NASA

Earth Resources
A Continuing
Bibliography
with Indexes

NASA SP-7041 (17)
April 1978

National Aeronautics and
Space Administration

PREVIOUS EARTH RESOURCE BIBLIOGRAPHIES

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NASA SP-7041(17)

EARTH RESOURCES

A Continuing Bibliography
With Indexes
Issue 17

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced between January 1, 1978 and March 31, 1978

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

NASA Scientific and Technical Information Office 1978
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Washington, DC

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INTRODUCTION

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

This literature survey lists 775 reports, articles, and other documents announced between January 1 and March 31, 1978 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 A78-10,000 in ascending accession number order;

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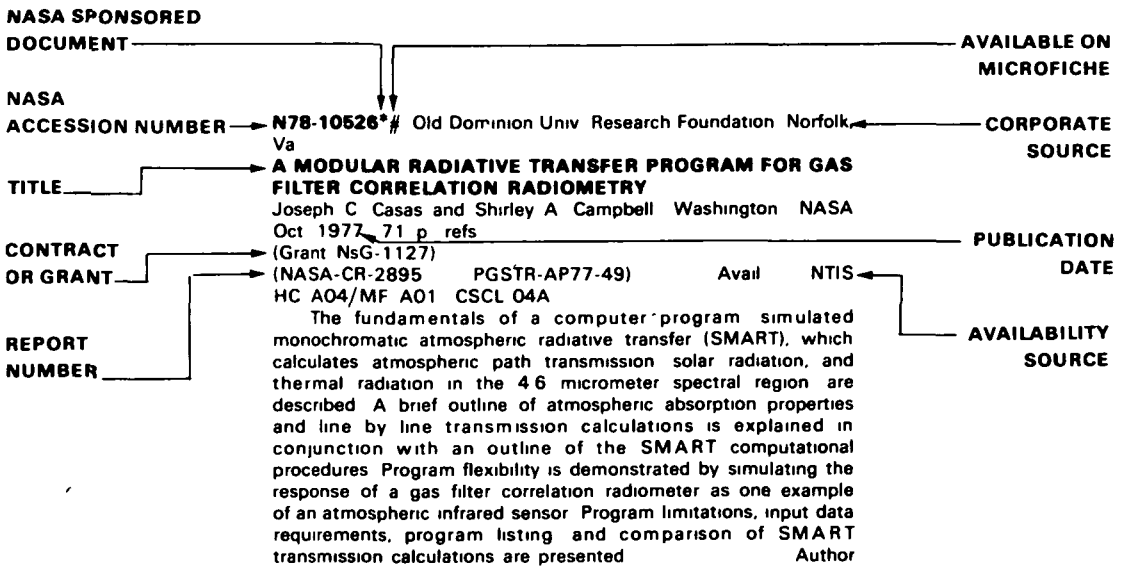

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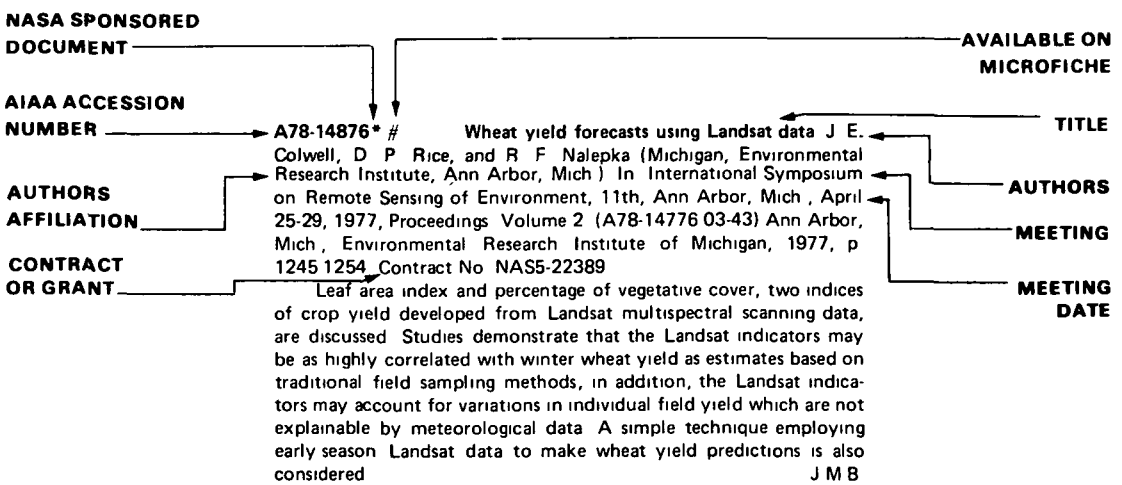

EARTH RESOURCES

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APRIL 1978

01
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

A78-10521 **Yield/reflectance relations in cabbage** J R Thomas and A H Gerbermann (U S Department of Agriculture, Agricultural Research Service, Weslaco, Tex) *Photogrammetric Engineering and Remote Sensing,* vol 43, Oct 1977, p 1257-1261, 1263-1266 16 refs

The reported investigation was conducted to measure the effects of nitrogen stress on the absorption and scattering coefficients and asymptotic reflectance of light from green cabbage wrapper leaves The effects of nitrogen and water stress on the reflectivity of a cabbage crop were evaluated and the observed film optical densities were related to cabbage yields It was found that in the visible spectral region nitrogen stress decreased the absorptive coefficient and increased the asymptotic reflectance of cabbage leaves The scattering coefficient was not affected by nitrogen deficiency The information provided by aerial photographs was useful for predicting cabbage yields G R

A78-10522 **Detection of oak wilt with color IR aerial photography** J J Ullman and D W French (Minnesota, University, St Paul, Minn) *Photogrammetric Engineering and Remote Sensing,* vol 43, Oct 1977, p 1267-1272 5 refs

A78-10523 **Measuring soil moisture with an airborne imaging passive microwave radiometer** J E Estes (California, University, Santa Barbara, Calif), M R Mel (Escatech, Playa del Key, Calif), and J O Hooper (U S Navy, Naval Weapons Center, China Lake, Calif) *Photogrammetric Engineering and Remote Sensing,* vol 43, Oct 1977, p 1273-1281 9 refs Contract No N00123-73-C-2352

A78-12878 # **Results of a remote sensing study of the effects of hail on vegetation (Risultati di un'esperienza di telerilevamento degli effetti delle grandinate sulla vegetazione)** E Rosini, M R Sciarretta, and D Vento (Ministero dell'Agricoltura e delle Foreste, Ufficio Centrale di Ecologia Agraria, Rome, Italy) In International Scientific-Technological Conference on Space, 17th, Rome, Italy, March 25, 26, 1977, Proceedings
Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 49-56 In Italian

Landsat imagery is used in examining the distribution and severity of crop damage inflicted by hailstorms in Switzerland, ground-truth assessments and radar imagery of the hail-generating clouds are also analyzed Spectral variations in satellite imagery obtained before and after hailstorms are employed to determine the extent of injury inflicted to the vegetation Ground measurements of the force and size of the impacting hailstones are also cited J M B

A78-12904 # **Anisotropic reflection properties of vegetated surfaces** K T Kriebel (Munchen, Universitat, Munich, West Germany) In International Scientific-Technological Conference on Space, 17th, Rome, Italy, March 25, 26, 1977, Proceedings
Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 391-400

Results are reported for measurements of the bidirectional reflectance properties of four vegetation-covered surfaces at a wavelength of 0 52 micron The surfaces include a savannah, a bog, pasture land, and a coniferous forest It is found that there is a strong azimuthal anisotropy in the bidirectional reflectance factor of the surfaces at medium and high zenith angles of incidence and that the anisotropy increases with increasing wavelength This phenomenon is attributed to shadowing effects caused by the vertical structure of the vegetation F G M

A78-12931 # **Agricultural applications of satellite remote sensing - The measurement and prediction of principal harvests (Le applicazioni in agricoltura del telerilevamento da satellite - Misura e previsioni dei principali raccolti)** M Checchi and F Smania (Italeco S p A , Rome, Italy) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings
Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 57-61 In Italian

The use of satellite data to monitor agricultural production and the state of development of crops is discussed Computer programs which permit a nearly real-time analysis of satellite imagery are reviewed, an interpretive technique which relies on both automatic processing and visual assessment of imagery is mentioned J M B

A78-13060 **Color aerial photography in the plant sciences and related fields, Proceedings of the Fifth Biennial Workshop, Sioux Falls, S Dak , August 19-21, 1975** Workshop sponsored by the American Society of Photogrammetry Falls Church, Va , American Society of Photogrammetry, 1977 166 p $8 00

Papers are presented on quality color photographic production at the EROS Data Center, photographic image enhancement and processing, the role of remote sensing in preventing plant disease, a method for detecting the imported fire ant, and tree stress detection through spectral ratioing of color film records Consideration is also given to the use of color IR photography for the detection of forest damage, surface resource inventory of Eastern Montana rangelands, and forest type mapping of the Atchafalaya River Basin from satellite and aircraft imagery B J

A78-13062 **Quality control techniques for high altitude color photography** R L LaPado (ESL, Inc , Sunnyvale, Calif) In Color aerial photography in the plant sciences and related fields, Proceedings of the Fifth Biennial Workshop, Sioux Falls, S Dak , August 19-21, 1975 Falls Church, Va , American Society of Photogrammetry, 1977, p 11-27 6 refs

The Airborne Instrumentation Research Project, based at NASA Ames Research Center, conducts approximately 200 photographic missions every year, employing two high-altitude U-2 aircraft There are two techniques under development aimed at improving both the consistency and quality of the U-2 photographic imagery The first is a film response calibration procedure which determines the filtration and exposure shift needed to achieve a standard sensitivity response for each film type used The second is an exposure calculation model that calculates the exposure required to produce a specified mean density on a photographic image The model is a wavelength dependent function that produces an f number as a function of shutter speed and 10 other input parameters (Author)

A78-13065 **Tree stress detection through spectral ratioing of color film records** T M Lillesand, R H Brock, W L Johnson (New York, State University, Syracuse, N Y), and J L Roberts (USAF, Rome Air Development Center, Griffiss AFB, N Y) In Color aerial photography in the plant sciences and related fields, Proceedings of the Fifth Biennial Workshop, Sioux Falls, S Dak , August 19-21, 1975 Falls Church, Va , American Society of Photogrammetry, 1977, p 79-107 24 refs Research supported by the U S Forest Service

