia approach to mapping of soil moisture and geology.** D. A. Pratt and C. D. Ellyett (Newcastle, University, Newcastle, Australia). *Remote Sensing of Environment,* vol. 8, May 1979, p. 151-168. 32 refs.

The application of thermal inertia mapping, using satellite and airborne thermal infrared data together with broadband visible imagery, to soil moisture and geological mapping is examined. Results of a simulation of the effects of soil moisture, clay/sand content and porosity on the thermal properties of soils are presented. Thermal inertia is found to display a strong dependence on soil moisture and porosity, and a slight dependence on soil type, indicating the possibility of soil moisture mapping with limited interpretation of soil type and porosity. Mapping of soils in semi-arid environments for mineralogical content is not directly possible using thermal inertia mapping techniques; however it should be possible to detect soil changes based upon porosity and residual soil moisture content, which are functions of the mineralogical composition. A.L.W.

A79-35644 # **The cartographic-remote sensing interface.** J. C. Sherman (Washington, University, Seattle, Wash.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 5, July 1978, p. 21-26.

Remote sensing technology provides a number of benefits to cartography, including the capability of obtaining data in a very short time in a true spatial context, increased potential for repeated observations, and the possibility of determining the characteristics of near-global systems. Applications of remote sensing data to analyses of agronomy, settlement characteristics, hydrology and geomorphology are discussed. J.M.B.

A79-35645 # **General nature of the cartographic-remote sensing interface.** A. J. Kimerling (Oregon State University, Corvallis, Ore.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 5, July 1978, p. 27-34. 7 refs.

Cartographic information processing systems for remote sensing imagery are discussed, with emphasis on future developments in the cartography-remote sensing field. The combination of digital Landsat data or digitized aerial photography with digital cartographic base data may be a chief means of producing thematic maps in the future. Creating automated procedures capable of generalizing nominal-scale environmental data for depiction on small-scale thematic maps represents one of the most difficult problems for cartographers working with remote sensing data. J.M.B.

A79-35646 # **The convergence of cartography and remote sensing.** E. A. Wingert (Hawaii, University, Honolulu, Hawaii). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 5, July 1978, p. 35-41.

The classification of remote sensing data according to the environmental processes which produced the radiative signature is among the chief tasks of the cartographer adapting remote sensing imagery to mapping. The cost and flexibility of manual and automated classification techniques are considered. Developing maps which do not contain excessive detail may be a means of controlling costs for some users. J.M.B.

A79-35647 # **Urban cartography using Landsat shade prints.** B. L. LaRose (Pace University, Briarcliff Manor, N.Y.) and G. C. Stierhoff (IBM Corp., Armonk, N.Y.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 5, July 1978, p. 57-65.

The use of shade prints of Landsat imagery to develop urban land-use classifications is discussed. The shade prints, available in the form of easily copied overstrike printouts, have been applied to land-use mapping of Manhattan and Washington, D.C. Techniques for separating atmospheric effects from cartographically significant information are considered. J.M.B.

A79-35919 # **Space technology in the service of geodesy, cartography, and earth science (Kosmicheskaia tekhnika na sluzhbe geodezii, kartografii i prirodovedeniia).** Iu. P. Kienko and A. V. Filipchenko. *Geodeziia i Kartografiia,* Mar. 1979, p. 26-32. In Russian.

The paper discusses a few examples of imagery taken aboard the Soyuz and the Salyut spacecraft. A photograph of a forest fire taken from Salyut-6 is shown. Some comments on the importance of this work for dynamic cartography are made. P.T.H.

A79-36075 **The MX 1502 satellite surveyor - Description and use.** S. Chamberlain (Magnavox Government and Industrial Electronics Co., Fort Wayne, Ind.). In: PLANS 1978; Position Location and Navigation Symposium, San Diego, Calif., November 6-9, 1978, Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1978, p. 99-104.

A portable position fixing unit which uses the Transit satellite system has been developed. The portable survey unit can compute three-dimensional positions on site, control its power consumption to conserve battery resources, and periodically test itself. An accuracy to within five meters rms is typical in the point positioning mode; an accuracy better than one meter rms may be obtained in the translocation mode. Setting up and operating the portable survey unit requires no particular electronic skills and can be learned in a few hours. Modular design simplifies field maintenance of the unit. J.M.B.

A79-36515 # **The CCRS Digital Image Correction System.** T. J. Butlin, F. E. Guertin, and S. S. Vishnubhatla (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 271-283. 6 refs.

The digital image correction system under development at the Canada Center for Remote Sensing for the correction of radiometric and geometric errors in Landsat MSS imagery is described. The system accepts and produces data on computer compatible tapes and consists of a PDP 11/70 minicomputer with a reprogrammable hardware corrector. The corrector performs detector equalization by means of individual lookup tables, and geometric repositioning and scene illumination compensation by means of piecewise linear functions of x, y, gain and offset. The image products are bounded by 0.5 deg latitude and 1 deg longitude with a 50 meter square pixel. Accuracy is better than 0.5 pixel and about five images can be processed in a day. The system can also be reprogrammed to process imagery acquired from other platforms or to offer other remote sensing products in a digital form. A.L.W.

A79-40254 # **Photointerpretation in the cartography of soils - Remarks concerning the preparation of a 1:50,000 map of soils in the Versaille plain (Fotointerpretacja w kartografii gleb uwagi z opracowywania mapy gleb niziny Wersalskiej w skali 1:50 000).** S. Bialousz (Warszawa, Politechnika, Warsaw, Poland). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 39-47. In Polish.

A79-40262 # **A photointerpretation technique for mapping heights of objects on the earth's surface and conducting viewing analyses for landscape planning purposes (Fotointerpretacyjna metoda opracowywania map wysokosci przedmiotow terenowych i przeprowadzania analiz widokowych na potrzeby planowania krajobrazu).** P. Wolski (Warszawa, Akademia Rolnicza, Warsaw, Poland). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 133-142. In Polish.

A79-40349 **Remote sensing - How far and how fine.** S. A. Hempenius (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *(International Association of Engineering Geology, Congress, 3rd, Madrid, Spain, Sept. 1978.) ITC Journal,* no. 1, 1979, p. 127-133.

The present paper concerns essentially some aspects of the acquisition and processing of data on objects and patterns on the earth surface from rapidly moving platforms. Methods of monitoring processes on the earth's surface from such platforms are discussed. V.P.

A79-40731 **Spacelab and observations of the earth (Spacelab et l'observation de la terre).** M. Fournet (ESA, Paris, France). In: Spacelab: Utilization and experimental design; Course on Space Technology, Toulouse, France, May 22-June 2, 1978, Proceedings. Toulouse, Centre National d'Etudes Spatiales, 1979, p. 493-507. In French.

The advantages and limitations of Spacelab as a platform for earth observations, specifically teledetection and spatial geodesy, are discussed. The types of missions in geodesy and teledetection envisioned for Spacelab are examined. Four typical experiments in these disciplines are described, including a photogrammetric chamber and microwave experiment to be flown with the first Spacelab payload, a SLALOM geodesy experiment in planning, and a proposed experiment in high-precision localization. C.K.D.

N79-22594# Control Data Corp., Minneapolis, Minn. Digital Image Systems Div.
DIGITAL CARTOGRAPHIC STUDY AND BENCHMARK Final Technical Report, 4 Jun. 1975 - Oct. 1978
D. J. Panton, M. E. Murphy, and D. S. Hanson Dec. 1978, 372 p refs
(Contract DAAG53-75-C-0195)
(AD-A064800; CDC-76003-78-R6; ETL-0168) Avail: NTIS HC A16/MF A01 CSCL 08/2

A flexible algorithm has been developed to meet the changing requirements for generating terrain data from digital stereo sensor records. The algorithm includes an image matching procedure in which parallax components are determined by automatically correlating conjugate image features. The algorithm is adaptive and can handle various types of sensor and natural terrain conditions. Reliability monitoring of the output terrain data is performed on the basis of the in-process analysis of local image areas. The reliability measure dictates various strategies that the algorithm can apply in image areas where automatic correlation is difficult. The algorithm was implemented on a distributive network of parallel digital processors. In this system, production speed is attained because of the inherent parallelism of the modular processors. Flexibility is maintained because the processors are microprogrammable. In this way, new sensor imaging characteristics and new algorithm strategies can be incorporated without disturbing the fundamental software and hardware structure of the system. Production times for compiling a representative stereo model on this parallel configuration far exceed the capability of general-purpose computers. GRA

N79-22595# Army Engineer Topographic Labs., Fort Belvoir, Va.
NEAR SURFACE BATHYMETRY SYSTEM
Gunther Schwarz Nov. 1978 35 p refs
(AD-A064532; ETL-0163) Avail: NTIS HC A03/MF A01 CSCL 08/10

This report describes the Near Surface Bathymetry System built under contract for Defense Mapping Agency - Hydrographic Center. Tests were performed to determine the characteristics and adherence to the specifications set forth in the Purchase Description. This report contains the results of these tests. Author (GRA)

N79-23558*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE MOHO AS A MAGNETIC BOUNDARY
Peter J. Wasilewski, Herman H. Thomas, and M. A. MayHew (BTS, Inc., Seabrook, Md.) Mar. 1979 22 p refs Submitted for publication
(NASA-TM-80245) Avail: NTIS HC A02/MF A01 CSCL 08G

Magnetic data are presented for mantle derived rocks: peridtites from St. Pauls rocks, dunite xenoliths from the kaupulehu flow in Hawaii, as well as peridolite, dunite, and eclogite xenoliths from Roberts Victor, Dutoitspan, Kilbourne Hole, and San Carlos diatremes. The rocks are paramagnetic or very weakly ferromagnetic at room temperature. Saturation magnetization values range from 0.013 emu/gm to less than 0.001 emu/gm. A review of pertinent literature dealing with analysis of the minerals in mantle xenoliths provides evidence that metals and primary Fe3O4 are absent, and that complex CR, Mg, Al, and Fe spinels dominate the oxide mineralogy. All of the available evidence supports the magnetic results, indicating that the seismic MOHO is a magnetic boundary. G.Y.

N79-27804 Columbia Univ., New York.
SHAPE OF THE OCEAN SURFACE AND IMPLICATIONS FOR THE EARTH'S INTERIOR Ph.D. Thesis
Michael Edward-Dewey Chapman 1979 210 p
Avail: Univ. Microfilms Order No. 7916393

For purposes of geological interpretation, techniques are developed to directly compute the geoid anomaly over models of density within the Earth. Ideal bodies such as line segments, vertical sheets, and rectangles are first used to calculate the geoid anomaly. Realistic bodies are modeled with formulas for two dimensional polygons and three dimensional polyhedra. Using Fourier transform methods the two dimensional geoid is seen to be a filtered version of the gravity field, in which the long wavelength components are magnified and the short wavelength components diminished. Dissert. Abstr.

04
GEOLOGY AND MINERAL RESOURCES

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

A79-35496 **Rock type discrimination using enhanced Landsat imagery.** F. Barzegar (Iranian Remote Sensing Center, Tehran, Iran). *Photogrammetric Engineering and Remote Sensing,* vol. 45, May 1979, p. 605-610.

Enhanced Landsat imagery has been utilized for distinguishing rock types in a 21,500 sq km area of Iran. Ground-truth investigations and previously obtained 1:20,000 scale aerial photography provided complementary data for the lithological mapping program. Three rock formations were analyzed: a cliff-forming cobble-size conglomerate, a slope-forming boulder-sized conglomerate, and alluvial regions. Density slicing enhancement proved to be an effective means for discriminating between the conglomerate types. J.M.B.

A79-35497 **Landsat geologic reconnaissance of the Washington, D.C. area westward to the Appalachians.** G. A. Rabchevsky, U. P. Boegli, and J. Valdes (American University, Washington, D.C.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, May 1979, p. 611-621. 15 refs. NSF-supported research.

The usefulness of satellite remote sensor imagery in the mapping of major geologic structures, boundaries of geologic units and lithologies, and geomorphic provinces in the Washington, D.C. area, westward to the Appalachian Plateau, was investigated. The remote sensor imagery data base consisted of Landsat satellite data and high altitude infrared aerial photography. Both laboratory and field work was utilized in the geologic analysis of the imagery. The imagery was processed primarily by photo-optical techniques and analyzed by conventional interpretation methods. A series of geological and geobotanical overlays were prepared to show the interpreted results. The results showed that conventional published geologic maps of regions can be effectively supplemented by interpreted satellite and aircraft imagery overlays. A special geologic contribution is the additional structural information derived from the imagery which may be useful in the search for new mineral targets in the Appalachians. (Author)

A79-36505 # **The effectiveness of multi-date, multi-scale aerial remote sensing imagery for monitoring coal mining operations and reclamation efforts in Alberta.** D. B. Patterson and K. M. Campbell (Department of the Environment, Environmental Coordination Services, Edmonton, Alberta, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 165-173. 10 refs.

A79-36541 # **Model studies of the reflectance properties of minerals and water.** G. J. Ousey (York University, Downsview, Ontario; Canadian Armed Forces, Canada), R. W. Nicholls, and G. R. Hébert (York University, Downsview, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 555-571. 21 refs. Department of Supply and Services Contract No. 06SU-KM601-6-0583.

Extensive comparisons have been made between a simple nondimensionalized Lorentz spectral reflectance model and measurements of the single and multiple infrared spectral reflectance features of several minerals and water. The comparisons demonstrate that the Lorentz model can adequately represent the spectral reflectance properties of minerals and water. Increased use of a multiple reflectance treatment for merged features could improve the reflectance modeling. Filter spectrometers for remote sensing applications may be developed on the basis of normal incidence spectral reflectance shapes determined in this study. J.M.B.

A79-40258 # **Geological observations over Israel and vicinity from Landsat and Skylab imagery.** A. Ginzburg, A. Flexer, and J. Otterman (Tel Aviv University, Tel Aviv, Israel). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 101-104.

A79-40346 **Remote sensing for engineering geology - Possibilities and limitations.** N. Rengers (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands). *(International Association of Engineering Geology, Congress, 3rd, Madrid, Spain, Sept. 1978.) ITC Journal,* no. 1, 1979, p. 44-67. 29 refs.

Basically, an engineering geological map should contain information on the distribution of soil units and their physical and mechanical properties; the hydrogeological and geomorphological conditions; and such geodynamic phenomena as erosion, deposition, mass movement, karst, and active faulting. In the present paper, the principles are reviewed of the remote sensing techniques commonly used by engineering geologists and surveyors involved in the application rather than the acquisition of such imagery. V.P.

A79-40347 **Geomorphological applications using aerial photographs - Two case studies in Venezuela.** G. A. Yanez (Universidad de Oriente, Ciudad Bolívar, Venezuela). *(International Association of Engineering Geology, Congress, 3rd, Madrid, Spain, Sept. 1978.) ITC Journal,* no. 1, 1979, p. 85-98.

The present paper deals with two geomorphological studies carried out in 1976. The first concerns the geotechnical mapping of the rapidly developing city of Guayana, situated at the confluence of the Orinoco and Caroni rivers. The second study concerns the prospecting of bauxite and aluminum laterites in the region of Guayana. Stereotriplets (with geological interpretations) obtained in these studies are given and discussed. V.P.