The paper reviews research being carried out at the SUNY College of Environmental Science and Forestry at Syracuse, New York in the photographic detection of tree stress Two studies are highlighted (1) the use of close-range (one meter) photography to monitor the spectral and spatial response of young poplars to ozone fumigation under controlled lab conditions, and (2) the application of an Experimental Photometric Interpretation Console in bi-band spectral ratioing of color film records acquired under field conditions, in this part of the program enhanced detection of Fomes annosus in red pines and potassium deficiency in white spruce has been realized B J

A78-13066 **Spectral reflectance deduced from color-infrared photos for forest damage detection** P A Murtha (British Columbia, University, Vancouver, Canada) In Color aerial photography in the plant sciences and related fields, Proceedings of the Fifth Biennial Workshop, Sioux Falls, S Dak , August 19-21, 1975 Falls Church, Va , American Society of Photogrammetry, 1977, p 109-116 9 refs

A television scanning densitometer was adapted to produce color images from which relative spectral reflectance data could be deduced The technique involved placing colored filters (blue, green, red) between the return-beam-vidicon (RBV) camera lens and the original, color-infrared positive transparency located on a light table The technique permitted analysis of density patterns of the individual dye layers in the positive transparency The technique which was tested with large-scale photos was also applied to 1 160,000 color-infrared photos of an SO2 damage site The results of the large-scale photo test are presented (Author)

A78-13067 **Surface resource inventory of eastern Montana rangelands utilizing high altitude color infrared aerial photography** F T Batson (U S Bureau of Land Management, Billings, Mont) and J C Elliott In Color aerial photography in the plant sciences and related fields, Proceedings of the Fifth Biennial Workshop, Sioux Falls, S Dak , August 19-21, 1975 Falls Church, Va , American Society of Photogrammetry, 1977, p 117-128 6 refs

A78-13068 **Forest type mapping of the Atchafalaya River Basin from satellite and aircraft imagery** J E DeSteiguer (Texas A & M University, College Station, Tex) In Color aerial photography in the plant sciences and related fields, Proceedings of the Fifth Biennial Workshop, Sioux Falls, S Dak , August 19-21, 1975 Falls Church, Va , American Society of Photogrammetry, 1977, p 129-141 14 refs

RB-57 aircraft photography, Skylab photography, and Landsat-1 imagery were tested and compared for forest type mapping of the Atchafalaya River Basin, Louisiana Variance ratio tests indicated a significant difference in overall accuracy did not exist between maps prepared from the three types of imagery Significant differences in accuracy were found between four regions of the basin, and were related to the extent, rather than type, of forests Several possibilities exist for improving map accuracy Satellite and high altitude aircraft imagery should receive increasing acceptance for extensive forest type mapping (Author)

A78-14791 # **Progress and needs in agricultural research, development, and applications programs** D G Moore and V I Myers (South Dakota State University, Brookings, S Dak) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 257-266 18 refs

The application of remote sensing to agriculture is discussed with particular reference to user structure (global, international, national, state level, regional, cooperatives, and individuals) and to the use of Landsat imagery It is noted that possibly the greatest deterrent to the application of remote sensing to agriculture is a combination of effects of data scale from satellites and timeliness of data availability, a deterrent which can be overcome B J

A78-14792 # **Remote sensing and today's forestry issues** L Sayn-Wittgenstein (Department of Fisheries and the Environment, Forest Management Institute, Ottawa, Canada) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1

Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 267-276 39 refs

The paper examines the actual and desirable roles of remote sensing in dealing with current issues in forestry, i e , national forest policy, supply and demand for forest products, and competing demand for forest land Remote sensing is discussed with reference to wood shortage and the need for forest management and regional inventories The utilization of Landsat for inventories in temperate zones and of Skylab for forest sensing is described and attention is given to evaluation of accuracy, large-scale photography, support of intensive forest management, forest protection, and biomass energy production B J

A78-14804 * # **LACIE - A look to the future** R B MacDonald and F G Hall (NASA, Johnson Space Center, Houston, Tex) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 429-465 14 refs

The Large Area Crop Inventory Experiment (LACIE) is a 'proof of concept' project designed to demonstrate the applicability of remote sensing technology to the global monitoring of wheat This paper discusses the need for more timely and reliable monitoring of food and fiber supplies, reviews the monitoring systems currently utilized by the USDA and United Nations Food and Agriculture Organization in the United States and in foreign countries, and elucidates the fundamentals involved in assessing the impact of variable weather and economic conditions on wheat acreage, yield, and production The experiment's approach to production monitoring is described briefly, and its status is reviewed as of the conclusion of 2 years of successful operation Examples of acreage and yield monitoring in the Soviet Union are used to illustrate the experiment's approach (Author)

A78-14808 * # **Use of multispectral data in design of forest sample surveys** S J Titus and L C Wensel (California, University, Berkeley, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmen-

tal Research Institute of Michigan, 1977, p 505-513 9 refs Contract No NAS9-14552

The use of multispectral data in design of forest sample surveys using a computer software package, WILLIAM, is described The system allows evaluation of a number of alternative sampling systems and, with appropriate cost data, estimates the implementation cost for each (Author)

A78-14809 # **Monitoring irrigated land acreage using Landsat imagery - An application example** W C Draeger (U S Geological Survey, EROS Data Center, Sioux Falls, S Dak) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1

Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 515-524

The utility of Landsat imagery for quickly and cheaply estimating irrigated land area was demonstrated in the Klamath River basin of Oregon Landsat color composite images, at 1 250,000 scale, acquired on two dates during the 1975 growing season, were interpreted Irrigated lands were delineated manually, and the irrigated area was estimated, based on dot-grid sampling of the manually delineated lands The image interpretation estimate of irrigated area was then adjusted by a comparison of interpretation results with ground data on 45 sample plots each 2 6 square kilometers in size Two interpreters independently estimated the irrigated area Their adjusted estimates were 115,000 hectares and 108,000 hectares respectively, with corresponding 95 percent confidence intervals of + or - 7,880 hectares and + or - 14,000 hectares The estimated cost of the survey, exclusive of management costs and training, was $1,500 (Author)

A78-14812 # **Multi-seasonal data analysis and some extensions for environmental monitoring** S Tanaka, Y Muranaka (Remote Sensing Technology Center of Japan, Tokyo, Japan), H Miyazawa (Toyo Aero Survey Co , Ltd , Tokyo, Japan), and Y Suga (Hosei University, Koganei, Tokyo, Japan) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 545-561 5 refs

Landsat imagery is employed to study seasonal changes in a rice paddy, to survey the different spectral signatures of winter and summer vegetation, and to assess the amount of land reclaimed in Tokyo Bay over an extended period In addition, the progress of a rice harvest is monitored by using the Landsat imagery J M B

A78-14824 # **Reindeer range inventory in western Alaska from computer-aided digital classification of Landsat data** T H George, W J Stringer, and J N Baldridge (Alaska, University, Fairbanks, Alaska) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 671-682 6 refs

A78-14827 * # **Further tests of the Suits reflectance model** E W LeMaster and J E Chance (Pan American University, Edinburg, Tex) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 703-710 6 refs Grant No NsG-9033

Experimental measurements of the visible light and infrared reflectance of spring wheat are used in examining the validity of the Suits (19,'2) model for vegetative canopy reflectance The degree of agreement between the experimental results and the theoretical model suggests a technique for the remote sensing of the leaf area index at 650 nm However, the Suits model needs to be modified when the sun and observer zenith angles are not small J M B

A78-14828 * # **Estimation of old field ecosystem biomass using low altitude imagery** S M Nor, G Safir, T M Burton, J E Hook, and G Schultink (Michigan State University, East Lansing, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 711-718 10 refs Grant No NGL-23-004-083

Color-infrared photography was used to evaluate the biomass of experimental plots in an old-field ecosystem that was treated with different levels of waste water from a sewage treatment facility Cibachrome prints at a scale of approximately 1 1,600 produced from 35 mm color infrared slides were used to analyze density patterns using prepared tonal density scales and multicell grids registered to ground panels shown on the photograph Correlations between mean tonal density and harvest biomass data gave consistently high coefficients ranging from 0 530 to 0 896 at the 0 001 significance level Corresponding multiple regression analysis resulted in higher correlation coefficients The results indicate that aerial infrared photography can be used to estimate standing crop biomass on waste water irrigated old field ecosystems Combined with minimal ground truth data, this technique could enable managers of waste water irrigation projects to precisely time harvest of such systems for maximal removal of nutrients in harvested biomass (Author)

A78-14829 # **The effect of soil water deficit on the reflectance of conifer seedling canopies** L Fox, III (Humboldt State University, Arcata, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 719-728 9 refs Research supported by the University of Michigan

A78-14844 * # **Two phase sampling for wheat acreage estimation.** R W Thomas and C M Hay (California, University, Berkeley, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 909-918 6 refs Contract No NAS9-14565

A two-phase Landsat-based sample allocation and wheat proportion estimation method was developed The technique employs manual, Landsat full frame-based wheat or cultivated land proportion estimates from a large number of segments comprising a first sample phase to optimally allocate a small phase-two sample of computer or manually processed segments Proportion estimates from each phase are then linked by regression or probability proportional to estimated size estimators to provide wheat proportion estimates and standard errors by reporting unit Application to the Kansas Southwest CRD (Crop Reporting District) for 1974 produced a wheat acreage estimate for that CRD within 2 42% of the USDA SRS-based estimate using a lower CRD inventory budget than for a simulated reference LACIE (Large Area Crop Inventory Experiment) system B J

A78-14845 # **Classification of Landsat agricultural data based upon color trends.** J D Tubbs (Arkansas, University, Fayetteville, Ark) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 919-923

A simple procedure has been developed which attempts to automate that portion of the photointerpretation logic process which involves labeling fields or pixels according to their observed color trends Decision rules have been developed for classifying an unknown observation by matching its color trend with that of expected trends for known crops The proposed color classifier has been applied to the problem of separating wheat from all non-wheat by using Landsat imagery obtained from at least three distinct growth stages for wheat B J

A78-14846 * # **The use of Landsat digital data to detect and monitor vegetation water deficiencies** D R Thompson (NASA, Johnson Space Center, Houston, Tex) and O A Wehmanen (Lockheed Electronics Co , Inc , Houston, Tex) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 925-931 9 refs Contract No NAS9-15200

In the Large Area Crop Inventory Experiment a technique was devised using a vector transformation of Landsat digital data to indicate when vegetation is undergoing moisture stress A relation was established between the remote-sensing-based criterion (the Green Index Number) and a ground-based criterion (Crop Moisture Index). (Author)

A78-14847 # **Pre-visual detection of stress in pine forests.** C E Olson, Jr (Michigan, University, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 933-944 60 refs

Extensive tree mortality due to recent attacks by the southern pine beetle has resulted in renewed interest in pre-visual detection of forest stress (an analysis applied when trees show no visible sign of damage but appear different from non-stressed trees in non-visible parts of the spectrum) This paper summarizes available information relating to pre-visual detection of forest stress with particular reference to detection of attacks by pine bark beetles Preliminary efforts to obtain early detection of attacks by pine bark beetles, using MSS data from the ERIM M-7 scanner, have not been sufficiently successful to demonstrate an operational capability, but indicate that joint processing of the 0 71-0 73, 2 00-2 60 and 9 3-11 7 micron bands holds some promise B J

A78-14860 * # **Evaluation of spectral channels and wavelength regions for separability of agricultural cover types** R Kumar (Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1081-1090 13 refs Grant No NGL-15-005-112

The purpose of this study was to evaluate the spectral channel as well as wavelength regions - visible, near infrared, middle infrared and thermal infrared - with respect to their estimated probability of correct classification (P-c) in discriminating agricultural cover types Multispectral scanner data in twelve spectral channels in the wavelength range of 0 4 to 11 7 micron acquired in the middle of July for three flightlines were analysed by applying automatic pattern recognition techniques The same analysis was performed for the data acquired in the middle of August, over the same three flightlines, to investigate the effect of time on the results The effect of deletion of each spectral channel as well as each wavelength region on P-c is given Values of P-c for all possible combinations of wavelength regions in the subsets of one to twelve spectral channels are also given The overall values of P-c were found to be greater for the data of the middle of August than the data of the middle of July (Author)

A78-14863 # **An application of Landsat digital technology to forest fire fuel type mapping** P H Kourtz (Canadian Forestry Service, Forest Fire Research Institute, Ottawa, Canada) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1111-1115

A78-14864 * # **Landsat image interpretation aids** R A Abotteen and H Malek (Lockheed Electronics Co , Inc , Houston, Tex) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1117-1121 6 refs Contract No NAS9-15200

In the Large Area Crop Inventory Experiment, image interpretation aids were produced to assist in selecting and/or identifying representative samples of signatures in a given Landsat scene The three methods employed are based on clustering techniques, information extraction, and aggregation of like spectral information on a two-dimensional spectral plot (Author)

A78-14876 * # **Wheat yield forecasts using Landsat data** J. E. Colwell, D P Rice, and R F Nalepka (Michigan, Environmental Research Institute, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1245-1254 Contract No NAS5-22389

Leaf area index and percentage of vegetative cover, two indices of crop yield developed from Landsat multispectral scanning data, are discussed Studies demonstrate that the Landsat indicators may be as highly correlated with winter wheat yield as estimates based on traditional field sampling methods, in addition, the Landsat indicators may account for variations in individual field yield which are not explainable by meteorological data A simple technique employing early-season Landsat data to make wheat yield predictions is also considered J M B

A78-14879 # **Computer-aided classification for remote sensing in agriculture and forestry in Northern Italy** J Dejace, J Mégier, and W Mehl (EURATOM and Comitato Nazionale per l'Energia Nucleare, Centro Comune de Ricerche, Ispra, Italy) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1269-1278 7 refs

A set of results concerning the processing and analysis of data from Landsat and airborne scanner is presented The possibility of performing inventories of irrigated crops - rice, planted groves, poplars, and natural forests in the mountains - beeches and chestnuts, is investigated in the Po valley and in an alpine site of Northern Italy Accuracies around 95 percent or better, 70 percent and 60 percent respectively, are achieved by using Landsat data and supervised classification Discrimination of rice varieties is proved with eight channels data from airborne scanner, processed after correction of the atmospheric effect due to the scanning angle, with and without linear feature selection of the data The accuracies achieved range from 65 percent to more than 80 percent (Author)

A78-14880 * # **The influence of multispectral scanner spatial resolution on forest feature classification** F G Sadowski, W A Malila, J E Sarno, and R F Nalepka (Michigan, Environmental Research Institute, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1279-1288 8 refs Contracts No NAS9-14123, No NAS9-14988.

A78-14897 * # **Airborne monitoring of crop canopy temperatures for irrigation scheduling and yield prediction** J P Millard (NASA, Ames Research Center, Moffett Field, Calif), R D Jackson, R J Reginato, S B Idso (U S Department of Agriculture, Agricultural Research Service, Phoenix, Ariz), R C Goettelman (LFE Corp , Richmond, Calif), and R L LaPado (ESL, Inc , Sunnyvale, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 1453-1461 11 refs.

The aim of the program discussed was to develop techniques for remotely measuring crop irrigation needs and predicting crop yields, with emphasis on wheat Airborne measurements, using an IR line

scanner and color IR photography, were made to evaluate the feasibility of measuring minimum and maximum (dawn and afternoon) crop temperatures to compute a parameter, termed 'stress degree day' (SDD) - a valuable indicator of crop water needs, which can be related to irrigation scheduling and yield Crop canopy temperature measurements by airborne IR techniques revealed the superiority of thermal IR data over color IR photography Water stress undetected in the latter technique was clearly detected in thermal imagery Color IR photography, however, is valuable in discerning vegetation The pseudo-colored temperature-difference images (and pseudo-colored images, reading directly in daily SDD increments) are shown to be well suited for assessing plant water status and, thus, for determining the irrigation needs and crop yield potentials V P

A78-14899 * # **Landsat data from agricultural sites - Crop signature analysis** P N Misra and S G Wheeler (IBM, Federal Systems Div , Houston, Tex) In - International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1473-1482 9 refs Contract No NAS9-14350

The Landsat multispectral scanner (MSS) data have been analyzed with a view toward classification to identify wheat The notion of spectral signature of a crop, a commonly used basis for classification, has been found to be inadequate Data analysis has revealed that the MSS data from agricultural sites are essentially two dimensional, and that the data from different sites and different acquisitions lie on parallel planes in the four-dimensional feature space These results have been exploited to gain new insight into the data and to develop alternate models for classification In particular, it has been found that the temporal pattern of change in the spectral response of a crop constitutes its signature and provides a basis for crop classification (Author)

A78-14900 # **Inventory of ricefields in France using Landsat and aircraft data** T Le Toan, P Cassirame, J Quach (Centre d'Etude Spatiale des Rayonnements, Toulouse, France), and R Marie (Institut National de la Recherche Agronomique, Montpellier, France) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1483-1495 7 refs

A78-14901 # **Forestland type identification and analysis in Western Massachusetts - A linkage of a Landsat forest inventory to an optimization study** G T Rafsnider (U S Department of Agriculture, Forest Service, Upper Darby, Pa), R. H Rogers, and A Morse (Bendix Corp , Aerospace Systems Div , Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1497-1505 7 refs

A78-14902 # **Large scale 70mm photography for range resources analysis in the western United States** P T Tueller (Nevada, University, Reno, Nev) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1507-1514 31 refs

Large scale 70mm aerial photography is a valuable supplementary tool for rangeland studies A wide assortment of applications have been developed varying from vegetation mapping to assessing environmental impact on rangelands Color and color infrared stereo pairs are useful for effectively sampling sites limited by ground accessibility They allow an increased sample size at similar or lower cost than ground sampling techniques and provide a permanent record. (Author)

A78-14903 # **Assessment of forest plantations from low altitude aerial photography** H A Nelson (Weyerhaeuser Co , Plymouth, N C) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1515-1522

A78-14904 * # **Performance tests of signature extension algorithms** R Abotteen, S Levy, M Mendlowitz, T Moritz, J Potter, S Thadani, and O Wehmanen (Lockheed Electronics Co , Inc , Houston, Tex) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1523-1532 6 refs Contract No NAS9-15200

Comparative tests were performed on seven signature extension algorithms to evaluate their effectiveness in correcting for changes in atmospheric haze and sun angle in a Landsat scene Four of the algorithms were cluster matching, and two were maximum likelihood algorithms The seventh algorithm determined the haze level in both training and recognition segments and used a set of tables calculated from an atmospheric model to determine the affine transformation that corrects the training signatures for changes in sun angle and haze level Three of the algorithms were tested on a simulated data set, and all of the algorithms were tested on consecutive-day data The classification performance on the data sets using the algorithms is presented, along with results of statistical tests on the accuracy and proportion estimates The three algorithms tested on the simulated data produced significant improvements over the results obtained using untransformed signatures For the consecutive-day data, the tested algorithms produced improvements in most but not all cases The tests indicated also that no statistically significant differences were noted among the algorithms (Author)

A78-14907 # **Estimation of soil moisture with radar remote sensing** P P Batlivala and F T Ulaby (University of Kansas Center for Research, Inc , Lawrence, Kan) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1557-1566

The radar response to soil moisture content was investigated using a truck-mounted 1-18 GHz (30-1 67 cm wavelength, respectively) Active Microwave Spectrometer system The sensitivity to soil moisture content and the accuracy with which it could be estimated were evaluated for both bare and vegetation-covered fields Bare field experiments were conducted to determine the optimum radar parameters (frequency, angle of incidence range and polarization configuration) for minimizing the response to surface roughness while retaining strong sensitivity to moisture content In the vegetation-covered case, the effects of crop type, crop height and row direction relative to the radar look direct were evaluated (Author)

A78-14915 # **Passive microwave remote sensing of soil moisture** K Ia Kondrat'ev, V V Melent'ev, Iu I Rabinovich, and E M Shul'gina (Leningradskii Gosudarstvennyi Universitet, Leningrad, USSR) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1641-1661 18 refs

Research and development work carried out on passive microwave remote sensing of soil moisture is discussed The theory and calculation of microwave emission from a medium with depth-dependent physical properties are outlined Means of determining vertical temperature and humidity profiles are examined, and laboratory and aircraft measurements of soil moisture are evaluated A technique developed for determining the productive-moisture content of soils is described V P

A78-15308 # **Convective cloud plumes mark Canadian fire sites** F C Parmenter (NOAA, National Environmental Satellite