N79-24412*# Stanford Univ., Calif. School of Earth Sciences.
HCMM: SOIL MOISTURE IN RELATION TO GEOLOGIC STRUCTURE AND LITHOLOGY, NORTHERN CALIFORNIA
Ernest I. Rich, Principal Investigator Apr. 1979 2 p ERTS
(Contract NAS5-24479)
(E79-10192; NASA-CR-158483) Avail: NTIS HC A02/MF A01 CSCL 08M

N79-26437 Iowa Univ., Iowa City.
REGIONAL GEOLOGIC ANALYSIS OF THE BLACK HILLS OF SOUTH DAKOTA AND WYOMING FROM REMOTE SENSING DATA Ph.D. Thesis
Kuo-Liang Pan 1978 308 p
Avail: Univ. Microfilms Order No. 7913354

Photogeological interpretation of 1:250,000 scale LANDSAT-1 of the Black Hills using conventional technique has revealed that meaningful geologic information can be obtained for large areas of dense forest cover. Landform classes, drainage systems and vegetation cover permit the delineation of four major and twenty-one smaller geomorphic subdivisions of the Black Hills. The topography revealed on the imagery by differential solar illumination is the most interpretable surface phenomenon leading to the identification of lithology and geomorphic, and structural features. The accuracy of image interpretation from high altitude aerial photography at approximately 1:120,000 scale accompanied by field checking is comparable to the accuracy of 1:50,000 scale ground mapping. Dissert. Abstr.

N79-27748*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TECTONIC MOTION SITE SURVEY OF THE NATIONAL RADIO ASTRONOMY OBSERVATORY, GREEN BANK, WEST VIRGINIA
W. J. Webster, Jr., R. J. Allenby, L. K. Hutton, P. D. Lowman, Jr., and H. A. Tiedemann Jun. 1979 23 p refs
(NASA-TM-79691) Avail: NTIS HC A02/MF A01 CSCL 08F

A geological and geophysical site survey was made of the area around the National Radio Astronomy Observatory (NRAO) to determine whether there are at present local tectonic movements that could introduce significant errors to Very Long Baseline Interferometry (VLBI) geodetic measurements. The site survey consisted of a literature search, photogeologic mapping with Landsat and Skylab photographs, a field reconnaissance, and installation of a seismometer at the NRAO. It is concluded that local tectonic movement will not contribute significantly to VLBI errors. It is recommended that similar site surveys be made of all locations used for VLBI or laser ranging. G.Y.

05

OCEANOGRAPHY AND MARINE RESOURCES

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

A79-32269 **Microwave measurements over sea in the Netherlands.** E. P. W. Attema (Delft, Technische Hogeschool, Delft, Netherlands) and P. Hoogeboom (Centrale Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek, Physisch Laboratorium TNO, The Hague, Netherlands). In: Surveillance of environmental pollution and resources by electromagnetic waves; Proceedings of the Advanced Study Institute, Spatind, Norway, April 9-19, 1978. Dordrecht, D. Reidel Publishing Co., 1978, p. 291-298.

Data from X-band side-looking airborne radar (SLAR), seatruth measurements made from an offshore platform, and radar backscatter determinations performed with a wavetank have provided the basis for a sea monitoring program undertaken by the Netherlands. The monitoring program is aimed at developing an operational system for oil spill detection, as well as an aid for ship traffic control. A digital calibrated SLAR system which will permit quantitative comparisons between ground and airborne measurements is scheduled to be in operation in 1979. J.M.B.

A79-32270 **Applications of remote sensing by conventional radars.** P. D. L. Williams (Decca Radar, Ltd., Chessington, Surrey, England). In: Surveillance of environmental pollution and resources by electromagnetic waves; Proceedings of the Advanced Study Institute, Spatind, Norway, April 9-19, 1978. Dordrecht, D. Reidel Publishing Co., 1978, p. 299-308. 13 refs.

The paper discusses some applications of civil marine radars for sensing air-sea interactions. These radars are nearly all pulse sets with rotating antennas having a fan beam some 20 deg in elevation with the nose set to the horizon and azimuth resolutions from three-quarters to 2 or perhaps 3 deg. Operational aspects of these radars in airborne applications are discussed. Coastal radars, with apertures up to 8 m, offer greater advantages, and some recent studies on their use at low grazing angles are mentioned. The dependence of the returns on winds is illustrated. P.T.H.

A79-32271 **Ericsson SLAR.** B. Ekengren (L. M. Ericsson Telephone Co., MI Div., Molndal, Sweden). In: Surveillance of environmental pollution and resources by electromagnetic waves; Proceedings of the Advanced Study Institute, Spatind, Norway, April 9-19, 1978. Dordrecht, D. Reidel Publishing Co., 1978, p. 309-318.

A side-looking airborne radar (SLAR) intended for ocean surveillance with special emphasis on oil slick mapping is briefly characterized. Operational curves are presented, e.g., average sea clutter power at different aircraft altitudes, average sea clutter as a function of vertical antenna lobewidth, average sea clutter return as function of antenna depression, and average sea clutter return at different wind speeds. The radar is basically an ordinary pulse radar with a long antenna that provides the necessary angular resolution. First flight testing results have shown that a small aircraft is stable enough to operate the SLAR without aircraft motion compensation, and that one can obtain a radar map with even intensity over a sufficiently large interval of range values. P.T.H.

A79-32272 * **Ocean waves.** N. Bartsch, M. Vogel (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Oberpfaffenhofen, West Germany), A. G. Kjelaas, H. Parr (Norges Teknisk-Naturvitenskapelige Forskningsrad, Kjeller, Norway), J. Thomas (Imperial College of Science and Technology, London, England), G. Valenzuela (U.S. Navy, Naval Research Laboratory, Washington, D.C.), P. D. L. Williams (Decca Development Laboratories, Chessington, Surrey, England), and O. H. Shemdin (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Surveillance of environmental pollution and resources by electromagnetic waves; Proceedings of the Advanced Study Institute, Spatind, Norway, April 9-19, 1978. Dordrecht, D. Reidel Publishing Co., 1978, p. 319-326.

Ocean wave data can be obtained from such active microwave probe techniques as monostatic HF and VHF, bistatic HF, HF synthetic aperture radar, altimeters, satellite and airborne synthetic aperture radar, carrier wave or pulsed dual-frequency radars, and coastal surveillance radar. Approaches to texture analysis of ocean wave imagery are discussed, with attention given to transform techniques or spatial frequency analysis, and the analysis of second-order gray level statistics. In addition, recommendations are made for further work on the modulation of short gravity waves by longer waves as a function of wind speed and wave direction, and the derivation of transfer functions for the ocean response of dual-frequency radars. J.M.B.

A79-33044 **The computation of ocean wave heights from GEOS-3 satellite radar altimeter data.** J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada). *Remote Sensing of Environment,* vol. 8, May 1979, p. 97-114. 13 refs.

Methods of determining wave heights from the shape of the radar return pulse in GEOS 3 radar altimeter data are discussed. Wave heights are analyzed using the standard deviation of the pulse leading edge shape, which is influenced by wave height. A Gaussian fitting technique can be used to derive wave heights from average pulse shapes, and the observed scatter in values derived from low rate data can be reduced by the techniques of fitting the pulse shape to the error function before differentiation, weighting the sample values by the reciprocal of the observed variance in the data from each gate, and correcting for bias and timing errors. When using high rate data, corrections can be made for the effects of timing jitter and range servo error on the average pulse shape. A comparison of corrected satellite data with sea truth in the northeast Pacific Ocean indicates that the analysis is capable of determining wave heights to within 0.5 m. A.L.W.

A79-33048 * **Landsat test of diffuse reflectance models for aquatic suspended solids measurement.** J. C. Munday, Jr. (Virginia Institute of Marine Science, Gloucester Point, Va.) and T. T. Alfoldi (Canada Centre for Remote Sensing, Ottawa, Canada). *Remote Sensing of Environment,* vol. 8, May 1979, p. 169-183. 33 refs. Grant No. NGL-47-022-005.

Landsat radiance data were used to test mathematical models relating diffuse reflectance to aquatic suspended solids concentration. Digital CCT data for Landsat passes over the Bay of Fundy, Nova Scotia were analyzed on a General Electric Co. Image 100 multispectral analysis system. Three data sets were studied separately and together in all combinations with and without solar angle correction. Statistical analysis and chromaticity analysis show that a nonlinear relationship between Landsat radiance and suspended solids concentration is better at curve-fitting than a linear relationship. In particular, the quasi-single-scattering diffuse reflectance model developed by Gordon and coworkers is corroborated. The Gordon model applied to 33 points of MSS 5 data combined from three dates produced $r = 0.98$. (Author)

A79-33125 **Eleven year chronicle of one of the world's most gigantic icebergs.** E. P. McClain (NOAA, National Environmental Satellite Service, Washington, D.C.). *Mariners Weather Log,* vol. 22, Sept. 1978, p. 328-333. 18 refs.

Sea-ice conditions have been monitored by satellites since the early 1960s; in this paper, the 11-year drift track of a large tabular iceberg is discussed. The iceberg originated from the Trolltunga ice tongue in Antarctica and was first registered on satellite imagery in

1967. In 1973, a Landsat view of the iceberg indicated a size of 4650 sq km. An optical device permitting variable magnification and one-dimensional stretching of imagery was adopted to obtain measurements of the iceberg. J.M.B.

A79-33969 * **Mapping of sea ice and measurement of its drift using aircraft synthetic aperture radar images.** F. Leberl (Graz, Technische Universität, Graz, Austria), M. L. Bryan, C. Elachi, T. Farr (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), and W. Campbell (U.S. Geological Survey, Tacoma, Wash.). *Journal of Geophysical Research,* vol. 84, Apr. 20, 1979, p. 1827-1835. 26 refs.

Side-looking radar images of Arctic sea ice were obtained as part of the Arctic Ice Dynamics Joint Experiment. Repetitive coverages of a test site in the Arctic were used to measure sea ice drift, employing single images and blocks of overlapping radar image strips; the images were used in conjunction with data from the aircraft inertial navigation and altimeter. Also, independently measured, accurate positions of a number of ground control points were available. Initial tests of the method were carried out with repeated coverages of a land area on the Alaska coast (Prudhoe). Absolute accuracies achieved were essentially limited by the accuracy of the inertial navigation data. Errors of drift measurements were found to be about + or - 2.5 km. Relative accuracy is higher; its limits are set by the radar image geometry and the definition of identical features in sequential images. The drift of adjacent ice features with respect to one another could be determined with errors of less than + or - 0.2 km. (Author)

A79-34267 * **Ice elevation map of Queen Maud Land, Antarctica, from balloon altimetry.** N. Levanon (Tel Aviv University, Tel Aviv, Israel) and C. R. Bentley (Wisconsin, University, Madison, Wis.). *Nature,* vol. 278, Apr. 26, 1979, p. 842-844. 11 refs. Research supported by the U.S.-Israel Binational Science Foundation, NASA, and NSF.

A79-36499 # **Landsat mapping of suspended sediments in Lake Taupo, New Zealand.** G. R. Cochrane (Auckland, University, Auckland, New Zealand) and E. J. Hajic (California, University, Santa Barbara, Calif.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 104-119. 18 refs.

A79-36509 # **Use of Landsat and NOAA imagery for mapping deformation and movement of Baffin Bay ice.** B. Dey (Gregory Geoscience, Ltd., Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 200-208. 9 refs. Research supported by Gregory Geoscience.

NOAA very high resolution radiometer and Landsat multispectral scanning images were employed in studying the deformation and movement of ice in Baffin Bay from 1975 to 1977. Daily areal variations of ice deformation and drift were monitored in the NOAA data; the higher resolution Landsat data yielded information on floe size and frequency distribution. Variations in the southward velocities of pack ice and ice floes were noted, and areal variations in sea ice movements were found. Short-term logistical planning as well as planning for long-term off shore operations may benefit from the Baffin Bay ice survey. J.M.B.

A79-36510 # **Landsat for the study of icebergs in the Baffin Bay-Labrador Sea area.** B. Dawe, R. D. Worsfold (Remotec Applications, Inc., St. John's, Newfoundland, Canda), K. A. Gustajtis, and E. Wedler (Newfoundland, Memorial University, St. John's, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 209-218. 6 refs.

Surface verification data and Landsat imagery were employed in developing an iceberg monitoring system for the Baffin Bay-Labrador Sea area. Conclusive iceberg identification can not be made with Landsat imagery alone, but requires in addition aircraft reports and ship- or shore-based radar measurements. Time differences between Landsat overpasses and surface assessments of icebergs, as well as errors in satellite position and radiance associated with quick-look imagery, are among the difficulties in Landsat detection of icebergs. A relationship between the Landsat detectability of an iceberg and its size and shape is under investigation. J.M.B.

A79-36521 # **Detection and monitoring of oil pollution in the ice environment through microwave techniques.** S. K. Parashar (Newfoundland, Memorial University, St. John's, Newfoundland, Canada), B. Dawe, and R. D. Worsfold (Remotec Applications, Inc., St. John's, Newfoundland, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 348-355. 41 refs.

To evaluate the use of microwave systems for monitoring oil pollution in the ice environment, the microwave scattering and emission characteristics of sea ice, oil on water, and the ocean were investigated. Microwave systems have yet to be tested for oil pollution surveillance in the ice environment, so that only qualitative assessments can be made on the microwave emission and scattering by considering the electrical and physical properties of oil, ice and water. The observations of oil spills in ice-infested waters, detection of oil in ice environment, microwave techniques for detecting oil in temperate oceans, oil absorbed in ice, under ice, and between layers of ice are discussed. It is concluded that microwave systems will be more useful when oil is in or on top of the ice layers, that information on interaction of sea ice parameters such as brine volume, surface roughness and porosity which affect scattering and emission is lacking, and that microwave system parameters such as frequency, resolution, angle and polarization have yet to be established. A.T.

A79-36525 # **Preliminary investigation of sea ice SAR data recorded over Hopedale, Labrador during Project SAR '77.** S. K. Parashar, C. Roche, D. Strong (Newfoundland, Memorial University, St. John's, Canada), and R. D. Worsfold (Remotec Applications, Inc., St. John's, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 382-390. 20 refs.

Synthetic aperture radar (SAR) data of sea ice were collected over Hopedale, Labrador during February and March, 1977. The four channel X- and L-band SAR system belonging to the Environmental Research Institute of Michigan (ERIM) was utilized by the Centre for Cold Ocean Resources Engineering to undertake Project SAR '77. A variety of first-year ice types were imaged. The radar imagery corresponded to antenna depression angles of 30 and 13 deg with all possible linear polarization combinations (HH, VV, HV, and VH). The results of imagery interpretation indicate that some ice types can be identified on both X- and L-band imagery, with X-band providing better contrast in most cases. Both HH and VV polarizations seem equally suitable for ice imaging, with cross-polarized imagery providing the most contrast in some cases. The presented results may be important in determining which channel combinations are required for mapping sea ice with radar. (Author)

A79-36535 # **Application of Landsat data in the study of oceanographical environment.** H. Ochiai (Toba Merchant Marine College, Toba, Mie, Japan), K. Takeda (National Institute of Resources, Science and Technology Agency, Tokyo, Japan), and K. Tsuchiya (National Space Development Agency of Japan, Tokyo, Japan). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 466-473.

The possibility of using Landsat MSS data to detect red tides in the Seto Inland Sea, to investigate fluctuations in the density of water emptied into the Ishikari Bay by the Ishikari River, and to monitor changes in the coastal current near the mouth of the Tenryu River was investigated. Landsat data were analyzed using IMAGE-100 and FACOM PIA digital systems. It was found that red tides were most easily detected from Band-6 data; red tide patterns were more easily recognized in color slice and theme extraction imagery than in contrast stretch imagery. The relative density of water in the Ishikari River was best established using Band-4 imagery. C.K.D.

A79-38378 **Satellite observations of the influence of bottom topography on the seaward deflection of the Gulf Stream off Charleston, South Carolina.** R. V. Legeckis (NOAA, National Environmental Satellite Service, Washington, D.C.). *Journal of Physical Oceanography,* vol. 9, May 1979, p. 483-497. 41 refs.