Service, Washington, D C) *Weather,* vol. 32, Nov 1977, p 424-427

Visible satellite data taken by GOES on June 5th, 1976, over the central U S and the Plains of Canada showed a number of smoke-cloud plumes generated by some of the larger forest fires burning in northwestern Ontario Each plume commences as a bright, sharp point source that increases in length and breadth downwind much in the fashion of satellite-viewed thunderstorms P T H

A78-15392 * **Using Landsat data to estimate evapotranspiration of winter wheat** E T Kanemasu, J L Heilman, J O Bagley, and W L Powers (Kansas State University of Agriculture and Applied Science, Manhattan, Kan) *Environmental Management,* vol 1, no 6, 1977, p 515-520 8 refs NASA-supported research

Results obtained from an evapotranspiration model as applied to Kansas winter wheatfields were compared with results determined by a weighing lysimeter, and the standard deviation was found to be less than 0 5 mm/day (however, the 95% confidence interval was between plus and minus 0 2 mm/day) Model inputs are solar radiation, temperature, precipitation, and leaf area index, an equation was developed to estimate the leaf area index from Landsat data The model provides estimates of transpiration, evaporation, and soil moisture M L

A78-16508 # **A Finnish system for forest management planning using aerial photographs** H Leppanen and M Myllyniemi (FINNMAP, Helsinki, Finland) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper.* 8 p

Production of 1 10,000 scale forestry management maps for Finland is discussed The production process involves use of 1 20,000 scale black and white infrared aerial photographs which are enlarged and processed to create stereophotographs The stereophotographs can be analyzed in the field with a simple pocket stereoscope The forestry maps are intended to provide a means for separating and classifying timber stands, and for assessing the development of the stands J M B

A78-16513 # **The use of remote sensing in the detection of crop damage (Utilisation de la télédétection dans la connaissance des dommages causés aux cultures)** C -M Girard (Paris-Grignon, Institut National Agronomique, Thiverval Grignon, Yvelines, France) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 7 p In French

The study of plant pathology and insect infestations in crops through such remote sensing techniques as panchromatic or infrared color photographs, multispectral scanning imagery and thermograms is reviewed Remote detection programs cited include those presently in operation in Canada, the Netherlands, France, Great Britain, Italy, the German Democratic Republic, the Soviet Union and the U S surveillance programs for corn blight, potato mildew, tomato and tobacco mosaic, and diseases of fruit trees are mentioned In addition, proposed projects involving the detection of nitrogen, potassium and magnesium deficiencies in coconuts (Ivory Coast) and the assessment of insect infestations (Mali) are considered J M B.

A78-16515 # **Approaches for solving forestry problems by utilizing aerospace methods (Wege zur Losung forstwirtschaftlicher Aufgaben unter Ausnutzung von aerokosmischen Mitteln)** S G Sinitsin and V I Sukhikh (National Committee of Photogrammetrists, Moscow, USSR) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 10 p. In German.

Remote sensing methods are widely used in the USSR to solve various types of forestry problems Multispectral aerial photos with scales in the range from 1 10,000 to 1 15,000 provide important information concerning the available forest resources Various technologies for forestry inventory studies have been developed, taking into account the particular characteristics of different forest types A method based on multispectral aerial color photos is employed to obtain information regarding the conditions of forests which have been adversely affected by parasites or in connection with industrial activities The utilization of earth satellites makes it possible to acquire information which cannot be conveniently provided by aircraft A description is provided of the requirements which have to be satisfied by photographs obtained with the aid of satellites for forestry applications Attention is also given to the optimal time periods for obtaining aerial photos, the development of an operational method for the detection of forest fires, and suitable approaches for the interpretation of the photographs. G R.

A78-16522 # **Mean annual volume growth from sequential volume determination on permanent aerial photographic plots** D A Stellingwerf and D Benessalah (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 15 p

A combination of field surveys and aerial photography to determine the volume of forest growth and cuttings The photographic data for the study consisted of 0 05 hectare plots of conifers made on black and white infrared film Mean annual volume growth was analyzed for two age classes of timber (40 to 120 years and 80 to 120 years), and regression equations were employed to investigate the volume of cuttings during a five-year period Emphasis was placed on using the least costly combination of field surveys and aerial reconnaissance to develop the forestry study J M B

A78-16523 # **Optimum ratio of photo-field plots for aerial volume and aerial volume growth regression construction** D A Stellingwerf (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 14 p

The optimum ratio of the number of photo plots to field plots for minimum cost with given standard error or minimum standard error with given cost is calculated for constructing an aerial volume table or aerial volume growth table for a 3000-ha forest of spruce Linear regression equations are used in both cases For both volume and volume growth, the combination of photo and field plots is always cheaper than field plots alone P T H

A78-16551 # **The dry deciduous forests of Bastar, Central India, on Landsat-1** E van Es (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 10 p

A78-16555 # **Visual interpretation of Landsat MSS imagery for a reconnaissance soil survey of a part of the Indo-Gangetic plain, India** F W Hilwig (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 32 p 29 refs

A78-17199 * **Distinguishing vegetation from soil background information** A J Richardson and C L Wiegand (U S Department of Agriculture, Weslaco, Tex) *Photogrammetric Engineering and Remote Sensing,* vol 43, Dec 1977, p 1541 1552 13 refs NASA Order T-4105-B

In aircraft and satellite multispectral scanner data, soil background signals are superimposed on or intermingled with information about vegetation A procedure which accounts for soil background would, therefore, make a considerable contribution to an operational use of Landsat and other spectral data for monitoring the productivity of range, forest, and crop lands A description is presented of an investigation which was conducted to obtain information for the development of such a procedure The investigation included a study of the soil reflectance that supplies the background signal of vegetated surfaces Landsat data as recorded on computer compatible tapes were used in the study The results of the investigation are discussed, taking into account a study reported by Kauth and Thomas (1976) Attention is given to the determination of Kauth's

plane of soils, sun angle effects, vegetation index modeling, and the evaluation of vegetation indexes Graphs are presented which show the results obtained with a gray mapping technique The technique makes it possible to display plant, soil, water, and cloud conditions for any Landsat overpass G R

A78-18248 * **Pattern recognition of Landsat data based upon temporal trend analysis** J L Engvall, J D Tubbs, and O A Holmes (NASA, Johnson Space Center, Mission Planning and Analysis Div , Houston, Tex) *Remote Sensing of Environment*, vol 6, no 4, 1977, p 303-314 10 refs

The Delta Classifier defined as an agricultural crop classification scheme employing a temporal trend procedure is applied to more than 100 different Landsat data sets collected during the 1974-1975 growing season throughout the major wheat-producing regions of the United States The classification approach stresses examination of temporal trends of the Landsat mean vectors of crops in the absence of corresponding ground truth information It is shown that the resulting classifications compare favorably to ground truth estimates for wheat proportion in those cases where ground truth is available, and that the temporal trend procedure yields estimates of the wheat proportion that are comparable to the best results from maximum likelihood classification with photointerpreter defined training fields S D

A78-18249 * **Evaluating soil moisture and yield of winter wheat in the Great Plains using Landsat data** J L Heilman, E T Kanemasu, J O Bagley, and V P Rasmussen (Kansas State University of Agriculture and Applied Science, Manhattan, Kan) *Remote Sensing of Environment*, vol 6, no 4, 1977, p 315-326 NASA supported research

Locating areas where soil moisture is limiting to crop growth is important for estimating winter-wheat yields on a regional basis In the 1975-76 growing season, we evaluated soil-moisture conditions and winter wheat yields for a five-state region of the Great Plains using Landsat estimates of leaf area index (LAI) and an evapotranspiration (ET) model described by Kanemasu et al (1977) Because LAI was used as an input, the ET model responded to changes in crop growth Estimated soil water depletions were high for the Nebraska Panhandle, southwestern Kansas, southeastern Colorado, and the Texas Panhandle Estimated yields in five-state region ranged from 1 0 to 2 9 metric ton/ha (Author)

A78-20172 # Differentiation of selected annual field crops throughout the growing season by their spectral reflectance properties E J Brach and A R Mack (Department of Agriculture, Research Branch, Ottawa, Canada) *Canadian Journal of Remote Sensing*, vol 3, Dec 1977, p 55 65 14 refs

N78-10529* National Aeronautics and Space Administration Goddard Inst for Space Studies New York

REMOTE SENSING OF VEGETATION AND SOIL USING MICROWAVE ELLIPSOMETRY Patent

Siegfried O Auer (NAS-NRC) and John B Schutt inventors (to NASA) Issued 4 Oct 1977 7 p Filed 15 Apr 1976 Supersedes N76-23671 (14 - 14, p 1814)

(NASA-Case-GSC-11976-1, US-Patent-4,052 666 US-Patent-Appl-SN-677352 US-Patent-Class-324-58 5B) Avail US Patent Office CSCL 08F

A method is described of determining vegetation height and water content of vegetation from the intensity and state of elliptical polarization of a reflected train of microwaves The method comprises the steps of reflecting a circularly polarized train of microwaves from vegetation at a predetermined angle of incidence and detecting the reflected train of microwaves The ratio of the intensities of the electric field vector components is determined the phase difference of the components is measured, and the refractive index and thickness of the layer of vegetation are computed from a formula The refractive index is given essentially by the water content of the vegetation

Official Gazette of the U S Patent Office

N78-10534*# Environmental Research Inst of Michigan Ann Arbor

WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA Progress Report, 16 May - 15 Oct. 1977

Richard F Nalepka John Colwell, Principal Investigators, Daniel P Rice, and Patricia A Bresnahan 15 Oct 1977 13 p refs ERTS

(Contract NAS5-22389)

(E78-10009 NASA-CR-155213, ERIM-114800-37-L) Avail NTIS HC A02/MF A01 CSCL 02C

The author has identified the following significant results Large area LANDSAT yield estimates were generated These results were compared with estimates computed using a meteorological yield model (CCEA) Both of these estimates were compared with Kansas Crop and Livestock Reporting Service (KCLRS) estimates of yield, in an attempt to assess the relative and absolute accuracy of the LANDSAT and CCEA estimates Results were inconclusive A large area direct wheat prediction procedure was implemented Initial results have produced a wheat production estimate comparable with the KCLRS estimate

N78-10538*# Kansas State Univ , Manhattan Dept of Statistics

PLANTING DATA AND WHEAT YIELD MODELS Final Report, 15 Feb. 1975 - 31 Mar 1977

Arlin M Feyerherm, Principal Investigator Sep 1977 89 p EREP

(Contract NAS9-14533)