A79-38380 **An analysis of Arctic sea ice fluctuations, 1953-77.** J. E. Walsh and C. M. Johnson (Illinois, University, Urbana, Ill.). *Journal of Physical Oceanography,* vol. 9, May 1979, p. 580-591. 37 refs. NSF Grants No. DPP-76-15352; No. DPP-77-17348.

Arctic sea ice data from the 1953-1977 period were digitized onto a set of 300 monthly grids covering the polar cap, each grid containing 1648 ice concentration points at a spacing of 1 deg latitude. The digitized data are used to evaluate the normal seasonal cycle of ice extent, the 25-year extremes for winter and summer, and the longitudinal dependence of the variance and trend of ice extent. Interannual variations of ice extent exceeding 5 deg latitude are found at most longitudes. The time series of total Arctic ice extent shows a statistically significant positive trend and correlates negatively with recent high-latitude temperature fluctuations. Empirical orthogonal functions of longitude are used to identify the major spatial and temporal scales of ice fluctuations with the 25-year period. B.J.

A79-39983 **Marine-optical studies within the framework of the Geoscientific Airborne Remote Sensing Programme /FMP/ 1976 in the German Bight.** H. Gienapp (Deutsches Hydrographisches Institut, Hamburg, West Germany). *Deutsche Hydrographische Zeitschrift,* vol. 32, no. 1, 1979, p. 3-18. 13 refs.

The present paper deals with a chromaticity measuring program devised to support marine-optical 'ground-truth' studies within the framework of an airborne remote sensing program. The chromaticity measuring program (which can be used also for remote sensing on land) consists of measuring chromaticity coordinates of the scattered (or transmitted) light in water samples and comparing them with chromaticity coordinates calculated from scanner spectra. V.P.

A79-40266 **New colorimetric working methods in oceanography (Neue farbmetrische Arbeitsmethoden in der Ozeanographie).** H. Gienapp (Deutsches Hydrographisches Institut, Hamburg, West Germany). *Deutsche Hydrographische Zeitschrift,* vol. 32, no. 2, 1979, p. 59-69. 6 refs. In German.

An automated method for measuring the color coordinates of the totally transmitted, as well as the scattered, light in seawater samples in a flowmeter apparatus, is described. The correlations of these parameters with content of suspended matter, chlorophyll, as well as yellow substance, are given. Furthermore, the applicability of the scattered light color coordinates measurements as remote sensing ground truth is discussed. Moreover, they permit the calculation of the turbidity (ASTM-Turbidity). (Author)

A79-40806 **Remote sensing of surface ocean circulation with satellite altimetry.** R. S. Mather, C. Rizos, and R. Coleman. *Science,* vol. 205, July 6, 1979, p. 11-17. 24 refs.

The retrieval of information related to ocean circulation from GEOS 3 radar altimeter data is discussed. The altimeter data bank is examined, along with parameters of the quasi-steady component of very long wavelength for which gravity-field components are known to be better than 1 part in 100 million. Measurements of time variations in the Sargasso Sea are analyzed, and the sea surface topography (SST) that maintains the Gulf Stream is considered. The results demonstrate the potential of the satellite altimeter as a tool for studying the dynamics of the surface layer of the oceans. F.G.M.

A79-42379 # **Analysis of Coast Guard missions for a maritime patrol airship.** H. K. Rappoport (Summit Research Corp., Gaithersburg, Md.). In: Lighter-Than-Air Systems Technology Conference, Palo Alto, Calif., July 11-13, 1979, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 1-5. (AIAA 79-1571)

A review of the U.S. Coast Guard's operation, has led to the selection of eight airship participation programs that, compared to the current operating platforms of ships and aircraft, were found to be cost effective. 30 potential airship missions, for the eight programs, were described and 263 mission profiles were compiled, including ice patrol, surveillance and inshore undersea warfare. Special attention was given to the point design analysis of these programs and the annual requirements for capable airships, as a function of flight duration. Emphasis was placed on statistical data and calculations of crew size and mission duration. 120,000 hours of operations of less than 40 hours were analyzed and it was concluded that 50 maritime patrol ships, at a cost of $10 million, could be utilized. The hourly cost of operating an airship was found to lie between $700 and $1200, depending on the mission requirements and flight duration. C.F.W.

A79-42381 # **The potential role of airships for oceanography.** R. E. Stevenson (U.S. Navy, Office of Naval Research; California, University, La Jolla, Calif.). In: Lighter-Than-Air Systems Technology Conference, Palo Alto, Calif., July 11-13, 1979, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 15-24. (AIAA 79-1574)

The use of an oceanographic airship to collect data of temperature discontinuities at sea surfaces, extending through the upper ocean, is proposed. A scenario of an oceanographic experiment is outlined, implementing an airship equipped with a complete satellite receiving system, expendable bathythermographs, salinity probes, sound velocimeters, plus a collection of remote sensors. Several photographs, mostly taken from orbiting satellites, are attached depicting ocean swells, large internal waves, eddies, whip wakes and sea surface slicks. C.F.W.

A79-42396 * # **Potential applications of a high altitude powered platform in the ocean/coastal zone community.** D. Escoe, P. Rigterink (Computer Sciences Corp., Silver Spring, Md.), and J. D. Oberholtzer (NASA, Wallops Flight Center, Wallops Island, Va.). In: Lighter-Than-Air Systems Technology Conference, Palo Alto, Calif., July 11-13, 1979, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 140-145. (AIAA 79-1602)

The results of a survey of the ocean/coastal zone community conducted for the NASA Wallops Flight Center to identify potential applications of a high altitude powered platform (HAPP) are presented. Such a platform would stationkeep at 70,000 feet for up to a year over a given location and make frequent high resolution observations, or serve as a regional communications link. The survey results indicate user interest among scientific researchers, operational

agencies and private industry. It is felt that such a platform would combine the desirable characteristics of both geostationary satellites (wide area, frequent observation) and aircraft (high resolution). As a result a concept for an operational HAPP system in the form of a 'mesoscale geostationary satellite' system evolved. Such a system could employ many of the same technologies used in current NASA and NOAA geostationary satellite programs. A set of generalized instrument requirements for HAPP borne sensors is also presented.
(Author)

N79-22584*# National Aeronautics and Space Administration. National Space Technology Labs., Bay Saint Louis, Miss.
SHORELINE AS A CONTROLLING FACTOR IN COMMERCIAL SHRIMP PRODUCTION
Kenneth H. Faller, Principal Investigator Feb. 1979 33 p refs
Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10185; NASA-TM-72732) Avail: NTIS HC A03/MF A01 CSCL 08A

The author has indentified the following significant results. An ecological model was developed that relates marsh detritus export and shrimp production. It was based on the hypothesis that the shoreline is a controlling factor in the production of shrimp through regulation of detritus export from the marsh. LANDSAT data were used to develop measurement of shoreline length and areas of marsh having more than 5.0 kilometers of shoreline per square kilometer of area for the Louisiana coast, demonstrating the capability of remote sensing to provide important geographic information. These factors were combined with published tidal ranges and salinities to develop a mathematical model that predicted shrimp production for nine geographic units of the Louisiana coast, as indicated by the long term average commercial shrimp yield.

N79-23477*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYSTEMS RESEARCH FOR REMOTE SENSING OCEAN SURFACE CIRCULATION USING SEASAT-A SPACECRAFT Final Technical Report, 1 Feb. 1978 - 1 Jan. 1979
Bruce D. Marsh (Johns Hopkins Univ.) and R. S. Mather 1979 8 p
(Grant NsG-5225)
(NASA-TM-80453) Avail: NTIS HC A02/MF A01 CSCL 08C

The research to develop satellite-based remote sensing techniques for sinoptic monitoring of ocean circulation is presented. Papers resulting from the research are abstracted.
M.M.M.

N79-23615*# National Aeronautics and Space Administration. Wallops Station, Wallops Island, Va.
ANALYSIS OF GEOS-3 ALTIMETER DATA AND EXTRACTION OF OCEAN WAVE HEIGHT AND DOMINANT WAVELENGTH Final Report
Edward J. Walsh Mar. 1979 30 p refs
(NASA-TM-73281) Avail: NTIS HC A03/MF A01 CSCL 08C

When the amplitude and timing biases are removed from the GEOS-3 Sample and Hold (S&H) gates, the mean return waveforms can be excellently fitted with a theoretical template which represents the convolution of: (1) the radar point target response; (2) the range noise (jitter) in the altimeter tracking loop; (3) the sea surface height distribution; and (4) the antenna pattern as a function of the range to mean sea level. Several techniques of varying complexity to remove the effect of the tracking loop jitter in computing the wave height are considered. They include: (1) realigning the S&H gates to their actual positions with respect to mean sea level before averaging; (2) using the observed standard deviation on the altitude measurement to remove the integrated effect of the tracking loop jitter, and (3) using a look-up table to correct for the expected value of range noise. Analysis of skewness in the GEOS return waveform demonstrates the potential of a satellite radar altimeter to determine the dominant wavelength of ocean waves. L.S.

N79-23623# Centre Oceanologique de Bretagne, Brest (France). Dept. Scientifique.
CAMPAIGN NIMBUS F: RESULTS OF OFFSHORE OPERATIONS, FEBRUARY 1976 - NOVEMBER 1977 [CAMPAGNE NIMBUS F: RESULTATS D'UNE EXPERIENCE MENEE A L'AIDE DE BOUEES DERIVANTS LOCALISEES PAR SATELLITE DANS L'ATLANTIQUE NORD-EST, FEVRIER 76 - NOVEMBRE 77]
Francois Madelain and Andre Billant Paris Centre Natl. pour l'Exploit. des Oceans 1978 97 p refs In FRENCH; ENGLISH summary
(CNEXO-RCM-15) Avail: NTIS HC A05/MF A01

Data collected during a drifting buoy experiment conducted in the northeast Atlantic from February 76 to November 77 are reported. Positioning and data transmission were done via the NIMBUS F satellite. Trajectories of the buoys and oceanographic and meteorological data are presented. Author (ESA)

N79-26754# SACLANT ASW Research Center, La Spezia (Italy).
SATELLITE OCEANOGRAPHY OF EASTERN BOUNDARY CURRENTS AND ITS IMPLICATIONS TO ASW
Robert E. Stevenson (Scripps Inst. of Oceanog., La Jolla, Calif.) 1 Nov. 1978 26 p refs Presented at Conf. on ASW in the Southwestern Approaches to the English Channel, La Spezia, Italy, 14-16 Mar. 1978
(AD-A067259; SACLANTCEN-SR-M-90) Avail: NTIS HC A03/MF A01 CSCL 08/3

The characteristics of western boundary currents are better known than those along the eastern edges of oceans. In the 1970s, however, close attention has been given to eastern boundary currents. The variability of the El Nino phenomenon off Peru, and coastal upwelling off Oregon, Peru/Chile, and Northwest Africa, have been studied by multi-national teams. Since 1975, U.S. Navy personnel and scientists sponsored by the Office of Naval Research have examined satellite imagery of the waters off California and Western Europe as a first step in real-time satellite oceanography. From these studies, we know now that eastern boundary currents have identifiable fronts (such as the Huelva front) and eddies (like the Socal eddy chain) that vary seasonally and inter-annually in intensity and scale. The fronts have lengths of tens of kilometres and depths of hundreds of metres; the eddies have diameters of 50 to 200 km and depths greater than 500 m. Both the eddies and fronts have surface temperature gradients of 1.5 C to 5 C. Deeper, the temperature gradients tend to be sharper than those at the surface. The data are useful therefore in solving tactical ASW problems.
GRA

N79-26755# EG and G Washington Analytical Services Center, Inc., Rockville, Md.
AIR DEPLOYED OCEANOGRAPHIC MOORING (ADOM) Progress Report, 1978
Apr. 1979 80 p refs
(Contract N00014-79-C-0227)
(AD-A068001; EG/G-TR-D370-0001) Avail: NTIS HC A05/MF A01 CSCL 08/10

This report documents the technological accomplishments in the Air Deployed Oceanographic Mooring (ADOM) program during 1978. Technology is being developed for deploying oceanographic sensors from an aircraft in two regions of the world's oceans: the open ocean and the polar seas. Two corresponding systems are being developed: an open ocean ADOM and an Artic ADOM. Both systems are presently configured to measure temperature, conductivity, and pressure. The actions, further analysis, and investigations necessary in the continuation of the ADOM technology development are detailed.
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.

A79-32266 **Microwave radiometry applications to remote sensing.** E. Schanda (Bern, Universität, Berne, Switzerland). In: Surveillance of environmental pollution and resources by electromagnetic waves; Proceedings of the Advanced Study Institute, Spatind, Norway, April 9-19, 1978. Dordrecht, D. Reidel Publishing Co., 1978, p. 253-273. 14 refs.

Physical fundamentals and constraints of passive microwave remote sensing are discussed. Application areas are indicated, the rationale for multi-wavelength operation of passive microwave sensors is reviewed and the state of the art in radiometer systems is summarized. Examples of applications and of basic research in meteorology and hydrology are given and a future utilization in atmospheric science is indicated. (Author)

A79-35498 * **Landsat analysis of lake quality.** F. L. Scarpace, L. T. Fisher (Wisconsin, University, Madison, Wis.), and K. W. Holmquist (Wisconsin Department of Natural Resources, Madison, Wis.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, May 1979, p. 623-633. 10 refs. Research supported by the U.S. Environment Protection Agency, University of Wisconsin, and NASA.

The trophic status of a number of inland lakes in Wisconsin has been assessed. The feasibility of using both photographic and digital representations of Landsat imagery was investigated during the lake classification project. The result of the investigation has been a semi-automatic data acquisition and handling system which, in conjunction with an analytical categorization scheme, can be used to classify all the significant lakes in the state. (Author)

A79-36506 * # **Water quality monitoring of Lake Mead - A practical look at the difficulties encountered in the application of remotely sensed data to analysis of temporal change.** A. Y. Smith and J. D. Addington (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 174-186. 16 refs. Contract No. NAS7-100.

A79-36520 # **Evaluation of high resolution side looking airborne radar on the University of Guelph test strip.** B. Brisco and R. Protz (Guelph, University, Guelph, Ontario, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 328-347. 23 refs. Department of Supply and Services Contract No. 08SU-01525-0198.

Imagery of the University of Guelph test strip snow covered area, obtained from the four channel ERIM (Environmental Research Institute of Michigan) synthetic aperture radar (SAR) system, was evaluated for soil survey and field type identification purposes. The imagery was compared with ground truth data, and it was observed that for all but the X-HH channel it was the soil-vegetation surface reflecting the incident radar waves. The X-HH channel exhibited a lack of tonal variation, indicating attenuation by an icy surface, high water content or ice layers within the snow pack. A more comprehensive ground truth program is needed at the time of the radar flight to relate earth surface variables to radar system parameters and the resulting image. Multi-temporal and multi-channel radar imagery, in combination with the use of ancillary data, have the potential to discriminate crops and soils for agricultural purposes. V.T.

A79-37291 * # **Aerial photographic water color variations from the James River.** W. E. Bressette (NASA, Langley Research Center, Marine and Applications Technology Div., Hampton, Va.). *University of Tennessee, Annual Remote Sensing of Earth Resources Conference, 8th, Tullahoma, Tenn., Mar. 27-29, 1979, Paper.* 13 p.

Photographic flights from 305 meters altitude were made throughout the day of May 17, 1977, over seven water data stations in the James River. The flights resulted in wide-angle, broadband, spectral radiance film exposure data between the wavelengths of 500 to 900 nanometers for sun elevation angles ranging from 37 to 64 deg and variable atmospheric haze conditions. It is shown from densitometer data that: (1) the dominant observed color from James River waters is determined by the optical properties of the total suspended solid load, (2) variability in observed color is produced by a changing solar elevation angle, and (3) the rate at which observed color changes is influenced by both solar elevation angle and atmospheric conditions. (Author)

A79-40253 # **Some hydrographic aspects of the Goplo Lake Millenium Park in the context of aerial photography analysis and terrain mapping (Niektore zagadnienia hydrograficzne Nadgoplanskiego Parku Tysiaclecia w swietle analizy zdjec lotniczych i kartowania terenowego).** A. T. Jankowski (Torun, Uniwersytet, Torun, Poland). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 26-38. 22 refs. In Polish.

A79-40257 # **Photointerpretation as a method of studying the development of contemporary processes in valleys (Fotointerpretacja jako metoda badania roazwoju wspolczesnych procesow dolinnych).** L. Baraniecki and M. Ruszczycka-Mizera (Wroclaw, Uniwersytet, Wroclaw, Poland). *Fotointerpretacja w Geografii,* vol. 2 (12), 1977, p. 83-93. In Polish.

An attempt is made to describe the historical development of a 42-km long sector of the Odra valley on the basis of aerial photographs. Analysis of the formations in this valley made it possible to identify a number of old river beds and a system of associated alluvial deposits and depressions, indicative of the formation of meanders. It proved possible to distinguish among the individual generations of meanders, and to identify some sectors in which the river reverted to some previous river bed. V.P.

N79-22586*# Environmental Research and Technology, Inc., Concord, Mass.
INVESTIGATION OF THE APPLICATION OF HCMM THERMAL DATA TO SNOW HYDROLOGY Progress Report, Jan. - Mar. 1979
James C. Barnes, Principal Investigator 3 Apr. 1979 5 p
Sponsored by NASA ERTS
(E79-10186; NASA-CR-158415) Avail: NTIS HC A02/MF A01 CSCL 08H

N79-22587*# South Dakota State Univ., Brookings. Remote Sensing Inst.

HCMM ENERGY BUDGET AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Jan. - Mar. 1979
Donald G. Moore, Principal Investigator and J. Heilman Mar. 1979 3 p refs ERTS
(Contract NAS5-24206)
(E79-10188; NASA-CR-158448; SDSU-RSI-79-06) Avail: NTIS HC A02/MF A01 CSCL 08H

N79-22588*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Report, 1 Jun. - 30 Nov. 1978
R. A. Weismiller and R. P. Mroczynski, Principal Investigators 30 Nov. 1978 76 p ERTS
(Grant NGL-15-005-186)
(E79-10189; NASA-CR-158449; LARS-CR-042179) Avail: NTIS HC A05/MF A01 CSCL 05A

The author has identified the following significant results. Twenty-eight quarter sections were mapped, representing a total area of 4480 acres or approximately 1.25% of the county. Soil series were not consistently separated on a countywide basis. When internal drainage and parent materials were ascertained, a soil series could be predicted. Each soil spectral class represented one predominant drainage class with minor inclusions of other drainage classes. The same is true with conventional field mapping units that also contain minor inclusions of other drainage classes. Most wetlands could be identified in the LANDSAT classification. There appeared to be some confusion in distinguishing between different wetland types and between some wetland and upland cover types.

N79-22591*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TROPHIC CLASSIFICATION OF SELECTED COLORADO LAKES
Richard J. Blackwell and Dale H. P. Boland (EPA) Jan. 1979 210 p refs Sponsored by NASA and EPA Original contains color illustrations
(Contract NAS7-100)
(NASA-CR-158500; EPA-600/4-79-0057; JPL-PUB-78-100) Avail: NTIS HC A10/MF A01 CSCL 08H

Multispectral scanner data, acquired over several Colorado lakes using LANDSAT-1 and aircraft, were used in conjunction with contact-sensed water quality data to determine the feasibility of assessing lacustrine trophic levels. A trophic state index was developed using contact-sensed data for several trophic indicators. Relationships between the digitally processed multispectral scanner data, several trophic indicators, and the trophic index were examined using a supervised multispectral classification technique and regression techniques. Statistically significant correlations exist between spectral bands, several of the trophic indicators and the trophic state index. Color-coded photomaps were generated which depict the spectral aspects of trophic state. Author

N79-22603# California Univ., Davis. Water Resources Center.
REMOTE SENSING OF PERCHED WATER TABLES, A PILOT STUDY
John E. Estes, David S. Simonett, Larry R. Tinney, C. Elaine Chezra, and Brenda Bowman Oct. 1978 88 p refs Sponsored by Office of Water Res. and Technol.
(PB-291753/2; UCAL-WRC-W-512; Contrib-175; W79-03040; OWRT-B-181-CAL(1)) Avail: NTIS HC A05/MF A01 CSCL 08H

Remote sensing techniques within the spectral range 0.4 micrometer to 23 cm of the electromagnetic spectrum are considered. Imagery from the visible and reflective infrared (aerial camera and LANDSAT scanner), thermal infrared (aircraft scanner), and microwave (both active L-band and passive 45 GHz micrad) region were analyzed. Significant temporal cycles were noted in the seasonal fluctuations of perched water tables as well as crop growth stages. Each of these phenomena plays important roles in establishing the utility of sensor systems to detect vegetative response to perched water tables. Results indicate that the thermal infrared region has unique detection capabilities because of differential subsurface heat flows associated with the presence of perched water tables. GRA

N79-23478*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE SENSING OF SNOW AND ICE: A REVIEW OF THE RESEARCH IN THE UNITED STATES 1975 - 1978
Albert Rango Feb. 1979 35 p refs Submitted for publication
(NASA-TM-79713) Avail: NTIS HC A03/MF A01 CSCL 08L

Research work in the United States from 1975-1978 in the field of remote sensing of snow and ice is reviewed. Topics covered include snowcover mapping, snowmelt runoff forecasting, demonstration projects, snow water equivalent and free water content determination, glaciers, river and lake ice, and sea ice. A bibliography of 200 references is included. Author

N79-24418*# South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
FEASIBILITY OF REMOTE SENSING BENTHIC MICROALGAE Final Report
Richard G. Zingmark [1979] 36 p refs
(Grant NsG-1523)
(NASA-CR-158618) Avail: NTIS HC A03/MF A01 CSCL 08A

Results of data analyses from multispectral scanning data are presented. The data was collected in July 1977 for concentration of chlorophyll in benthic microalgae (mainly diatoms) on an estuary mudflat. G.Y.

N79-25448*# Minnesota Univ., Minneapolis. Space Science Center.
A STUDY OF MINNESOTA LAND AND WATER RESOURCES USING REMOTE SENSING Progress Report, 1 Jan. - 31 Dec. 1978
William Shepherd, Principal Investigator 1 Jan. 1979 167 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-24-005-263)
(E79-10199; NASA-CR-158511) Avail: NTIS HC A08/MF A01 CSCL 08H

N79-25452*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE APPLICATION OF REMOTE SENSING TECHNOLOGY TO THE SOLUTION OF PROBLEMS IN THE MANAGEMENT OF RESOURCES IN INDIANA Semiannual Report, 1 Jun. - 30 Nov. 1978
R. A. Weismiller and R. P. Mroczynski, Principal Investigators 30 Nov. 1978 75 p refs ERTS
(Grant NGL-15-005-186)
(E79-10203; NASA-CR-158558; LARS-CR-042179) Avail: NTIS HC A04/MF A01 CSCL 05A

The author has identified the following significant results. Of the sampling techniques considered, a combination soil mapping and area sampling offered the most practical method for gathering soils data. Using the dot grid count, a relative percentage composition of soils can be calculated for each spectral class. From these percentages, a legend describing the dominant soils and inclusions can be developed. Interval drainage class seemed to be correlated with magnitude. For every parent material area, the more poorly drained soils had a lower magnitude of reflectance. Soil spectral classes seemed to be predominantly one internal drainage class.

N79-25453*# Wisconsin Univ., Madison. Inst. for Environmental Studies.
MULTIDISCIPLINARY RESEARCH ON THE APPLICATION OF REMOTE SENSING TO WATER RESOURCES PROBLEMS Progress Report, Aug. 1977 - Jul. 1978
Ralph W. Kiefer, Principal Investigator Jul. 1978 100 p refs Original contains color imagery. Original Photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-50-002-127)
(E79-10204; NASA-CR-158559) Avail: NTIS HC A05/MF A01 CSCL 08H

N79-25454*# Delaware Univ., Newark. Coll. of Marine Studies.
QUANTITATIVE ASSESSMENT OF EMERGENT BIOMASS AND SPECIES COMPOSITION IN TIDAL WETLANDS USING REMOTE SENSING
David S. Barlett and Vytautas Klemas, Principal Investigators 1979 16 p refs Presented at Workshop on Wetland and Estuarine Processes and Water Quality Modeling, New Orleans, La., 10-18 Jun. 1979 Sponsored by NASA ERTS
(E79-10205; NASA-CR-158560) Avail: NTIS HC A02/MF A01 CSCL 08C

N79-25455*# Delaware Univ., Newark. Coll. of Marine Studies.
ASSESSMENT OF TIDAL WETLAND HABITAT AND PRODUCTIVITY
David S. Barlett and Vytautas Klemas, Principal Investigators 1979 11 p refs Presented at 13th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 23-27 Apr. 1979 ERTS
(E79-10206; NASA-CR-158561) Avail: NTIS HC A02/MF A01 CSCL 08C

N79-25458*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.
A DEMONSTRATION OF WETLAND VEGETATION MAPPING IN FLORIDA FROM COMPUTER-PROCESSED SATELLITE AND AIRCRAFT MULTISPECTRAL SCANNER DATA
M. Kristine Butera, Principal Investigator May 1978 57 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(E79-10209; NASA-TM-80415; Rept-168) Avail: NTIS HC A04/MF A01 CSCL 08B

The author has identified the following significant results. Major vegetative classes identified by the remote sensing technique were cypress swamp, pine, wetland grasses, salt grass, mixed mangrove, black mangrove, and Brazilian pepper. Australian pine and melaleuca were not satisfactorily classified from LANDSAT. Aircraft scanners provided better resolution resulting in a classification of finer surface detail. An edge effect, created by the integration of diverse spectral responses within boundary elements of digital data, affected the wetlands classification. Accuracy classification for aircraft was 68% and for LANDSAT was 74%.

N79-25473# Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
HYDROLOGIC PARAMETERS FROM LANDSAT IMAGERY FOR WILLIAMS FORK WATERSHED M.S. Thesis
Jose Elvecio Pernia 1978 138 p refs Sponsored by Interior Dept.
(PB-292083/3; W79-04073; OWRT-B-160-COLO(1)) Avail: NTIS HC A07/MF A01 CSCL 08H

Mapping the major cover types of the Williams Fork Watershed, extracting physiographic parameters of the basin, and temporal mapping of snowcover were the main objectives of the study. Physiographic parameters for the studied watershed, including watershed area, perimeter, basin shape, basin axial length, length of main stream, total stream length, drainage density, and drainage pattern, were derived from the LANDSAT MSS transparencies using visual interpretation. Temporal snowcover mapping the Williams Fork Watershed was performed, using a zoom transfer scope, on the LANDSAT transparencies, for USS band 5. GRA

N79-26440*# Cornell Univ., Ithaca, N. Y. School of Civil and Environmental Engineering.
REMOTE SENSING PROGRAM Semiannual Status Report, 1 Dec. 1978 - 31 May 1979
Ta Liang, Arthur J. McNair, and Warren R. Philipson, Principal Investigators Jun. 1979 102 p refs ERTS
(Grant NGL-33-010-171)
(E79-10211; NASA-CR-158683; SASR-14) Avail: NTIS HC A06/MF A01 CSCL 05B

N79-26441*# Department of Agriculture, Phoenix, Ariz. Water Conservation Lab.
HCMM HEAT CAPACITY MAPPING MISSION Quarterly Progress Report, 1 Feb. - 30 Apr. 1979
Ray D. Jackson, Principal Investigator 30 Apr. 1979 1 p ERTS
(NASA Order S-40255-B)
(E79-10214; NASA-CR-158686) Avail: NTIS HC A02/MF A01 CSCL 05B

N79-28062*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NASA JSC WATER MONITOR SYSTEM: CITY OF HOUSTON FIELD DEMONSTRATION
R. E. Taylor, E. L. Jeffers, and D. H. Fricks Jul. 1979 57 p refs
(NASA-RP-1041; S-490; JSC-14832) Avail: NTIS HC A04/MF A01 CSCL 13B

A water quality monitoring system with on-line and real time operation similar to the function in a spacecraft was investigated. A system with the capability to determine conformance to future high effluent quality standards and to increase the potential for reclamation and reuse of water was designed. Although all system capabilities were not verified in the initial field trial, fully automated operation over a sustained period with only routine manual adjustments was accomplished. Two major points were demonstrated: (1) the water monitor system has great potential in water monitoring and/or process control applications; and (2) the water monitor system represents a vast improvement over conventional (grab sample) water monitoring techniques. S.E.S.

07

DATA PROCESSING AND DISTRIBUTION SYSTEMS

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

A79-32657 # **Landsat images and interpretation.** J. R. O'Malley (West Georgia College, Carrollton, Ga.). *Remote Sensing of the Electro Magnetic Spectrum,* vol. 5, Oct. 1978, p. 50-57.

Applications of the interpretation of Landsat images are outlined. Advantages of Landsat images for geographical studies include their repetitive nature, small scale pattern and textural resolution and spectral coverage. Disadvantages are due to atmospheric and illumination conditions and problems of scale. Examples of the use of Landsat images to monitor floods, highway construction, urban development and land use patterns are presented. Interpretation problems associated with weather systems and the application of aerial photointerpretation techniques to Landsat data are also illustrated, noting that by correct scale selection and appropriate application of interpretation aids, some of the problems of data extraction from space imagery can be avoided. A.L.W.

A79-34409 * **A real-time satellite data acquisition, analysis and display system - A practical application of the GOES network.** R. A. Sutherland, J. L. Langford, J. F. Bartholic, and R. G. Bill, Jr. (Florida, University, Gainesville, Fla.). *Journal of Applied Meteorology,* vol. 18, Mar. 1979, p. 355-360. 7 refs. Research supported by the University of Florida; Contract No. NAS10-8920.

A real-time satellite data acquisition, analysis and display system is described which uses analog data transmitted by telephone line over the GOES network. Results are displayed on the system color video monitor as 'thermal' images which originated from infrared surface radiation sensed by the Geostationary Operational Environmental Satellite (GOES). (Author)

A79-36490 # **An approach to the use of statistical context in remote sensing data analysis.** E. F. Kit and P. H. Swain (Purdue University, West Lafayette, Ind.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 37-41. Department of Defense Contract No. MDA-903-77-G-1.

A statistical model is developed for using image context in maximum likelihood classification. Experimental results using both simulated and real multispectral remote sensing data demonstrate the utility of the model. Some practical problems associated with the use of the model are discussed. (Author)

A79-36492 # **Registration of digital images.** W. A. Davis and S. K. Kenue (Alberta, University, Edmonton, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 48-52. 8 refs. National Research Council of Canada Grant No. A-7634.

This paper is concerned with the alignment or registration of digital images. The paper will begin with a brief survey of current registration techniques. The problems of automatic registration will be discussed and previous techniques outlined. A new method for automatically selecting control points and registering two Landsat images will be presented. Lastly, a method for registering digital images with large scale differences will be given. (Author)

A79-36494 # **Unsupervised classification in the ARIES image analysis system.** P. Letts (Computing Devices Co., Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 61-71.