(E78-10013, NASA-CR-151525) Avail NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results A variable date starter model for spring wheat depending on temperature was more precise than a fixed date model The same conclusions for fall-planted wheat were not reached If the largest and smallest of eight temperatures were used to estimate daily maximum and minimum temperatures respectively, a 1-4 F bias would be introduced into these extremes For Kansas, a reduction of 0 5 bushels/acre in the root-mean-square-error between model and SRS yields was achieved by a six fold increase (7 to 42) in the density of weather stations An additional reduction of 0 3 b/A was achieved by incorporating losses due to rusts in the model

N78-12496*# Environmental Research Inst of Michigan, Ann Arbor Infrared and Optics Div

AN EVALUATION OF THE SIGNATURE EXTENSION APPROACH TO LARGE AREA CROP INVENTORIES UTILIZING SPACE IMAGE DATA Final Technical Report, 15 May 1976 - 14 Nov. 1977

Richard F Nalepka, Principal Investigator, Richard C Cicone, John L Stinson, and Ronald J Balon Nov 1977 117 p refs EREP

(Contract NAS9-14988)

(E78-10016, NASA-CR-151552, ERIM-122700-33-F) Avail NTIS HC A06/MF A01 CSCL 02C

The author has identified the following significant results Two examples of haze correction algorithms were tested CROP-A and XSTAR The CROP-A was tested in a unitemporal mode on data collected in 1973-74 over ten sample segments in Kansas Because of the uniformly low level of haze present in these segments, no conclusion could be reached about CROP-A s ability to compensate for haze It was noted, however, that in some cases CROP-A made serious errors which actually degraded classification performance The haze correction algorithm XSTAR was tested in a multitemporal mode on 1975-76 LACIE sample segment data over 23 blind sites in Kansas and 18 sample segments in North Dakota, providing wide range of haze levels and other conditions for algorithm evaluation It was found that this algorithm substantially improved signature extension classification accuracy when a sum-of-likelihoods classifier was used with an alien rejection threshold

N78-12521# Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif

EVALUATION OF SKYLAB (EREP) DATA FOR FOREST AND RANGELAND SURVEYS Final Forest Service Research Paper

Robert C Aldrich 1976 83 p refs Prepared in cooperation with Rocky Mountain Forest and Range Experiment Station, Ft Collins, Colo

(PB-270543/2, FSRP-PSW-113) Avail NTIS HC A05/MF A01 CSCL 02F

Data products were examined monocularly or stereoscopically using a variety of magnifying interpretation devices Land use, forest types, physiographic sites, plant communities, and forest stress were interpreted and mapped at sites in Georgia, South Dakota, and Colorado Microdensitometric techniques and computer assisted data analysis and sampling procedures were developed and tested against ground truth Results indicate that only Skylab S190B color photographs are good for classification of forest and nonforest land GRA

N78-13499*# Environmental Research Inst of Michigan, Ann Arbor

INVESTIGATIONS OF SPECTRAL SEPARABILITY OF SMALL GRAINS, EARLY SEASON WHEAT DETECTION, AND MULTICROP INVENTORY PLANNING Final Report, 15 May 1976 - 14 Nov 1977

Richard F Nalepka, Principal Investigator, William A Malila, and James M Gleason Nov 1977 85 p refs

(Contract NAS9-14988)

(E78-10015 NASA-CR-151553, ERIM-122700-34-F) Avail NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results LANDSAT data from seven 5 by 6 segments having crop type information were analyzed to determine the potential for spectral separation of spring wheat from other small grains as an alternative to the primary LACIE procedure for estimating spring wheat acreage Within segment field-center classification accuracies for spring wheat vs barley tended to be best in mid-July when crop color changes were in progress When correlations were made for differences in atmospheric haze data from several segments could be aggregated, and results that approached within segment accuracies were obtained for selected dates LACIE field measurement spectral reflectance data provided information on both wheat development patterns and the importance of various agronomic factors on wheat reflectance, the most important being availability of soil moisture To investigate early season detection for winter wheat, reflectance of developing wheat patterns was simulated through reflectance modeling and was analyzed along with field measured reflectance from a Kansas site The green component development of the wheat field was analyzed as a function of data throughout the season A selected threshold was not crossed by all fields until mid-April These reflectance data were shown to be consistent actual LANDSAT data

N78-13500*# Purdue Univ , Lafayette Ind Lab for Applications of Remote Sensing

COMPARING SOIL BOUNDARIES DELINEATED BY DIGITAL ANALYSIS OF MULTISPECTRAL SCANNER DATA FROM HIGH AND LOW SPATIAL RESOLUTION SYSTEMS

S J Kristof, Principal Investigator, M F Baumgardner, A L Zachary, and E R Stoner 1977 11 p refs EREP

(Contract NAS9-14016)

(E78-10017, NASA-CR-151530, LARS-Publ-082477) Avail NTIS HC A02/MF A01 CSCL 08M

The author has identified the following significant results Computer-aided analysis techniques used with aircraft MSS data showed that the spatial resolution was sufficient to recognize each soil mapping unit of the test site Some difficulties occurred where different soil series were intricately mixed, and this mixture showed as a separate spectral mapping unit, or where the difference between two soils depended on the depth of silty surface material Analysis of LANDSAT data with computer-aided techniques showed that it was not possible to find spectrally homogeneous soil features of the seven soil series on the 40 ha test site on the digital display or on a picture print map Cluster techniques could be used on an extended test area to group spectrally similar data points into cluster classes

N78-13502*# Michigan State Univ , East Lansing

USE OF REMOTE SENSING FOR LAND USE POLICY FORMULATION Semiannual Progress Report, Dec. 1976 - May 1977

Myles Boylan, Principal Investigator 28 Aug 1977 31 p refs ERTS

(Grant NGL-23-004-083)

(E78-10020, NASA-CR-155247) Avail NTIS HC A03/MF A01 CSCL 08B

N78-14455*# Weyerhauser Co Plymouth, N C

FOREST LAND MANAGEMENT BY SATELLITE LANDSAT-DERIVED INFORMATION AS INPUT TO A FOREST INVENTORY SYSTEM

Darrel L Williams (NASA Goddard Space Flight Center) and Gerald F Haver Principal Investigators Dec 1976 40 p Sponsored by NASA Original contains color imagery Original photography may be purchased from the EROS Data Center Sioux Falls, S D ERTS

(E78-10038, NASA-CR-155259) Avail NTIS HC A03/MF A01 CSCL 02F

The author has identified the following significant results Analysis of LANDSAT temporal data specifically the digitally merged winter and summer scenes, provided the best overall classification results Comparison of temporal classification results with available ground truth reveal a 94% agreement in the delineation of hardwood categories a 96% agreement for the combined pine category, and a greater than 50% agreement for each individual pine subcategory For nearly 1000 acres, compared clearcut acreage estimated with LANDSAT digital data differed from company inventory records by only 3% Through analysis of summer data, pine stands were successfully classified into subcategories based upon the extent of crown closure Maximum spectral separability of hardwood and pine stands was obtained from the analysis of winter data

N78-14456*# Environmental Research Inst of Michigan, Ann Arbor Infrared and Optics Div

PROCEDURE B A MULTISEGMENT TRAINING SELECTION AND PROPORTION ESTIMATION PROCEDURE FOR PROCESSING LANDSAT AGRICULTURAL DATA Final Report, 15 May 1976 - 14 Nov 1977

Richard F Nalepka, Principal Investigator R J Kauth, and W Richardson Nov 1977 143 p refs Original contains imagery Original photography may be purchased from the EROS Data Center Sioux Falls, S D EREP

(Contract NAS9-14988)

(E78-10039, NASA-CR-151576, ERIM-122700-31-F) Avail NTIS HC A07/MF A01 CSCL 02F

N78-14459*# Purdue Univ Lafayette, Ind Lab for Applications of Remote Sensing

AGRICULTURAL SCENE UNDERSTANDING Final Report

D A Landgrebe Principal Investigator Marvin E Bauer, LeRoy Silva, Roger M Hoffer, and Marion F Baumgardner Nov 1977 184 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls S D EREP

(Contract NAS9-14970)

(E78-10043 NASA-CR-155343, LARS-112677, T-1314/4, MA-129TA) Avail NTIS HC A09/MF A01 CSCL 02C

The author has identified the following significant results The LACIE field measurement data were radiometrically calibrated Calibration enabled valid comparisons of measurements from different dates, sensors and/or locations Thermal band canopy results included (1) Wind velocity had a significant influence on the overhead radiance temperature and the effect was quantized Biomass and soil temperatures, temperature gradient, and canopy geometry were altered (2) Temperature gradient was a function of wind velocity (3) Temperature gradient of the wheat canopy was relatively constant during the day (4) The laser technique provided good quality geometric characterization

N78-14482*# Environmental Research Inst of Michigan Ann Arbor

INVESTIGATION OF TECHNIQUES FOR INVENTORYING FORESTED REGIONS VOLUME 1 REFLECTANCE MODELING AND EMPIRICAL MULTISPECTRAL ANALYSIS OF FOREST CANOPY COMPONENTS Final Report, 15 May 1976 - 14 Nov 1977

Richard F Nalepka Principal Investigator, F G Sadowski, and W A Malila Nov 1977 80 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls S D EREP

(Contract NAS9-14988)

(E78-10046, NASA-CR-151561 ERIM-122700-35-F1-Vol-1)

Avail NTIS HC A05/MF A01 CSCL 02F

The author has identified the following significant results Effects of vegetation density on overall canopy reflectance differed dramatically, depending on spectral band, base material, and vegetation type For example, reflectance changes caused by variations in vegetation density were hardly apparant for a simulated burned surface in LANDSAT band 5, while large changes occurred in band 7 When increasing densities of tree overstory were placed over understories, intermediate to dense overstories effectively masked the understories and dominated the spectral signatures Dramatic changes in reflectance occurred for canopies placed on a number of varying topographic positions Such changes were seen to result in the spectral overlap of some nonforested with densely forested situations

N78-14463*# Environmental Research Inst of Michigan, Ann Arbor Infrared and Optics Div

INVESTIGATION OF TECHNIQUES FOR INVENTORYING FORESTED REGIONS VOLUME 2 FORESTRY INFORMATION SYSTEM REQUIREMENTS AND JOINT USE OF REMOTELY SENSED AND ANCILLARY DATA Final Report, 14 May 1976 - 14 Nov 1977

Richard F Nalepka Principal Investigator Richard C Cicone William A Malila, and Eric P Crist Nov 1977 145 p refs Original contains imagery Original photography may be purchased from the EROS Data Center Sioux Falls, S D EREP