A variety of techniques for unsupervised classification of multispectral scanning imagery has been applied to classify an area of 1001 pixels by 671 lines. The concept of self-generating trees, a standard method in artificial intelligence, is adopted for multidimensional histogram analysis to yield flexibility in the number of dimensions and a wide data range in each dimension. General normal distributions are constructed on the basis of local maxima or saddle points in the histogram. A purity filter permits study of homogeneous areas and detection of unexpected subcategories. Analysis of the merging of local maxima provides a simple linear test for category separability. The unsupervised classification methodology described here may be employed for forest inventories. J.M.B.

A79-36498 * # **Wetland classification on the Alaskan North Slope.** J. W. Morrow (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.) and V. Carter (U.S. Geological Survey, Reston, Va.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 94-103. 13 refs. Contract No. NAS7-100.

An interactive supervised wetland classification was performed on Landsat digital data for three sites on the North Slope of Alaska. Color-coded classification maps identifying 10 wetland subcategories were produced. Field observations, topographic maps, and aerial photographs were employed as collateral data in classifying and verifying the Landsat information. J.M.B.

A79-36507 * # **The application of Landsat data to mapping avalanche hazards.** S. Waterman (Colorado, University, Boulder, Colo.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 187-191. 5 refs. Grant No. NGL-06-003-200.

Two test areas, representing a variety of avalanche hazards, were selected in the San Juan Mountains of Colorado. Midwinter Landsat digital data were analyzed using a clustering technique, and the results compared to 1:24,000 scale maps of avalanche hazards derived from air photo interpretation and field surveys. Confined avalanches were readily identified because of the high contrast between the snow covered avalanche track and the adjacent forested slopes. Unconfined avalanches could not be identified without supplementary topographic data. Spatial characteristics were of primary importance in delineating avalanche tracks. Spatial resolution was the limiting factor in avalanche detection. Landsat data should prove useful for rapid reconnaissance mapping of avalanche hazards, particularly in the absence of other data sources. (Author)

A79-36517 # **Photomaps from precision rectified Landsat imagery.** R. Orth, K. Brydges, and F. Wong (MacDonald, Dettwiller and Associates, Ltd., Richmond, British Columbia, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 292-298.

The technique of precision image rectification using Ground Control Points (GCPs) with an attitude time series estimator is capable of providing Landsat imagery to an accuracy of 80 m rms. Class A planimetric map accuracy at a scale of 1:250,000 can therefore be achieved in photomap production from such imagery. This paper describes the production of such Landsat photomaps from digital imagery obtainable on standard computer compatible tapes. The first section describes the preparation stage, involving the selection of GCPs and determination of their coordinates for a particular Landsat scene. The MDA Image Analysis System is then used to determine the attitude time series for that scene and to produce a rectified image on 10 inch x 10 inch film. The resulting image film is then enlarged and photographically reproduced by conventional photolab techniques to give the final map product, as described in the next section. (Author)

A79-36538 # **SAR mechanisms for imaging waves.** R. K. Raney (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada) and R. A. Shuchman (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 495-505. 21 refs. Research supported by the Department of Energy, Mines and Resources and U.S. Navy.

A scattering model is proposed which appears to explain for the first time almost all features observed in the Doppler domain and image domain of Synthetic Aperture Radar (SAR) imagery of oceanic waves. The model, which is suitable for airborne and orbital radars, accounts for the coherence time of capillary centered scattering cells, and their coherently observable wave motions, including their vertical displacements. SAR wave imagery together with the results of detailed observations on the ERIM optical processor are presented to illustrate the pertinent effects. These results lead to the generic description of an optimum processor for wave contrast enhancement. (Author)

A79-36539 # **Digital techniques for the multi-look processing of SAR data with application to Seasat-A.** J. R. Bennett and I. G. Cumming (MacDonald, Dettwiller and Associates, Ltd., Richmond, British Columbia, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 506-516. 6 refs. Department of Energy, Mines and Resources Contract No. ISQ77-00172.

Digital techniques for azimuth look extraction, compression and registration of synthetic aperture radar (SAR) data as a function of slant range are presented. The phase properties of the Doppler histories are exploited to allow flexible look extraction in the frequency domain while maintaining automatic look registration in the output range. It is assumed that individual point reflector Doppler histories lie totally within a single range gate. Results obtained from a simulation with Seasat parameters are presented. C.K.D.

A79-40497 * **Digital techniques for processing Landsat imagery.** W. B. Green (California Institute of Technology, Jet Propulsion Laboratory, Science Data Analysis Section, Pasadena, Calif.). In: Information technology. Amsterdam, North-Holland Publishing Co., 1978, p. 605-621. 15 refs. Contract No. NAS7-100.

An overview of the basic techniques used to process Landsat images with a digital computer, and the VICAR image processing software developed at JPL and available to users through the NASA sponsored COSMIC computer program distribution center is presented. Examples of subjective processing performed to improve the information display for the human observer, such as contrast enhancement, pseudocolor display and band rationing, and of quantitative processing using mathematical models, such as classification based on multispectral signatures of different areas within a given scene and geometric transformation of imagery into standard mapping projections are given. Examples are illustrated by Landsat scenes of the Andes mountains and Altyn-Tagh fault zone in China before and after contrast enhancement and classification of land use in Portland, Oregon. The VICAR image processing software system which consists of a language translator that simplifies execution of image processing programs and provides a general purpose format so that imagery from a variety of sources can be processed by the same basic set of general applications programs is described. A.T.

A79-40584 **Up-link symbol-synchronous TDMA SATCOM system architectures.** R. J. Huff (Stanford Telecommunications, Inc., Sunnyvale, Calif.). In: NTC '78; National Telecommunications Conference, Birmingham, Ala., December 3-6, 1978, Conference Record. Volume 3. Piscataway, N.J., Institute of Electrical and Electronics Engineers, Inc., 1978, p. 40.3.1-40.3.5. 14 refs. Contract No. F30602-75-C-0061.

Candidate architectures for time division multiple access (TDMA) satellite communication systems wherein signal processing operations would be performed by satellite-borne subsystems are considered. These architectures require symbol-synchronous up-links to be established and maintained. Also, each up-link signal would be detected differentially - either at one or more terrestrial terminals after being relayed or by a satellite-bounce detector. These concepts provide a basis for implementing practical TDMA systems wherein one or more of the following operations would be performed within the satellites: adaptive spatial processing, spectrum collapsing and bandpass filtering, signal detection, message switching, forward error correction coding, remodulation, spectrum spreading of the down-link signal, antenna beam switching, and resource management. Selected combinations of these operations are delineated and their relative advantages and limitations are addressed. Prototype demand-assignment TDMA modems and an experimental satellite simulator, which are considered to have established that the concepts considered are both practical and effective, are also described briefly. (Author)

A79-41127 * **Radiometric correction and equalization of satellite digital data.** V. R. Algazi, G. E. Ford, and J. A. Kazakoff (California, University, Davis, Calif.). In: Annual Asilomar Conference on Circuits, Systems, and Computers, 12th, Pacific Grove, Calif., November 6-8, 1978, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 336-340. 8 refs. Grants No. NGL-05-003-404; No. NsG-5092.

Satellite digital data from Landsat and NOAA satellites is often marred by striping or streaking errors due to variations in the response of the radiometric sensors. In this paper, we discuss the equalization of the digital data as a preprocessing step, prior to image enhancement or automatic classification. The methods described make use of statistics of the data itself to generate nonlinear or linear memory-less equalization algorithms. These algorithms, by contrast to multidimensional filtering, do not result in a loss of spatial resolution. Examples of applications to Landsat and NOAA-3 thermal infrared data are given and illustrated. (Author)

A79-41128 **On the correction of geometric distortion in satellite-acquired images.** G. E. Ford, V. R. Algazi, and B. G. Agee (California, University, Davis, Calif.). In: Annual Asilomar Conference on Circuits, Systems, and Computers, 12th, Pacific Grove, Calif., November 6-8, 1978, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p. 341-344. 6 refs.

The problem of correcting geometric distortions in satellite imagery to make the imagery compatible with data from another data base, such as a map, is considered, based on experience with Landsat and NOAA-VHRR data. Geometric distortions in digital data arise primarily from earth curvature and rotation, scan skew, differences in the horizontal and vertical pixel scales, and variations in satellite velocity, altitude and attitude. Geometric correction for Landsat data is performed using a bivariate polynomial geometric distortion model and that for NOAA-VHRR data employs a deterministic correction based on orbital parameters, followed by a bivariate polynomial transformation, due to the large distortions in the data. The procedures are relatively easy to implement on a

minicomputer, although time-consuming, and lead to geometric corrections of Landsat and NOAA images to within one pixel rms.
A.L.W.

A79-41129 **Architecture of a tree-based image processor.**
W. W. Armstrong and J. Gecsei (Montréal, Université, Montreal, Canada). In: Annual Asilomar Conference on Circuits, Systems, and Computers, 12th, Pacific Grove, Calif., November 6-8, 1978, Conference Record. New York, Institute of Electrical and Electronics Engineers, Inc., 1979, p.345-349. 8 refs. Research supported by the National Research Council of Canada, Ministère de l'Education du Québec, and Université de Montréal.

Special-purpose hardware for image processing usually involves high-speed arithmetic operators. Here a processor is described whose central element is a fast combinational network in the form of a binary tree. It is programmable by computer analysis of image data or by adaptation. To achieve high efficiency, the processor is pipelined and shares the memory of its host computer. Its use for fast classification of LANDSAT imagery is described. (Author)

N79-23480# Michigan Univ., Ann Arbor. Wetlands Ecosystem Research Group.
REBUS: A COMPUTER ROUTINE FOR PREDICTIVE SIMULATION OF WETLAND ECOSYSTEMS
P. E. Parker, P. K. Gupta, K. R. Dixon, R. H. Kadlec, and D. E. Hammer Aug. 1978 186 p refs
(Grant NSF ENV-76-80708)
(PB-291587/4; NSF/RA-780347) Avail: NTIS HC A09/MF A01 CSCL 08A

REBUS (Routine for Executing Biological Unit Simulation) is a use oriented computer program package written in FORTRAN 4 for simulation of the dynamic behavior for ecosystems. It was designed to allow the ecologist without previous experience in process simulation to analyze complex ecosystems. Dynamic simulation is the creation of a mathematical model which describes the time varying behavior of a physical system to be studied. This model ecosystem can conveniently be observed under any desired conditions. With a model that adequately represents the real system, long-term effects can be successfully predicted which could not practicably be tested by experiment. Data preparation, REBUS operation, block functions, and unit routines are reviewed. A second version, REBUS 2 was implemented for use in conjunction with optimization and design activities and is discussed. GRA

N79-23710# National Technical Information Service, Springfield, Va.
A DIRECTORY OF COMPUTER SOFTWARE APPLICATIONS: NATURAL RESOURCES AND EARTH SCIENCES Progress Report, 1970 - Dec. 1978
Dec. 1978 151 p
(PB-288486/4; NTIS/SA-78/18) Avail: NTIS HC $28.00/MF $28.00 CSCL 05B

Natural resource and earth science reports that list computer programs and/or their documentation are cited. These software applications pertain to topics such as mining, hydrology, soil and rock properties, earthquake modeling, forestry, remote sensing, cartography, geophysics, coastal zone management, and geothermal systems. The directory contains complete bibliographic data for each report as well as a subject and a corporate author index. GRA

N79-24430# National Technical Information Service, Springfield, Va.
INSTRUMENTATION AND DATA PROCESSING USED IN EARTH RESOURCES TECHNOLOGY SATELLITES (ERTS), VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - 1978
Audrey S. Hundemann Mar. 1979 208 p Supersedes NTIS/PS-78/0070; NTIS/PS-77/0081; NTIS/PS-76/0055; NTIS/PS-75/105
(NTIS/PS-79/0206/7; NTIS/PS-78/0070; NTIS/PS-77/0081; NTIS/PS-76/0070; NTIS/PS-76/0055; NTIS/PS-75/105)
Avail: NTIS HC $28.00/MF $28.00 CSCL 14B

New or improved remote sensing techniques are given. Topic areas covered include pattern recognition, spectrum analysis, image enhancement, photointerpretation, multispectral photography, and mapping. GRA

N79-25442 British Library Lending Div., Boston Spa (England).
DIGITAL PROCESSING OF THE NOAA WEATHER SATELLITE SCANNING-RADIOMETER (SR) DATA RECEIVED AT THE FU METEOROLOGICAL INSTITUTE. PART 4: GEOGRAPHICAL RECTIFICATION AND PRESENTATION IN A STEREOGRAPHIC MAP PROJECTION
D. Koslowsky 6 Nov. 1978 33 p refs Transl. into ENGLISH of West German report, Freie Univ., Inst. Met. u. Inst. Geoph. Wissensch., Met. Abh., Neue Folge, Ser. B. H. 9, 1977, Beil. 86/77 32 p
(BLL-Trans-1362-(9022.549)) Avail: British Library Lending Div., Boston Spa, Engl.

Each measurement of the system composed of the Earth's surface and the atmosphere taken by the radiometer on board a near polar orbiting satellite is a unique event. In order to extract as much information as possible from the measurements they must be rendered physically and geographically comparable; this means standardizing the data. Meteorological research is interested in the space and time variation over the course of hours and days, of the meteorologically significant structures they reveal, and this with the aim of connecting them with other meteorological parameters. An operational method was developed for this standardization, offering rectification of the satellite data into a polar stereographic projection, almost in real time. All programs are run on a DEC PDP 11/45 minicomputer. G.Y.

N79-25449*# Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
THE ANALYTICAL DESIGN OF SPECTRAL MEASUREMENTS FOR MULTISPECTRAL REMOTE SENSOR SYSTEMS
D. J. Wiersma and D. A. Landgrebe, Principal Investigators 1979 272 p refs EREP
(Contract NAS9-15466)
(E79-10200; NASA-CR-160170; LARS-TR-122678; TR-EE-79-13) Avail: NTIS HC A12/MF A01 CSCL 14B

The author has identified the following significant results. In order to choose a design which will be optimal for the largest class of remote sensing problems, a method was developed which attempted to represent the spectral response function from a scene as accurately as possible. The performance of the overall recognition system was studied relative to the accuracy of the spectral representation. The spectral representation was only one of a set of five interrelated parameter categories which also included the spatial representation parameter, the signal to noise ratio, ancillary data, and information classes. The spectral response functions observed from a stratum were modeled as a stochastic process with a Gaussian probability measure. The criterion for spectral representation was defined by the minimum expected mean-square error.

N79-25459*# National Aeronautics and Space Administration. Earth Resources Lab., Slidell, La.
A PROCEDURE FOR EXTRACTION OF DISPARATE DATA FROM MAPS INTO COMPUTERIZED DATA BASES
Bobby G. Junkin, Principal Investigator Apr. 1978 53 p refs Original contains color illustrations ERTS
(E79-10210; NASA-TM-80414; Rept-167) Avail: NTIS HC A04/MF A01 CSCL 05B

N79-25460*# National Aeronautics and Space Administration, Washington, D. C.

MATHEMATIC MODELING OF THE EARTH'S SURFACE AND THE PROCESS OF REMOTE SENSING
B. M. Balter Jun. 1979 32 p refs Transl. into ENGLISH of "Matematicheskoye Modelirovaniye Zemnoy Poverkhnosti i Protsessa Distantsionnogo Zondirovaniya", Rept. Pr-354 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1977 p 1-29 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75622; Pr-354) Avail: NTIS HC A03/MF A01 CSCL 08B

It is shown that real data from remote sensing of the Earth from outer space are not best suited to the search for optimal procedures with which to process such data. To work out the procedures, it was proposed that data synthesized with the help of mathematical modeling be used. A criterion for simularity to reality was formulated. The basic principles for constructing methods for modeling the data from remote sensing are recommended. A concrete method is formulated for modeling a complete cycle of radiation transformations in remote sensing. A computer program is described which realizes the proposed method. Some results from calculations are presented which show that the method satisfies the requirements imposed on it.
G.Y.

N79-27626 Ain Shams Univ., Cairo (Egypt).
EGYPT AS SEEN BY LANDSAT
Farouk El-Baz [1979] 160 p Partly in ENGLISH; partly in ARABIC Prepared in cooperation with Smithsonian Institution, Washington, D. C. Original contains color illustrations
Avail: Dar Al-Maares, 1119 Corniche, El-Nil, Cairo, Egypt HC 11 Egyptian pounds

The land area and territorial waters of Egypt are presented. The LANDSAT images allow for the geology of the region to be studied. LANDSAT imagery has two advantages over other imagery: (1) The LANDSAT images provide complete coverage of Egypt at the same scale; and (2) Because LANDSAT images are all taken vertically, they are suitable for planimetric mapping and direct horizontal distance measurements. R.E.S.

N79-27630*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF REGISTRATION, COMPRESSION AND CLASSIFICATION ALGORITHMS. VOLUME 1: RESULTS
R. Jayroe, R. Atkinson, L. Callas, J. Hodges, B. Gaggini, and J. Peterson Feb. 1979 126 p refs 2 Vol.
(NASA-TM-78227-Vol-1) Avail: NTIS HC A07/MF A01 CSCL 05B

The registration, compression, and classification algorithms were selected on the basis that such a group would include most of the different and commonly used approaches. The results of the investigation indicate clearcut, cost effective choices for registering, compressing, and classifying multispectral imagery.
R.E.S.

N79-27631*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF REGISTRATION, COMPRESSION AND CLASSIFICATION ALGORITHMS. VOLUME 2: DOCUMENTATION
R. Jayroe, R. Atkinson, L. Callas, J. Hodges, B. Gaggini, and J. Peterson Feb. 1979 330 p refs 2 Vol.
(NASA-TM-78227-Vol-2) Avail: NTIS HC A15/MF A01 CSCL 05B

The IBM-360 FORTRAN listings of the algorithms used in the investigation are presented in this programmer's user manual. R.E.S.

N79-27642# Instituto de Pesquisas Espaciais, Sao Paulo (Brazil).
CLASSIFICATION OF MULTISPECTRAL IMAGES OF NATURAL RESOURCES USING TABLE LOOK-UP APPROACH AND CLUSTERING [CLASSIFICACAO DE IMAGENS MULTI-ESPECTRAIS DE RECURSOS NATURAIS USANDO TABLE LOOK-UP E AGREGACAO]
Nelson I. Tanaka, Renato H. L. Pedrosa, and Nelson D. A. Mascarenhas Mar. 1979 105 p refs In PORTUGUESE; ENGLISH summary
(INPE-1439-TDL/006) Avail: NTIS HC A06/MF A01

Two computational methods were implemented, with the objective of optimizing the classification time of earth resources multispectral images, obtained through the LANDSAT. Both methods were based on the table look-up approach: one uses two tables and the other uses a data structure accessed through hashing. Furthermore, a classification system using clustering was also implemented, based on the ISODATA algorithm.
Author

N79-27646# Research Inst. of National Defence, Stockholm (Sweden).
PROGRAM LIBRARY FOR HANDLING AND PROCESSING OF REMOTELY SENSED MULTISPECTRAL DATA
S. Ingvar Aakersten and Lars-Erik Gustafsson Sep. 1978 94 p refs Revised
(FOA-C-30146-E1) Avail: NTIS HC A05/MF A01

A brief user's guide to a system of computer programs for the handling, processing, and analysis of multispectral pictorial data is presented. The system is implemented on an IBM 370/165 at the Stockholm computer center. The programs are used in batch processing with one specially prepared source deck for every separate application task. Examples are given of typical combinations of tasks for image generation and type area identification starting with appropriately edited digital data.
Author (ESA)

08
INSTRUMENTATION AND SENSORS

Includes data acquisition and camera systems and remote sensors.

A79-33372 **Comparison of auroral ovals from all-sky camera studies and from satellite photographs.** F. R. Bond (Department of Science, Antarctic Div., Melbourne, Australia) and S.-I. Akasofu (Alaska, University, Fairbanks, Alaska). *Planetary and Space Science,* vol. 27, Apr. 1979, p. 541-549. 9 refs. NSF Grant No. ATM-77-26522.

A79-34820 # **Maritime proton magnetometer MPM-5 (Morskoi protonnyi magnitometr MPM-5).** I. I. Beliaev (Akademiia Nauk SSSR, Institut Okeanologii, Moscow, SSR). *Okeanologiia,* vol. 19, Jan.-Feb. 1979, p. 178-180. In Russian.

The maritime proton magnetometer MPM-5 and its technical characteristics are described. The magnetometer has high sensitivity (0.1 nT) and quick response (up to one measurement per second), and also good noise protection. Tests of the magnetometer conducted at Lake Baikal have shown that it provides highly accurate measurements. The rms error for measurements in a quiet field was plus or minus 0.2-0.3 nT. P.T.H.

A79-36514 # **Radiometric determination of thermal emissivity in situ.** J. Vlcek (Toronto, University, Toronto, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 251-254. 6 refs. Research supported by the Canadian Forestry Service.

Methods are described for radiometric determination of thermal emissivity of natural features in the field. Instrumentation used consisted of an AGA Thermovision System T-750 with a filter limiting the spectral response to between 4.8 - 6.5 micron and a PRT-10L radiometer with a spectral range of 6 - 20 micron. Preliminary results for each method are given. (Author)

A79-36519 # **AQUASAND - A beach reflectance model and validation tests.** R. A. Shuchman, G. H. Suits, and C. F. Davis (Michigan, Environmental Research Institute, Ann Arbor, Mich.). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 318-327. Contract No. N0014-74-0273.

The AQUASAND radiative transfer model for predicting the reflectance of beach sands in the .35 to 2.5 micrometer range, a modification of the Suits model for the directional reflectance of a vegetation canopy, (1972) is described. The reflectance of a beach is calculated from the coefficients of absorption and scattering and the forward scattering fraction for each mineral present, the average number of sand grains per given volume, void space, and the moisture depth profile. AQUASAND was used to generate reflectance curves for seven beaches of diverse mineralogy, grain size, and moisture content. Overall shape of the curves is in good agreement with spectra measured by the ERIM Cary 14 spectroreflectometer. C.K.D.

A79-36537 * # **Radar image processing of real aperture SLAR data for the detection and identification of iceberg and ship targets.** J. G. Marthaler (U.S. Coast Guard, Office of Research and Development, Washington, D.C.) and J. E. Heighway (NASA, Lewis Research Center, Applications Div., Cleveland, Ohio). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 483-494.

An iceberg detection and identification system consisting of a moderate resolution Side Looking Airborne Radar (SLAR) interfaced with a Radar Image Processor (RIP) based on a ROLM 1664 computer with a 32K core memory updatable to 64K is described. The system can be operated in high- or low-resolution sampling modes. Specifically designed algorithms are applied to digitized signal returns to provide automatic target detection and location, geometrically correct video image display and data recording. The real aperture Motorola AN/APS-94D SLAR operates in the X-band and is tunable between 9.10 and 9.40 GHz; its output power is 45 kW peak with a pulse repetition rate of 750 pulses per hour. Schematic diagrams of the system are provided, together with preliminary test data. C.K.D.

A79-38371 **Temperature calibration of fast infrared scanners.** C. Dancak (Wisconsin, University, Madison, Wis.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, June 1979, p. 749-751.

A theoretical calibration function relating the electrical output of an airborne infrared scanner to the surface temperature of the scanned terrain is derived from radiometric principles. The function is applicable to scanners employing fast, photon-sensitive detectors, such as InSb and HgCdTe. Computed values of the function are used to plot a calibration curve for an idealized scanner of 8 to 14-micron bandwidth. A simple fourth-power law of the form AT to the fourth power + B can be fitted to the plotted curve with errors of less than 0.05 C over a 25-deg temperature range. The assumption of a T to the 4th power temperature dependence in thermal scanning at 8 to 14 microns is thereby justified on a theoretical basis. In addition, the temperature dependence of a fast infrared scanner is shown to be fundamentally different from that of a slow infrared radiometer of identical bandwidth. (Author)

A79-38740 **A Seasat synthetic aperture radar preprocessor /SARP/.** E. L. Waltz (Bendix Corp., Aerospace Systems Div., Ann Arbor, Mich.). In: ITC/USA/'78; Proceedings of the International Telemetering Conference, Los Angeles, Calif., November 14-16, 1978. Pittsburgh, Pa., Instrument Society of America, 1978, p. 793-802.

The Seasat SARP system permits playback of SAR data for digital processing into ocean imagery. The system includes a high data rate recorder, SAR digital preprocessing, array processor, mass storage disk, and host computer. Data tapes are played back at reduced rates and the SAR digital preprocessing performs the functions of frame synchronization, decommutation of time and status data, presummation of adjacent azimuth returns and correction of gain as a function of range. The data are formatted into presummed range returns and are transferred to the array processor for buffering and subsequent storage on the mass disk. B.J.

A79-38884 **Terrain displays for mission briefing.** R. A. Heartz (General Electric Co., Fairfield, Conn.). In: Annual Simulation Symposium, 11th, Tampa, Fla., March 15-17, 1978, Record of Proceedings. Tampa, Fla., Annual Simulation Symposium; Long Beach, Calif., IEEE Computer Society, 1978, p. 239-252.

Terrain displays derived from digital data bases and generated on color TV monitors may replace the maps, photographs and sketches currently used to brief pilots. Computer-generated imagery can show terrain elevation, terrain relief shading from any direction, slope steepness and direction, hydrography, farmland, forests, buildings and symbology. Displays can be merged, specific themes can be selected from imagery, and a zoom view of any desired area can be produced. In addition to perspective views from any position in the data base, simulated sensor images (radar, far-looking IR or TV) can be generated. Minimum scene update rates and minimum data bases for the terrain displays are discussed. J.M.B.

A79-39984 **Infra-red radiometry in the German Bight.** G. A. Becker, K. Huber (Deutsches Hydrographisches Institut, Hamburg, West Germany), and H. Krause (Hamburg, Universität, Hamburg, West Germany). *Deutsche Hydrographische Zeitschrift,* vol. 32, no. 1, 1979, p. 19-26. 9 refs. Research supported by the Bundesministerium für Forschung und Technologie.

A number of IR scanning sensors were studied as to their effectiveness in the determination of surface temperature distributions. The measurement accuracy was found to meet the purposes of hydrographical studies. An accuracy of roughly plus or minus 0.2 K appears to be attainable under meteorological conditions characterized by low water vapor content and cloudless sky. IR remote sensing methods are particularly effective at a pronounced temporal and spatial variability of the water surface temperature. The small scale structures detected in such cases were not attainable by conventional methods. V.P.

A79-40236 * **Seasat altimeter calibration - Initial results.** B. D. Tapley (Texas, University, Austin, Tex.), G. H. Born, H. H. Hagar, J. Lorell, M. E. Parke (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), J. M. Diamante, B. C. Douglas (NOAA, National Ocean Survey, Rockville, Md.), R. Kolenkiewicz, J. G. Marsh (NASA, Goddard Space Flight Center, Greenbelt, Md.), and W. F. Townsend (NASA, Wallops Flight Center, Wallops Island, Va.). *Science,* vol. 204, June 29, 1979, p. 1410-1412. 6 refs. Contract No. NAS7-100.

Preliminary analysis of radar altimeter data indicates that the instrument has met its specifications for measuring spacecraft height above the ocean surface (plus or minus 10 centimeters) and significant wave height (plus or minus 0.5 meter). There is ample evidence that the radar altimeter, having undergone development through three earth orbit missions (Skylab, Geodynamics Experimental Ocean Satellite 3 and Seasat), has reached a level of precision that now makes possible its use for important quantitative oceanographic investigations and practical applications. (Author)

A79-40238 * **Seasat scanning multichannel microwave radiometer - Results of the Gulf of Alaska workshop.** R. G. Lipes, E. G. Njoku, A. L. Riley (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), R. L. Bernstein (California, University, Scripps Institution of Oceanography, La Jolla, Calif.), V. J. Cardone (Oceanweather, Inc., New York, N.Y.), K. B. Katsaros (Washington, University, Seattle, Wash.), D. B. Ross (NOAA, Atlantic Oceanic and Meteorological Laboratory, Miami, Fla.), C. T. Swift (NASA, Langley Research Center, Hampton, Va.), and F. J. Wentz (Frank J. Wentz and Associates, San Francisco, Calif.). *Science,* vol. 204, June 29, 1979, p. 1415-1417. Contract No. NAS7-100.

Scanning multichannel microwave radiometer results obtained by the Gulf of Alaska Seasat Experiment Workshop are reported. The Seasat SMMR provided data from five channels operating at 6.6, 10.7, 18, 21, and 37 GHz at vertical and horizontal polarizations. Two preliminary algorithms were used to retrieve geophysical parameters from the data: the Wentz algorithm (Bierman et al., 1978) based on a theoretically derived function for computing brightness temperatures and the Wilheit algorithm, based on statistical relationships between brightness temperatures and the geophysical parameters obtained from an ensemble of realistic sea-surface temperature values, wind speeds, atmospheric temperature profiles, water vapor profiles and cloud models. In spite of the immaturity of the data-processing algorithms, results are encouraging. For open ocean, rain-free cells of high-quality surface truth wind determinations display standard deviations of 3 m/sec about a bias of 1.5 m/sec. The sea-surface temperature exhibits a standard deviation of about 1.5 deg C about a bias of 3 to 5 deg C under a variety of meteorological conditions. C.K.D.

A79-40239 * **Seasat synthetic aperture radar - Ocean wave detection capabilities.** F. I. Gonzalez (NOAA, Pacific Marine Environmental Laboratory, Seattle, Wash.), R. C. Beal (Johns Hopkins University, Applied Physics Laboratory, Laurel, Md.), W. E. Brown (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.), P. S. DeLeonibus, J. W. Sherman, III (NOAA, National Environmental Satellite Service, Washington, D.C.), J. F. R. Gower (Institute of Ocean Sciences, Sidney, British Columbia, Canada), D. Lichy (U.S. Army, Coastal Engineering Research Center, Fort Belvoir, Va.), D. B. Ross (NOAA, Sea-Air Interaction Laboratory, Boulder, Colo.), C. L. Rufenach (NOAA, Wave Propagation Laboratory, Boulder, Colo.), and R. A. Shuchman (Michigan, Environmental Research Institute, Ann Arbor, Mich.). *Science,* vol. 204, June 29, 1979, p. 1418-1421. 15 refs. NASA-sponsored research; Contract No. NOAA-MO-A01-78-00-4339.

A preliminary assessment has been made of the capability of the Seasat synthetic aperture radar to detect ocean waves. Comparison with surface and aircraft measurements from five passes of the satellite over the Gulf of Alaska indicates agreement to within about 15 percent in wavelength and about 25 deg in wave direction. These results apply to waves 100 to 250 meters in length, propagating in a direction predominantly across the satellite track, in sea states with significant wave height in a range of 2 to 3.5 meters. (Author)

A79-40240 * **Seasat visible and infrared radiometer.** E. P. McClain (NOAA, National Environmental Satellite Service, Washington, D.C.) and R. A. Marks (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif.). *Science,* vol. 204, June 29, 1979, p. 1421-1424. Contract No. NAS7-100.