(Contract NAS9-14988)

(E78-10047, NASA-CR-151575, ERIM-122700-35-F2-Vol-2)

Avail NTIS HC A07/MF A01 CSCL 02F

The author has identified the following significant results Effects of terrain topography in mountainous forested regions on LANDSAT signals and classifier training were found to be significant The aspect of sloping terrain relative to the sun s azimuth was the major cause of variability A relative insolation factor could be defined which in a single variable, represents the joint effects of slope and aspect and solar geometry on irradiance Forest canopy reflectances were bound, both through simulation and empirically, to have nondiffuse reflectance characteristics Training procedures could be improved by stratifying in the space of ancillary variables and training in each stratum Application of the Tasselled-Cap transformation for LANDSAT data acquired over forested terrain could provide a viable technique for data compression and convenient physical interpretations

N78-14482*# South Dakota State Univ Brookings Remote Sensing Inst

PROGRESS AND NEEDS IN AGRICULTURAL RESEARCH, DEVELOPMENT, AND APPLICATIONS PROGRAMS

D G Moore and V I Myers *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 257-266 refs

Avail NTIS HC A99/MF A01 CSCL 02C

The dynamic nature of agriculture requires repetitive resource assessments such as those from remote sensing Until recently the use of remote sensing in agriculture has been limited primarily to site specific investigations without large-scale evaluations Examples of successful applications at various user levels are provided The stage of development for applying remote sensing to many agricultural problems is assessed, and goals for planning future data characteristics for increased use in agriculture are suggested Author

N78-14483*# Canadian Forestry Service Ottawa (Ontario)

REMOTE SENSING AND TODAY'S FORESTRY ISSUES

L. Sayn-Wittgenstein *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 267-276 refs

Avail NTIS HC A99/MF A01 CSCL 02F

The actual and the desirable roles of remote sensing in dealing with current forestry issues such as national forest policy supply and demand for forest products and competing demands for forest land are discussed Topics covered include wood shortage, regional timber inventories, forests in tropical and temperate zones, Skylab photography forest management and protection available biomass studies, and monitoring Author

N78-14496*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va

LACIE A LOOK TO THE FUTURE

R B MacDonald and F G Hall *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 429-465 refs

Avail NTIS HC A99/MF A01 CSCL 02C

The Large Area Crop Inventory Experiment (LACIE) is a project designed to demonstrate the applicability of remote sensing technology to monitor globally an important world food crop - wheat The need for more timely and reliable monitoring of food and fiber supplies is discussed, and the monitoring systems currently utilized are reviewed The fundamentals involved in assessing the impact of variable weather and economic conditions on wheat acreage, yield and production are elucidated The experiment s approach to production monitoring is described and its status is reviewed Examples of acreage and yield monitoring in the Soviet Union are used to illustrate the experiment's approach Author

N78-14500*# California Univ Berkeley Dept of Forestry and Resource Management

USE OF MULTISPECTRAL DATA IN DESIGN OF FOREST SAMPLE SURVEYS

Stephen J Titus and Lee C Wensel *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 505-513 refs

(Contract NAS9-14552)

Avail NTIS HC A99/MF A01 CSCL 02F

The use of multispectral data in design of forest sample surveys using a computer software package is described The system allows evaluation of a number of alternative sampling systems and, with appropriate cost data estimates the implementation cost for each Author

N78-14516*# Alaska Univ Fairbanks Geophysical Inst

REINDEER RANGE INVENTORY IN WESTERN ALASKA FROM COMPUTER-AIDED DIGITAL CLASSIFICATION OF LANDSAT DATA

T H George, W J Stringer and J N Baldridge *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 671-682 refs

Avail NTIS HC A99/MF A01 CSCL 06C

An inventory of reindeer-range resources was conducted for the USDA Soil Conservation Service of 1 6 million hectares of wildlands in western Alaska using clustering techniques with digital Landsat data Computer-aided digital analysis produced a provisional map of rangeland types which was used to design the field collection of vegetation and soil types data This field data facilitated refinement of the inventory map and was used to describe the map units The informational classes important to range resources were wet, moist and alpine tundra, tidal marsh, brush and open spruce forest A significant feature of the study was the extraction of acreage figures by administrative boundaries within the study area In addition to soil and vegetation association map products (at scales of 1 250,000 and 1 63,360) acreage values were tallied from the digital data for each of the four grazing permit areas established by the Bureau of Land Management Author

N78-14519*# Pan American Univ Edinburg, Tex
FURTHER TESTS OF THE SUITS REFLECTANCE MODEL
E W Lemaster and J E Chance *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 703-710 refs
Avail NTIS HC A99/MF A01 CSCL 20F

Experiments performed by stacking cotton leaves in the port of a spectroradiometer indicate that single leaf reflectance ceases to vary with more than two leaves in the visible region and eight leaves in the infrared region Chance and LeMaster have shown that the Suits spectral reflectance model predicts an asymptotic dependence of crop reflectance on leaf area index (LAI) with crop reflectance static for leaf area indices in excess of two in the visible regions and six in the infrared regions of the spectrum These results are experimentally verified in the field for Milam and Penjamo spring wheat, and a theoretical relationship is discussed that relates crop reflectance at 650 nm to crop canopy LAI Experimental data are given that relate observer zenith angle to crop reflectance for wheat The Suits reflectance model calculations for wheat fail to agree with this data Author

N78-14521*# Humboldt State Coll Arcata Calif
THE EFFECT OF SOIL WATER DEFICIT ON THE REFLECTANCE OF CONIFER SEEDLING CANOPIES
L Fox *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 719-728 refs

Avail NTIS HC A99/MF A01 CSCL 02F

The effects of soil water deficit on spruce and pine seedling canopy reflectance needle reflectance and transmittance, and canopy density were measured in a greenhouse with a diffuse source of radiant flux A potential for early or pre-visual detection of plant water stress was not supported by these measurements made at visible and reflected infrared wavelengths to 1950 nm Needles were found to transmit approximately thirty percent of the radiant flux incident on them at 780 nm, ten percent at 700 nm and were found to be opaque at 450 550, 600 and 650 nm Author

N78-14538*# California Univ , Berkeley Space Sciences Lab
TWO PHASE SAMPLING FOR WHEAT ACREAGE ESTIMATION
Randall W Thomas and Claire M Hay *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 909-918 refs
(Contract NAS9-14565)
Avail NTIS HC A99/MF A01 CSCL 02C

A two phase LANDSAT-based sample allocation and wheat proportion estimation method was developed This technique employs manual LANDSAT full frame-based wheat or cultivated land proportion estimates from a large number of segments comprising a first sample phase to optimally allocate a smaller phase two sample of computer or manually processed segments Application to the Kansas Southwest CRD for 1974 produced a wheat acreage estimate for that CRD within 2 42 percent of the USDA SRS-based estimate using a lower CRD inventory budget than for a simulated reference LACIE system Factor of 2 or greater cost or precision improvements relative to the reference system were obtained Author

N78-14539*# Arkansas Univ Fayetteville Dept of Mathematics
CLASSIFICATION OF LANDSAT AGRICULTURAL DATA BASED UPON COLOR TRENDS
J D Tubbs *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 919-923 refs
Avail NTIS HC A99/MF A01 CSCL 02C

An automated classification procedure is described The decision rules were developed for classifying an unknown observation by matching its color trend with that of expected trends for known crops The results of this procedure were found to be encouraging when compared with the usual supervised classification procedures Author

N78-14540*# National Aeronautics and Space Administration Lyndon B Johnson Space Center Houston, Tex
THE USE OF LANDSAT DIGITAL DATA TO DETECT AND MONITOR VEGETATION WATER DEFICIENCIES
D R Thompson and O A Wehmanen (Lockheed Electron Co Inc Houston Tex) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 925-931 refs
(Contract NAS9-15200)
Avail NTIS HC A99/MF A01 CSCL 02C

A technique devised using a vector transformation of LANDSAT digital data to indicate when vegetation is undergoing moisture stress is described A relation established between the remote sensing-based criterion (the Green Index Number) and a ground-based criterion (Crop Moisture Index) is discussed Author

N78-14541*# Michigan Univ , Ann Arbor School of Natural Resources
PRE-VISUAL DETECTION OF STRESS IN PINE FORESTS
Charles E Olson Jr *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 933-944 refs
Avail NTIS HC A99/MF A01 CSCL 02F

Pre-visual or early detection of forest stress with particular reference to detection of attacks by pine bark beetles is discussed Preliminary efforts to obtain early detection of attacks by pine bark beetles using MSS data from the ERIM M-7 scanner were not sufficiently successful to demonstrate an operational capability but indicate that joint processing of the 0 71 to 0 73, 2 00 to 2 60, and 9 3 to 11 7 micrometer bands holds some promise Ratio processing of transformed data from the 0 45 to 0 52 1 55 to 2 60 and 4 5 to 5 5 or 9 3 to 11 7 micrometer regions appears even more promising Author

N78-14554*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)
EVALUATION OF SPECTRAL CHANNELS AND WAVELENGTH REGIONS FOR SEPARABILITY OF AGRICULTURAL COVER TYPES
R Kumar *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1081-1090 refs

Avail NTIS HC A99/MF A01 CSCL 02C

The spectral channels were evaluated as well as wavelength regions, visible, near infrared middle infrared and thermal infrared were evaluated with respect to their estimated probability of correct classification (P sub c) in discriminating agricultural cover types Multispectral scanner data in twelve spectral channels in the wavelength range of 0 4 to 11 7 micrometers acquired in the middle of July for three flightlines were analyzed by applying automatic pattern recognition techniques The same analysis was performed for the data acquired in the middle of August over the same three flightlines to investigate the effect of time on the results The effect of deletion of each spectral channel as well as each wavelength region on P sub c was given Values of P sub c for all possible combinations of wavelength regions in the subsets of one to twelve spectral channels were also given The overall values of P sub c were found to be greater for the data of the middle of August than the data of the middle of July Author

N78-14555*# INTERA Environmental Consultants Ltd Houston Tex
THERMAL IMAGERY FOR CENSUS OF UNGULATES
M C Wride and K Baker (Parks Canada, Western Region) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1091-1099 refs