The visual and infrared radiometer (VIRR) system on Seasat is described, and methods used in the geophysical evaluation of digital data from this system are discussed. The main function of the radiometer system is to provide images of visual reflection and thermal infrared emission from ocean, coastal and atmospheric features to facilitate interpretation of data from other Seasat sensors; in addition, it is expected to provide some derived quantitative measurements of such factors as sea-surface temperature and cloud-top height. Some results of a statistical comparison of Seasat VIRR-derived sea-surface temperatures in a cloud-free region with a National Oceanic and Atmospheric Administration (NOAA) analysis based on surface measurements made in the same region are presented. The data sets were in agreement of plus or minus 1.7 deg K root-mean-square. The means of the two sets of temperatures were 293.9 deg K (VIRR) and 293.1 deg K (NOAA), and the standard deviations were 3.21 deg and 3.2 deg K, respectively. C.K.D.

A79-41231 **ALEX F - A remote sensor system for environmental monitoring (ALEX F - Ein Fernerkundungssystem für die Umweltforschung).** P. Mörl, M. Reinhardt, and W. Renger (Deutsche Forschungs- und Versuchsanstalt für Luft- und Raumfahrt, Institut für Physik der Atmosphere, Oberpfaffenhofen, West Germany). *DFVLR-Nachrichten,* June 1979, p. 26-28. In German.

The airborne ALEX F (Aerosol Lidar Experiment; Flugzeug) experiment uses a Nd-YAG laser (operating at 10.6 microns) to measure aerosol concentrations in the atmosphere. The lidar is particularly well suited for the study of smog layers and the monitoring of particulate emissions from industrial stacks. The design and operation of the lidar are described and some sample results, obtained in Europe, are discussed. B.J.

A79-42160 # **Optimization of the characteristics of a scatterometer for investigating underlying surfaces (Optimizatsiia kharakteristik skatterometra dlia issledovaniia podstilaiushchikh poverkhnostei).** M. G. Bulatov, I. A. Troitskii, and V. S. Etkin. *Radiotekhnika,* vol. 34, Apr. 1979, p. 55-57. 5 refs. In Russian.

Consideration is given to the use of airborne or satellite-borne scatterometers to measure the radar cross sections of underlying surfaces. A procedure for developing an optimal scatterometer is proposed based on the matching of the energy characteristics of the device with the characteristics of the underlying surface and the flight characteristics (i.e., height and velocity). B.J.

A79-42188 Recent microwave radiation studies of continental covers. N. A. Armand, A. E. Basharinov, and A. M. Shutko (Akademiia Nauk SSSR, Institut Radiotekhniki i Elektroniki, Moscow, USSR). *Acta Astronautica,* vol. 6, May-June 1979, p. 647-655. 20 refs.

An extensive program of studies of microwave radiation properties of continental covers was carried out in 1976 and 1977 from ground stations, aircraft, and satellites. On this basis it was possible to determine the microwave spectra of moist soils, vegetative covers, glaciers and thermal sources. The results of these studies are now being used in the development of remote sensing methods for geophysical research and for practical purposes. (Author)

N79-22583*# Oklahoma State Univ., Stillwater. Dept. of Agricultural Engineering
IMPROVED PRECISION IN AERIAL APPLICATION EQUIPMENT Quarterly Progress Report, 1 Jan. - 31 Mar. 1979
Lawrence O. Roth, Principal Investigator 31 Mar. 1979 3 p ERTS
(Grant NsG-6018)
(E79-10184; NASA-CR-158414) Avail: NTIS HC A02/MF A01 CSCL 02C

N79-22589*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A COMPARISON OF MEASURED AND CALCULATED UPWELLING RADIANCE OVER WATER AS A FUNCTION OF SENSOR ALTITUDE
Thom A. Coney and Jack A. Salzman 1979 19 p refs Presented at the 13th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 23-27 Apr. 1979; sponsored by Mich. Univ.
(NASA-TM-79147; E-003) Avail: NTIS HC A02/MF A01 CSCL 08H

A comparison is made between remote sensing data measured over water at altitudes ranging from 30 m to 15.2 km and data calculated for corresponding altitudes using surface measurements and an atmospheric radiative transfer model. Data were acquired on June 22, 1978 in Lake Erie, a cloudless, calm, near haze free day. Suspended solids and chlorophyll concentrations were 0.59 + or - 0.02 mg/1 and 2.42 + or - 0.03 micrograms/1 respectively throughout the duration of the experiment. Remote sensor data were acquired by two multispectral scanners each having 10 bands between 410 nm and 1040 nm. Calculated and measured nadir radiances for altitudes of 152 m and 12.5 km agree to within 16% and 14% respectively. The variation in measured radiance with look angle was poorly simulated by the model. It was concluded that an accurate assessment of the source of error will require the inclusion in the analysis of the contributions made by the sea state and specular sky reflectance. Author

N79-23313*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VHF DOWNLINE COMMUNICATION SYSTEM FOR SLAR DATA
R. J. Schertler, T. L. Chase, R. A. Mueller, I. Kramarchuk, R. J. Jirberg, and R. T. Gedney 1979 10 p refs Presented at the 13th Intern. Symp. on Remote Sensing of Environment, Ann Arbor, Mich., 23-27 Apr. 1979; sponsored by Michigan Univ.
(NASA-TM-79164; E-025) Avail: NTIS HC A02/MF A01 CSCL 17I

A real time VHF downlink communication system is described for transmitting side-looking airborne radar (SLAR) data directly from an aircraft to a portable ground/shipboard receiving station. Use of this receiving station aboard the U.S. Coast Guard icebreaker Mackinaw for generating real-time photographic quality radar images is discussed. The system was developed and demonstrated in conjunction with the U.S Coast Guard and NOAA National Weather Service as part of the Project Icewarn all weather ice information system for the Great Lakes Winter Navigation Program. Author

N79-24419*# Mitre Corp., McLean, Va.
MICROWAVE REMOTE SENSING LABORATORY DESIGN
E. Friedman Mar. 1979 83 p refs Sponsored by NASA
(Contract F19628-78-C-0001)
(NASA-CR-159015; MTR-7975) Avail: NTIS HC A05/MF A01 CSCL 14B

Application of active and passive microwave remote sensing to the study of ocean pollution is discussed. Previous research efforts, both in the field and in the laboratory were surveyed to derive guidance for the design of a laboratory program of research. The essential issues include: choice of radar or radiometry as the observational technique; choice of laboratory or field as the research site; choice of operating frequency; tank sizes and material; techniques for wave generation and appropriate wavelength spectrum; methods for controlling and disposing of pollutants used in the research; and pollutants other than oil which could or should be studied. R.E.S.

N79-24420*# Environmental Sensing Algorithm Development Co., Sunland, Calif.
EVALUATION AND ANALYSIS OF SEASAT-A SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR) ANTENNA PATTERN CORRECTION (APC) ALGORITHM Final Report
J. L. Kitzis and S. N. Kitzis 25 May 1979 95 p refs Prepared for JPL
(Contracts NAS7-100; JPL-955368)
(NASA-CR-158674; JPL-9950-85) Avail: NTIS HC A05/MF A01 CSCL 20N

The brightness temperature data produced by the SMMR final Antenna Pattern Correction (APC) algorithm is discussed. The algorithm consisted of: (1) a direct comparison of the outputs of the final and interim APC algorithms; and (2) an analysis of a possible relationship between observed cross track gradients in the interim brightness temperatures and the asymmetry in the antenna temperature data. Results indicate a bias between the brightness temperature produced by the final and interim APC algorithm. S.E.S.

N79-24421*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A HYDROLOGICAL ANALYSIS OF EAST AUSTRALIAN FLOODS USING NIMBUS 5 ELECTRICALLY SCANNING MICROWAVE RADIOMETER DATA
Lewis J. Allison, Thomas J. Schmugge, and Gavin Byrne (Commonwealth Scientific and Industrial Research Organization, Australia) Mar. 1979 48 p refs Submitted for publication
(NASA-TM-79689) Avail: NTIS HC A03/MF A01 CSCL 08H

A chronology of a major Australian flood in 1974 is presented using Nimbus 5 Passive Microwave Data (ESMR) and other conventional and satellite supporting data. L.S.

N79-25364*# Wentz (Frank J.) and Associates, San Francisco, Calif.
DESIGN STUDY FOR FUTURE SATELLITE MICROWAVE SCATTEROMETERS, PART 3 Final Report
Frank J. Wentz 26 Mar. 1979 27 p refs
(Contract NAS1-15288)
(NASA-CR-159079; FWA79-003-Pt-3) Avail: NTIS HC A03/MF A01 CSCL 14B

A computerized simulation analysis for a number of scatterometer antenna configuration and polarization modes including the Seasat scatterometer (SASS) is presented. The results of the simulations were expressed in terms of performance statistics. These statistics relate to the wind direction alias removal capability and to the rms sensing errors for friction velocity and wind direction X. The statistics are analyzed, and optimum scatterometer configurations are recommended. The accuracy of the SASS in measuring U* and X, and its capability to resolve wind direction aliases are assessed. M.M.M.

N79-26756# Semcor, Inc., Moorestown, N. J.
ATLAS OF INFRARED IMAGERY OF THE SEA SURFACE

Phase Report, Nov. 1958 - Jul. 1972
Barbara J. Moser 25 Aug. 1978 124 p
(Contract N62269-77-C-0382)
(AD-A067731; NADC-78226-30) Avail: NTIS HC A06/MF A01 CSCL 08/10

This report is a collection of 192 examples of thermal imagery recorded from aircraft over bodies of water. These infrared pictures show the surface expressions of eddies, convection cells, currents, and thermal fronts in addition to sea ice, wind streaks, whitecaps, and waves. Explanatory information, such as portions of National Ocean Survey charts corresponding to some of the imagery, is provided. The imagery presented was recorded during the period May 1959 to May 1972 by seven airborne passive infrared line scanners (the Reconofax Camera; AN/AAD-2; Reconofax IV, Mark II; AN/AAR-30; AN/AAR-32; AN/AAR-35; and Reconofax XIIIA); brief descriptions of the equipment and a table of design and performance parameters are supplied. The imagery was recorded in the 3- to 5.5-micrometer and 8-to 14-micrometer spectral bands. Sensitivities of sets with the various detector types employed (Ge:Au, Ge:Cu, Ge:Hg, InSb, HgCdTe) ranged from 0.001 to 0.3 K; resolutions varied from 18.4 to 1.0 mrad. Author (GRA)

N79-27635*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN ALGORITHM FOR RETRIEVAL OF OCEAN SURFACE AND ATMOSPHERIC PARAMETERS FROM THE OBSERVATIONS OF THE SCANNING MULTICHANNEL MICROWAVE RADIOMETER (SMMR)
T. T. Wilheit and A. T. C. Chang May 1979 36 p refs Submitted for publication
(NASA-TM-80277) Avail: NTIS HC A04/MF A01 CSCL 08C

A formalism was developed which can be used to interpret the data in terms of sea surface temperature, sea surface wind speed, and the atmospheric overburden of water vapor and liquid water. It was shown with reasonable instrumental performance assumptions, these parameters could be derived to useful accuracies. Although the algorithms were not derived for use in rain, it is shown that, at least, token rain rates can be tolerated without invalidating the retrieved geophysical parameters. R.E.S.

N79-27636*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DIRECTIONAL SPECTRA OF OCEAN WAVES FROM MICROWAVE BACKSCATTER: A PHYSICAL OPTICS SOLUTION WITH APPLICATION TO THE SHORT-PULSE AND TWO-FREQUENCY MEASUREMENT TECHNIQUES
Frederick C. Jackson Jun. 1979 31 p refs Submitted for publication
(NASA-TM-80295) Avail: NTIS HC A03/MF A01 CSCL 08C

Two simple microwave radar techniques that are potentially capable of providing routine satellite measurements of the directional spectrum of ocean waves were developed. One technique, the short pulse technique, makes use of very short pulses to resolve ocean surface wave contrast features in the range direction; the other technique, the two frequency correlation technique makes use of coherency in the transmitted waveform to detect the large ocean wave contrast modulation as a beat or mixing frequency in the power backscattered at two closely separated microwave frequencies. A frequency domain analysis of the short pulse and two frequency systems shows that the two measurement systems are essentially duals; they each operate on the generalized (three frequency) fourth-order statistical moment of the surface transfer function in different, but symmetrical ways, and they both measure the same directional contrast modulation spectrum. A three dimensional physical optics solution for the fourth-order moment was obtained for backscatter in the near vertical, specular regime, assuming Gaussian surface statistics. Author

N79-27640*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MODEL FOR THE MICROWAVE EMISSIVITY OF THE OCEAN'S SURFACE AS A FUNCTION OF WIND SPEED
Thomas T. Wilheit Apr. 1979 25 p refs Submitted for publication
(NASA-TM-80278) Avail: NTIS HC A02/MF A01 CSCL 08C

A quanitative model is presented which describes the ocean surface as a ensemble of flat facets with a normal distribution of slopes. The variance of the slope distribution is linearly related to frequency up to 35 GHz and constant at higher frequencies. These facets are partially covered with an absorbing nonpolarized foam layer. Experimental evidence is presented for this model. Author

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GENERAL

Includes economic analysis.

A79-34759 * # **Post Landsat-D advanced concept evaluation /PLACE/.** L. D. Alexander, U. R. Alvarado (General Electric Co., Space Div., Philadelphia, Pa.), and F. S. Flatow (NASA, Goddard Space Flight Center, Greenbelt, Md.). In: Conference on Advanced Technology for Future Space Systems, Hampton, Va., May 8-10, 1979, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 504-510. Contract No. NAS2-9580. (AIAA 79-0944)

The aim of the Post Landsat-D Advanced Concept Evaluation (PLACE) program was to identify the key technology requirements of earth resources satellite systems for the 1985-2000 period. The program involved four efforts: (1) examination of future needs in the earth resources area, (2) creation of a space systems technology model capable of satisfying these needs, (3) identification of key technology requirements posed by this model, and (4) development of a methodology (PRISM) to assist in the priority structuring of the resulting technologies. B.J.

A79-34770 * # **Opportunities for space exploitation to year 2000 - A challenge for advanced technology.** A. J. Calio (NASA, Washington, D.C.). In: Conference on Advanced Technology for Future Space Systems, Hampton, Va., May 8-10, 1979, Technical Papers. New York, American Institute of Aeronautics and Astronautics, Inc., 1979, p. 581-587. (AIAA 79-0901)

Application of satellite remote sensing to wide range of areas requires the development or improvement of specialized spaceborne and ground-based equipment and systems. This paper describes some of the important areas for remote sensing and the opportunities that must be met in order to advance technology and capabilities for the exploitation of space to the year 2000. B.J.

A79-34866 * **Reaping the space investment.** A. J. Calio (NASA, Washington, D.C.). In: The future United States space program; Proceedings of the Twenty-fifth Anniversary Conference, Houston, Tex., October 30-November 2, 1978. Part 2. San Diego, Calif., American Astronautical Society; Univelt, Inc., 1979, p. 707-720. (AAS 78-181)

By 1999 operational space systems will be implemented routinely on a worldwide scale in many areas vital to human survival and life quality. Geosynchronous-based monitoring and observation will be extensively used. The Shuttle era will bring in the capability to allow monitoring and identifying pollution sources which fail to stay within required limits. Remotely sensed data over land masses will provide needed facts on renewable and nonrenewable earth resources. New instruments and techniques will have been developed to provide geologists with clues to the declining number of deposits of fuels and minerals. Also, practical methods for predicting earthquakes will have been elaborated by 1999. Communications will see implementation of many of the technological goals of 1978. S.D.

A79-36486 **Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings.** Symposium sponsored by CASI, Canadian Institute of Surveying, Fisheries and Environment Canada, and Department of Energy, Mines and Resources. Edited by A. MacEwan (Environment Canada, Pacific Forest Research Centre, Victoria, British Columbia, Canada). Ottawa, Canadian Aeronautics and Space Institute, 1979. 614 p. In English and French. $40.

Applications of remote sensing to forest and agricultural inventories, wetland mapping, soil erosion assessments, sea ice studies and mineral deposit mapping are discussed. Attention is also given to classification algorithms and image enhancement techniques. Topics of the papers include a Landsat-based forest survey of South Carolina, two-dimensional digital filters for multispectral scanning imagery, real-time on-board signal extraction methods for statistical and noisy remote sensing data, thermal infrared mapping of forest fires, Landsat mapping of suspended sediments in a lake, air quality forecasts derived from remote sensing data, aerial photography for park management, remote determinations of soil moisture, and remote measurements of Great Lakes surface temperature. J.M.B.

A79-36536 # **Assessment of the CCRS Airborne Program.** J. Cihlar (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada). In: Canadian Symposium on Remote Sensing, 5th, Victoria, British Columbia, Canada, August 28-31, 1978, Proceedings. Ottawa, Canadian Aeronautics and Space Institute, 1979, p. 474-482.

A survey of principal investigators who received airborne remote sensing data during the 1975/76 to 1977/78 period was undertaken to assess the results of the Canada Centre for Remote Sensing (CCRS) Airborne Program. The purpose of the survey was to determine how the airborne data were used, what benefits resulted from their use, and what applications were developed to an operational level. This paper presents major results of the assessment, discusses the impact of the CCRS Airborne Program, and describes an approach toward improving the effectiveness of transferring remote sensing methods to operational use. (Author)

A79-38370 **Some legal considerations in remote sensing.** H. F. Lins, Jr. (U.S. Geological Survey, Reston, Va.). *Photogrammetric Engineering and Remote Sensing,* vol. 45, June 1979, p. 741-748. 14 refs.

The paper introduces to users of remotely sensed data some of the legal aspects of these data and their uses. Evidentiary, environmental management, and enforcement applications are examined along with privacy and international-regulation considerations. The criteria governing the admissibility of remote sensing evidence are reliability of remote sensing techniques, proper conduct of the remote sensing process, authentication and proof of contents, and expert testimony. Neither the U.S. Constitution nor any of state constitutions explicitly guarantee a right of privacy. Remote sensing specialists should maintain an awareness of the dynamic conditions surrounding the legal aspects of their profession. S.D.

A79-38872 **India's earth resources satellite.** H. P. Mama. *Spaceflight,* vol. 21, July 1979, p. 300, 301.

The Satellite for Earth Observation (SEO), the second Indian satellite launched by the USSR in February 1979, for studying cultivated land, forests, rivers, snow and wetland in coastal areas is described. Consideration is given to its design and to two slow-scan TV cameras and a passive microwave radiometer, forming the main payload of SEO. The satellite is a 26 faceted polyhedron with roughly 3500 Soviet supplied silicon N/P solar cells, generating about 40 watts average power, and an Ni-Cd battery to store power. The TV cameras operate in the visible (0.54 to 0.66 microns) and the near IR (0.75 to 0.85 microns) bands. The three-horn Dice-type Satellite Microwave Radiometer (SAMIR) payload is a passive receiver for measuring microwave radiations in the 19.35 GHz range from the sea surface, and is manufactured by the Indian Research Organization (ISRO). ISRO has also produced a Data Collection/Relay Package - an unattended, battery-powered unit that can be placed in remote areas to collect and transmit meteorological data to a central receiver station via SEO. V.T.

A79-40332 # **European remote sensing satellite system for land applications.** E. Velten, E. Bachor, and H. Dittmar. *Dornier-Post* (English Edition), no. 3, 1979, p. 48-50.

The overall system study for the remote sensing satellite, an important element of the future ESA programs, is discussed. Mission objectives of a land application satellite system, directed toward the requirements of European users, include gathering statistical information for agriculture and forestry, water resources management, and development aid. Other applications covered are global ocean monitoring including air-sea interaction, circulation and polar ice surveys, and coastal ocean monitoring concerning fisheries, environmental monitoring, economic zone surveillance, and continental shelf operations. Payload applications for these objectives are also given. ESA system study objectives included: definition of a technically feasible overall system; definition of a development program; elaboration of proposals for a supporting research and technology program; and identification of necessary growth potential. M.E.P.

N79-22582* New Mexico Univ., Albuquerque. Technology Application Center.
LITERATURE REVIEW OF THE REMOTE SENSING OF NATURAL RESOURCES Quarterly Literature Review, Oct. - Dec. 1978
Jan. 1979 308 p Sponsored by NASA
(NASA-CR-157961; TAC-RS-78-004) Avail: NTIS HC A14 for foreign requestors only. Domestic orders, Univ. of New Mexico, Tech. Application Center, Albuquerque CSCL 05B
A bibliography is presented concerning remote sensing techniques. Abstracts of recent periodicals are included along with author, and keyword indexes. M.M.M.

N79-25117# Committee on Science and Technology (U. S. House).
NASA SPACE AND TERRESTRIAL APPLICATIONS, USER DEVELOPMENT ACTIVITIES
Washington GPO 1978 498 p refs Hearings before the Subcomm. on Space Sci. and Applications of the Comm. on Sci. and Technol., 95th Congr., 2d Sess., 27-29 Jun. 1978
(GPO-32-438) Avail: Subcomm. on Space Sci. and Applications
The remote sensing technology of NASA's earth monitoring programs is discussed as well as its transfer of activities to the commercial market place. M.M.M.

N79-25124# Applied Physics Lab., Johns Hopkins Univ., Laurel Md.
ARTIFICIAL EARTH SATELLITE DESIGNED AND FABRICATED BY THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY, REVISED Status Report, 1959 1978
Jul. 1978 242 p refs Revised
(Contract N00024-78-C-5384)
(AD-A066299; APL/JHU/SDO-1600-Rev) Avail: NTIS HC A11/MF A01 CSCL 22/2
Satellites designed and fabricated by the Applied Physics Laboratory of The Johns Hopkins University since the inception of the space program at APL in 1957 are described. The descriptions, including artist's concepts and other illustrations, are arranged in chronological order according to primary mission category. Satellite categories include navigation satellites (Transit, TRIAD, TIP, TRANSAT, etc.), geodetic research satellites (ANNA, GEOS, LIDOS, etc.), orbital environment and dynamics research satellites (TRAAC, 5E-series, DODGE), ionospheric research satellites (Beacon and Direct Measurement Explorers, P76-5), and astronomical exploration satellites (Small Astronomy Satellites). Appendixes include a functional description of the Navy Navigation Satellite System and several bibliographies. This report is updated from time to time with the issuance of new and revised material, and is one of a series that includes APL/JHU SDO-3100, 'Navy Navigation Satellite System User Equipment Handbook' and APL/JHU SDO-4100, 'Instrumentation Developed by APL/JHU for Non-APL Spacecraft.' Author (GRA)

N79-25446*# Mississippi State Univ., Mississippi State.
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 Nov. 1978 - 30 Apr. 1979
W. Frank Miller, Principal Investigator, Dale A. Quattrochi, Bradley D. Carter, Gary K. Higgs, Jimmy L. Solomon, and Charles L. Wax 1 May 1979 101 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. 57198 ERTS
(Grant NGL-25-001-054)
(E79-10196; NASA-CR-158510; SAPR-11) Avail: NTIS HC A06/MF A01 CSCL 05A
The author has identified the following significant results. The Lowndes County data base is essentially complete with 18 primary variables and 16 proximity variables encoded into the geo-information system. The single purpose, decision tree classifier is now operational. Signatures for the thematic extraction of strip mines from LANDSAT Digital data were obtained by employing both supervised and nonsupervised procedures. Dry, blowing sand areas of beach were also identified from the LANDSAT data. The primary procedure was the analysis of analog data on the I2S signal slicer.

N79-25451*# Michigan State Univ., East Lansing.
USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION Annual Progress Report, Dec. 1977 - Nov. 1978
Myles Boylan, Principal Investigator 9 Mar. 1979 74 p refs ERTS
(Grant NGL-23-004-083)
(E79-10202; NASA-CR-158557) Avail: NTIS HC A04/MF A01 CSCL 05A

N79-25466# Austrian Solar and Space Agency, Vienna.
REMOTE SENSING IN AUSTRIA. SURVEY OF EXISTING AND PLANNED PROJECTS [FERNERKUNDUNG IN OESTERREICH. UEBERSICHT BESTEHENDER UND GEPLANTER VORHABEN]
Graz Oct. 1977 119 p In GERMAN Sponsored by Bundesmin. fuer Wiss. u. Forsch. Original contains color illustrations
(ASSA-FA-7) Avail: NTIS HC A06/MF A01
Austrian remote sensing applications include basic research and system development, agriculture, forestry, water management, regional planning, environment protection, and geology. The existing and future programs of aeromagnetic measurements are given, as well as the sources of aerial and satellite data procurement. J.A.M.

N79-26447*# Oregon State Univ., Corvallis. Environmental Remote Sensing Applications Lab.
SEVENTH YEAR PROJECTS AND ACTIVITIES OF THE ENVIRONMENTAL REMOTE SENSING APPLICATIONS LABORATORY (ERSAL) Annual Progress Report, 1 Apr. 1978 - 31 Mar. 1979
Gary L. Benson and Barry J. Schrumpf, Principal Investigators 31 Mar. 1979 79 p refs ERTS
(Contract NGL-38-002-053)
(E79-10220; NASA-CR-158687) Avail: NTIS HC A05/MF A01 CSCL 05B

N79-26449# Aspen Corp., Germantown, Md.
LAND AND NATURAL RESOURCES MANAGEMENT: AN ANALYSIS OF SELECTED FEDERAL POLICIES PROGRAMS, AND PLANNING MECHANISMS. REPORT TO THE PRESIDENT'S INTERAGENCY TASK FORCE ON ENVIRONMENTAL DATA AND MONITORING PROGRAMS Final Report
Feb. 1979 177 p refs Sponsored in part by Geol. Survey.
(Contract EQ9AC001)
(PB-292500/6) Avail: NTIS HC A09/MF A01 CSCL 13B
The report to the President's Interagency Task Force on Environmental Data and Monitoring Programs identifies major

federal land and natural resource policies and analyzes representative policy conflicts. It identifies approximately 25 agencies and more than 70 laws that influence land and natural resources policy. GRA

N79-26456# Environmental Research Inst. of Michigan, Ann Arbor. Applications Div.
AID'S REMOTE SENSING GRANT PROGRAM Final Report
Thomas W. Wagner and Donald S. Lowe Aug. 1978 119 p refs
(Contract AID/TA-C-1148)
(PB-292872/9; ERIM-111800-1-F) Avail: NTIS HC A06/MF A01 CSCL 02C

The results of a program to transfer remote sensing technology to ten developing countries are presented. The program included: (1) awarding financial grants to investigators in developing countries; (2) providing technical assistance to those investigators; and (3) carrying out several special studies at AID's request. The ten countries that had grant projects selected on the basis of competitive proposals were Bangladesh, Bolivia, Chile, Lesotho, Pakistan, Peru, Phillippines, Sri Lanka, Thailand, and Zaire. GRA

N79-26469# Canada Centre for Remote Sensing, Ottawa (Ontario).
CCRS AIRBORNE PROGRAM ASSESSMENT. VOLUME 1: ANALYSIS
Josef Cihlar Apr. 1978 43 p refs 2 Vol.
(PB-293161/6; RR-78-3-Vol-1) Avail: NTIS HC A03/MF A01 CSCL 08F

A five-month survey of the users of airborne remote sensing data produced by the Airborne Operations of the Canada Center for Remote Sensing was undertaken. The purpose of the survey was to determine how the airborne data were used, what benefits accrued from their use, and what applications were developed to an operational level. Volume I contains an analysis of the findings. Particular attention was given to categories of users, project characteristics, and to demonstrated applications. Rudimentary statistical analyses were carried out to determine type of use, principal sensor, and benefit attributes of the airborne projects. Recommendations aimed at improving the effectiveness of the airborne data utilization were made. GRA

N79-26470# Canada Centre for Remote Sensing, Ottawa (Ontario).
CCRS AIRBORNE PROGRAM ASSESSMENT. VOLUME 2: USER REPORTS
Josef Cihlar Apr. 1978 193 p refs 2 Vol.
(PB-293162/4; RR-78-3-Vol-2) Avail: NTIS HC A09/MF A01 CSCL 08F

Results of a survey to determine how remote sensing data were used, what benefits accrued from their use, and what applications were developed to an operational level are presented. GRA

N79-27061# Council for Scientific and Industrial Research, Pretoria (South Africa).
CSIR ANNUAL REPORT, 1978
1979 76 p
(AR-34) Avail: NTIS HC A05/MF A01

Activities directed toward the identification of key technologies required for the social, economic, and industrial development of the Republic of South Africa are reported. Particular emphasis is given to the establishment of data bases for the chemical industry, programs for the conservation of energy and the protection of the environment and the nation's resources, and the computer-aided compilation of a textile dictionary in English and Africaans. Topics covered include the reduction of data from Meteosat, LANDSAT, and Nimbus-6 satellites for resource management and weather forecasting; the preparation of retrospective bibliographies and other literature searching activities; the development of integrated circuits; mechanical stress investigations for the lumber industry; the herbicidal control of water hyacinths; packaging for the sorghum beer and food processing industries toxic hazards; and environmental monitoring. A.R.H.

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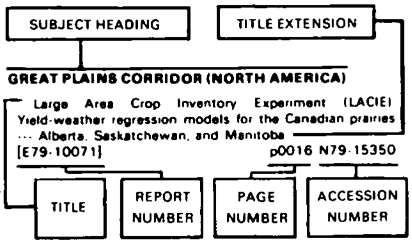

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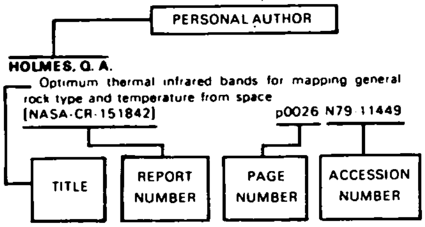

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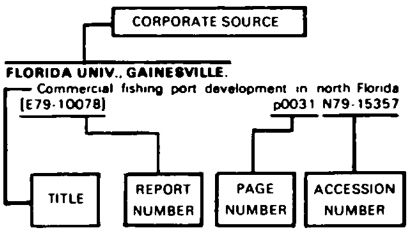

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NAS5-24383 .... p0016 N79-15358

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REPORT/ACCESSION NUMBER INDEX

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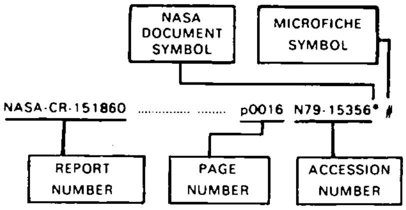

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1. Report No. NASA SP-7041 (23)	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle EARTH RESOURCES A Continuing Bibliography (Issue 23)		5. Report Date October 1979
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
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9. Performing Organization Name and Address National Aeronautics and Space Administration Washington, D. C. 20546		11. Contract or Grant No.
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16. Abstract

This bibliography lists 226 reports, articles, and other documents introduced into the NASA scientific and technical information system between July 1, 1979 and September 30, 1979. 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.

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