Avail NTIS HC A99/MF A01 CSCL 06C

A Daedalus thermal linescanner mounted in a light single engine aircraft was used to image the entire 270 square kilometers within the fenced perimeter of ElK Island Park, Alberta, Canada The data were collected during winter 1976 in morning and midday (overcast conditions) processed and analyzed to obtain a number for total ungulates Five different ungulate species were present during the survey Ungulates were easily observed

during the analysis of linescanner imagery and the total number of ungulates was established at 2175 compared to figures of 1010 and 1231 for visual method aerial survey results of the same area that year It was concluded that the scanner was much more accurate and precise for census of ungulates than visual techniques Author

N78-14557*# Canadian Forestry Service Ottawa (Ontario) Forest Fire Research Institute

AN APPLICATION OF LANDSAT DIGITAL TECHNOLOGY TO FOREST FIRE FUEL TYPE MAPPING

P H Kourtz *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1111-1115

Avail NTIS HC A99/MF A01 CSCL 02F

The role of digital classifications suitable as fuel maps was examined A Taylor enhancement was produced for an 8 million hectare fire control region showing water muskeg, coniferous deciduous and mixed stands, clearcut logging, burned areas, regeneration areas, nonforested areas and large forest roads Use of the map by fire control personnel demonstrated its usefulness for initial attack decision making Author

N78-14570*# Environmental Research Inst of Michigan, Ann Arbor

WHEAT YEILD FORECASTS USING LANDSAT DATA

John E Colwell, Daniel P Rice and Richard F Nalepka *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1245-1254

(Contract NAS5-22389)

Avail NTIS HC A99/MF A01 CSCL 02C

Several considerations of winter wheat yield prediction using LANDSAT data were discussed In addition, a simple technique which permits direct early season forecasts of wheat production was described Author

N78-14573*# Joint Research Centre of the European Communities, Ispra (Italy)

COMPUTER-AIDED CLASSIFICATION FOR REMOTE SENSING IN AGRICULTURE AND FORESTRY IN NORTHERN ITALY

J Dejace, J Megier, and W Mehl *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1269-1278 refs

Avail NTIS HC A99/MF A01 CSCL 02C

A set of results concerning the processing and analysis of data from LANDSAT satellite and airborne scanner is presented The possibility of performing inventories of irrigated crops-rice planted groves-poplars and natural forests in the mountians-beeches and chestnuts, is investigated in the Po valley and in an alphine site of Northern Italy Accuracies around 95% or better 70% and 60% respectively are achieved by using LANDSAT data and supervised classification Discrimination of rice varieties is proved with 8 channels data from airborne scanner processed after correction of the atmospheric effect due to the scanning angle, with and without linear feature selection of the data The accuracies achieved range from 65% to more than 80% The best results are obtained with the maximum likelihood classifier for normal parameters but rather close results are derived by using a modified version of the weighted euclidian distance between points with consequent decrease in computing time around a factor 3 Author

N78-14574*# Environmental Research Inst of Michigan, Ann Arbor

THE INFLUENCE OF MULTISPECTRAL SCANNER SPATIAL RESOLUTION ON FOREST FEATURE CLASSIFICATION

F G Sadowski W A Malila, J E Sarno, and R F Nalepka *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1279-1288 refs Sponsored in part by Dept of Agriculture

(Contracts NAS9-14123 NAS9-14988)

Avail NTIS HC A99/MF A01 CSCL 02F

Inappropriate spatial resolution and corresponding data processing techniques may be major causes for non-optimal forest classification results frequently achieved from multispectral scanner (MSS) data Procedures and results of empirical investigations are studied to determine the influence of MSS spatial resolution on the classification of forest features into levels of detail or hierarchies of information that might be appropriate for nationwide forest surveys and detailed in-place inventories Two somewhat different but related studies are presented The first consisted of establishing classification accuracies for several hierarchies of features as spatial resolution was progressively coarsened from (2 meters) squared to (64 meters) squared The second investigated the capabilities for specialized processing techniques to improve upon the results of conventional processing procedures for both coarse and fine resolution data Author

N78-14576*# Food and Agriculture Organization of the United Nations, Rome (Italy)

AERIAL ALBEDOS OF NATURAL VEGETATION IN SOUTH-EASTERN AUSTRALIA

J A Howard *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1301-1307 refs

Avail NTIS HC A99/MF A01 CSCL 02C

Black-and-white low-level 70mm photography was used to record the track of the aircraft, which was then plotted on conventional 1 80,000 23 cm photogrammetric photographs and referenced against simultaneous measurements of the beam albedos of vegetation Using stereoscopic pairs of the 70mm photographs, the vegetation was classified into sub-formations Marked differences in the 'sub-formation' albedos were observed A two-way table using stand height and crown cover of the sub-formations clearly showed a very distinctive trend of albedos This finding may be important in other vegetal studies Author

N78-14583*# Environmental Research Inst of Michigan Ann Arbor

APPLICATIONS OF LANDSAT DATA TO THE INTEGRATED ECONOMIC DEVELOPMENT OF MINDORO, PHILLIPINES

T W Wagner and J C Fernandez (Bur of Mines Manila) *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1375-1380

Avail NTIS HC A99/MF A01 CSCL 05C

LANDSAT data is seen as providing essential up-to-date resource information for the planning process LANDSAT data of Mindoro Island in the Philippines was processed to provide thematic maps showing patterns of agriculture, forest cover terrain wetlands and water turbidity A hybrid approach using both supervised and unsupervised classification techniques resulted in 30 different scene classes which were subsequently color-coded and mapped at a scale of 1 250 000 In addition, intensive image analysis is being carried out in evaluating the images The images, maps and aerial statistics are being used to provide data to seven technical departments in planning the economic development of Mindoro Multispectral aircraft imagery was collected to compliment the application of LANDSAT data and validate the classification results Author

N78-14591*# National Aeronautics and Space Administration Ames Research Center Moffett Field Calif

AIRBORNE MONITORING OF CROP CANOPY TEMPERATURES FOR IRRIGATION SCHEDULING AND YIELD PREDICTION

John P Millard Ray D Jackson (Agricultural Res Serv Phoenix Ariz) Robert C Goettelman (LFE Corp Richmond Calif) Robert J Reginato (Agricultural Res Serv Phoenix, Ariz) Sherwood B Idso (Agricultural Res Serv Phoenix Ariz), and Richard L LaPado (ESL Inc) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1453-1461 refs

Avail NTIS HC A99/MF A01 CSCL 02C

Airborne and ground measurements were made on April 1 and 29, 1976, over a USDA test site consisting mostly of wheat in various stages of water stress but also including alfalfa and bare soil These measurements were made to evaluate the

feasibility of measuring crop temperatures from aircraft so that a parameter termed stress degree day SDD could be computed Ground studies have shown that SDD is a valuable indicator of a crop's water needs and that it can be related to irrigation scheduling and yield The aircraft measurement program required predawn and afternoon flights coincident with minimum and maximum crop temperatures Airborne measurements were made with an infrared line scanner and with color IR photography The scanner data were registered, subtracted, and color-coded to yield pseudo-colored temperature-difference images Pseudo-colored images reading directly in daily SDD increments were also produced These maps enable a user to assess plant water status and thus determine irrigation needs and crop yield potentials Author

N78-14593*# International Business Machines Corp Houston, Tex Federal Systems Div
LANDSAT DATA FROM AGRICULTURAL SITES CROP SIGNATURE ANALYSIS
P N Misra and S G Wheeler *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1473-1482 refs
(Contract NAS9-14350)
Avail NTIS HC A99/MF A01 CSCL 02C

The LANDSAT multispectral scanner (MSS) data were analyzed with a view toward classification to identify wheat The notion of spectral signature of a crop a commonly used basis for classification was found to be inadequate Data analysis has revealed that the MSS data from agricultural sites were essentially two dimensional, and that the data from different sites and different acquisition lay on parallel planes in the four dimensional feature space These results were exploited to gain new insight into the data and to develop alternate models for classification In particular it was found that the temporal pattern of change in the spectral response of a crop constitutes its signature and provides a basis for crop classification Author

N78-14594*# Centre d Etude Spatiale des Rayonnements Toulouse (France)
INVENTORY OF RICEFIELDS IN FRANCE USING LANDSAT AND AIRCRAFT
T LeToan, P Cassirame, J Quach and R Marie (Inst Natl de Rech Agron , Montpellier, France) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1483-1495 refs
Avail NTIS HC A99/MF A01 CSCL 02C

The methodology for mapping ricefields in Southern France is developed using 1975 LANDSAT 2 and aircraft data and taking into account the features of the fields Author

N78-14595*# Forest Service Upper Darby, Pa
FORESTLAND TYPE IDENTIFICATION AND ANALYSIS IN WESTERN MASSACHUSSETTS. A LINKAGE OF A LANDSAT FOREST INVENTORY TO AN OPTIMIZATION STUDY
Giles T Rafsnider, Robert H Rogers (Bendix Corp , Ann Arbor Mich) and Anthony Morse (Bendix Corp Ann Arbor Mich) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1497-1505 refs

Avail NTIS HC A99/MF A01 CSCL 02F

Digital land cover files derived from computer processing of LANDSAT and soil productivity data were linked and used by linear programming model to determine production of forested areas under different management strategies Results of model include maps and data graphics for four-county region in Western Massachusetts Author

N78-14596*# Nevada Univ , Reno
LARGE SCALE 20mm PHOTOGRAPHY FOR RANGE RESOURCES ANALYSIS IN THE WESTERN UNITED STATES
Paul T Tueller *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1507-1514 refs
Avail NTIS HC A99/MF A01 CSCL 14E

Large scale 70mm aerial photography is a valuable supplementary tool for rangeland studies A wide assortment of applications were developed varying from vegetation mapping to assessing environmental impact on rangelands Color and color infrared stereo pairs are useful for effectively sampling sites limited by ground accessibility They allow an increased sample size at similar or lower cost than ground sampling techniques and provide a permanent record Author

N78-14597*# Weyerhauser Co , Plymouth N C
ASSESSMENT OF FOREST PLANTATIONS FROM LOW ALTITUDE AERIAL PHOTOGRAPHY
Harold A Nelson *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1515-1522

Avail NTIS HC A99/MF A01 CSCL 02F

Vertical color, and color-infrared aerial photography obtained from altitudes between 183 m and 915 m provide a cost effective method of determining tree survival and height growth in pine plantations on the North Carolina Coastal Plain All interpretations were performed by professional forestry personnel from the original 70 mm color transparencies Prompt assessment of tree survival is necessary if failed spots are to be successfully replanted Counts of living trees made after the third growing season and sometimes only two growing seasons after planting are accurate enough to permit planning of replanting operations without extensive ground surveys Author

N78-15536*# Department of Agriculture, Washington, D C Statistical Reporting Service
PILOT STUDY OF THE POTENTIAL CONTRIBUTIONS OF LANDSAT DATA IN THE CONSTRUCTION OF AREA SAMPLING FRAMES
George Hanuschak, Principal Investigator and Kathleen Morrissey Oct 1977 72 p refs Sponsored by NASA Original contains color imagery Original photography may be purchased from the EROS Data Center Sioux Falls, S D ERTS
(E78-10037 NASA-CR-155262) Avail NTIS HC A04/MF A01 CSCL 05B

N78-15539*# Department of Agriculture, Washington, D C Statistical Reporting Service
THE AUXILIARY USE OF LANDSAT DATA IN ESTIMATING CROP ACREAGES RESULTS OF THE 1975 ILLINOIS CROP-ACREAGE EXPERIMENT
Chapman Gleason, Principal Investigator Robert R Starbuck, Richard S Sigman, George A Hanuschak Michael E Craig Paul W Cook, and Richard D Allen Oct 1977 86 p refs Sponsored by NASA ERTS
(E78-10049, NASA-CR-155508) Avail NTIS HC A05/MF A01 CSCL 02C

The author has identified the following significant results It was found that classifier performance was influenced by a number of temporal, methodological, and geographical factors Best results were obtained when corn was tasselled and near the dough stage of development, Dates earlier or later in the growing season produced poor results Atmospheric effects on results cannot be independently measured or completely separated from the effects due to the maturity stage of the crops Poor classifier performance was observed in areas where considerable spectral confusion was present

N78-15540*# Mississippi State Office of Science and Technology, Jackson
THE USE OF LANDSAT DIGITAL DATA AND COMPUTER IMPLEMENTED TECHNIQUES FOR AN EROSION HAZARD-REFORESTATION NEEDS ASSESSMENT
James E Anderson Principal Investigator and Armond T Joyce Aug 1977 59 p refs Sponsored by NASA Original contains color imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(E78-10050 NASA-CR-155509, Rept-165) Avail NTIS HC A04/MF A01 CSCL 05B

N78-15542*# South Dakota State Univ., Brookings Remote Sensing Inst

APPLICATION OF REMOTE SENSING TECHNOLOGY IN SOUTH DAKOTA TO ASSESS WILDLIFE HABITAT CHANGE, DESCRIBE MEANDERING LAKES, IMPROVE AGRICULTURAL CENSUSING, MAP ASPEN, AND QUANTIFY CELL SELECTION CRITERIA FOR SPATIAL DATA Semiannual Progress Report, 1 Jul - 31 Dec 1977

Victor I Myers, Principal Investigator, R G Rest, K J Dalsted, J C Eidenshink, F A Schmer, and M E Wehde 31 Dec 1977 80 p refs Original contains color imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS

(Grant NGL-42-003-007)

(E78-10053, NASA-CR-155514 SDSU-RSI-77-17) Avail NTIS HC A05/MF A01 CSCL 08F

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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

A78-10041 **The determination of volatile organic compounds in city air by gas chromatography combined with standard addition, selective subtraction, infrared spectrometry and mass spectrometry** C W Louw, J F. Richards (South African Council for Scientific and Industrial Research, Air Pollution Research Group, Pretoria, Republic of South Africa), and P K Faure (Rand Afrikaans University, Johannesburg, Republic of South Africa) *Atmospheric Environment,* vol 11, no 8, 1977, p 703-717 25 refs

A78-10056 * **Instrumental sensing of stationary source emissions.** W F Herget and W D. Conner (U S Environmental Protection Agency, Research Triangle Park, N C) *Environmental Science and Technology,* vol 11, Oct 1977, p 962-967 5 refs NASA-supported research

A variety of programs have been conducted within EPA to evaluate the capability of various ground-based remote-sensing techniques for measuring the SO2 concentration, velocity, and opacity of effluents from coal-burning power plants The results of the remote measurements were compared with the results of instack measurements made using EPA reference methods. Attention is given to infrared gas-filter correlation radiometry for SO2 concentration, Fourier-transform infrared spectroscopy for SO2 concentration, ultraviolet matched-filter correlation spectroscopy for SO2 concentration, infrared and ultraviolet television for velocity and SO2 concentration, infrared laser-Doppler velocimetry for plume velocity, and visible laser radar for plume opacity G R

A78-10658 * **Quantitative mapping of suspended solids in wastewater sludge plumes in the New York Bight apex** R W Johnson (NASA, Langley Research Center, Hampton, Va), I W Duedall (New York, State University, Stony Brook, N Y), R M Glasgow (Vought Corp , Hampton, Va), J R Proni, and T A Nelsen (NOAA, Miami, Fla) *Water Pollution Control Federation, Journal,* vol 49, Oct 1977, p 2063-2073 13 refs

The purpose of this investigation was to apply the previously reported methodology to remotely sensed data that were collected over wastewater sludge plumes in the New York Bight apex on September 22, 1975 Spectral signatures were also determined during this study These signatures may be useful in the specific identification of sludge plumes, as opposed to other plumes such as those created by the disposal of industrial acid wastes (Author)

A78-11283 * **Characterization of terrestrial service environments - The simultaneous occurrence of combined conditions of solar insolation and climatic variables.** R E Thomas, D C Carmichael (Battelle Columbus Laboratories, Columbus, Ohio), and W F Carroll (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) In International Solar Energy Society, Annual Meeting, Orlando, Fla., June 6-10, 1977, Proceedings Sections 14-25 Cape Canaveral, Fla , International Solar Energy Society, 1977, p. 14-1 to 14-6 9 refs ERDA-supported research, Contract No NAS7 100

Computational methods for occurrences of combined environmental and pollution variables are compared General statistical data and diurnal statistics on 24 environmental variables are treated Combinations of variables dealt with include air temperature, relative humidity, wind speed, total insolation, air temperature and weather event (rain, fog), air pollutant and weather event, wind speed, wind direction, and weather event, air temperature, total insolation, and weather event, air temperature, relative humidity, wind speed, computed direct insolation levels, air temperature, relative humidity, air pollution R D V

A78-11809 **Tropospheric photochemical and photophysical processes** J N Pitts, Jr (California, University, Riverside, Calif) and B J Finlayson-Pitts (California State University, Fullerton, Calif) In Tunable lasers and applications, Proceedings of the Conference, Loen, Norway, June 6-11, 1976
Berlin and New York, Springer-Verlag, 1976, p 236-258 51 refs Research supported by the California Air Resources Board and Petroleum Research Fund, U S Environmental Protection Agency Grant No R-800649, NSF Grants No GP-35424, No MPS-73-08638-A02, No AEN-73-02904-A02

Attention is given to those species known or suspected to be present in ambient air which may have significant chemical, physical, or biological effects and for which no satisfactory conventional monitoring techniques exist at present In addition, the importance of secondary aerosols (particulates) produced by gas-to-particle conversion processes in the polluted troposphere is discussed, with special emphasis on the problems to which tunable lasers might be applied G R

A78-11810 **Photochemistry in the stratosphere** H S Johnston (California, University, Berkeley, Calif) In Tunable lasers and applications, Proceedings of the Conference, Loen, Norway, June 6-11, 1976 Berlin and New York, Springer-Verlag, 1976, p 259-278 44 refs

In studies involving aspects of stratospheric photochemistry, measurements of the trace species in the stratosphere could frequently simplify the problem significantly Attention is given to the screening of solar radiation, diurnal variations, investigations which could be carried out with tunable lasers, the pollution of the stratosphere, and the sources, sinks, and reservoirs of ozone-destroying catalysts Dominant factors in stratospheric photochemistry are considered, taking into account the formation of ozone in the upper and middle stratosphere in connection with the photolysis of molecular oxygen G R

A78-11811 **Remote sensing using tunable lasers.** K. W Rothe and H Walther (Munchen, Universitat, Garching, Max-Planck-Gesellschaft zur Forderung der Wissenschaften, Munich, West Germany). In Tunable lasers and applications, Proceedings of the Conference, Loen, Norway, June 6-11, 1976
Berlin and New York, Springer-Verlag, 1976, p 279-293 66 refs Research supported by the Bundesministerium fur Forschung und Technologie

Lasers constitute a useful tool for remote measurements of atmospheric parameters via backscattering processes At altitudes higher than 30 km, Rayleigh scattering of laser light related to the presence of the molecular constituents of the air becomes dominant over Mie scattering, associated with aerosols, dust, or other small particles in the lower atmosphere Rayleigh data provide information regarding the molecular density variation, and thereby, indirectly also the atmospheric pressure and temperature Trace constituents in the lower atmosphere can be observed with the aid of approaches based on fluorescence, Raman scattering, or absorption effects Absorption methods appear to be especially suitable for pollution monitoring applications Particular attention is given to the differential absorption method and measurements conducted with it It is concluded that the differential absorption method constitutes the most sensitive technique known at the present time G.R

A78-12405 **Comparability of CO2 measurements.** W Bischof (Stockholms, Universitet, International Meteorological Institute, Stockholm, Sweden) *Tellus,* vol 29, Oct 1977, p. 435-444 14 refs Statens Naturvetenskapliga Forskningsrad Contract No. G0223-060

In measuring the atmospheric CO2 concentration, corrections for the carrier-gas effect are required at present for each individual gas analyzer. It is shown that standard gases of CO2/air composition offer less complication in the data comparison than the CO2/N2 standards most commonly used for calibration. CO2/air standards used in Stockholm and related to the Scripps manometric calibration scale have remained stable over more than 10 years Aircraft data from the upper troposphere and the lower stratosphere obtained in the Stockholm project are in fair agreement with data from the Mauna Loa and South Pole stations An accelerating increase over the period from 1963 to 1975 (i e , about 0 5 ppm/yr at the beginning and about 1 3 ppm/yr at the end of the period) has been observed
(Author)

A78-12938 # **A mask correlation remote sensor for measurements of SO2 optical depths on long light source - Instrument distances** F Evangelisti, G Giovanelli, G Orsi, T Tirabassi, and O Vittori (CNR, Bologna, Italy) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 123-130 5 refs

A78-12955 # **The application of remote sensing to the monitoring of coastal water pollution (L'applicazione del telerilevamento al monitoraggio dell'inquinamento di acque costiere).** M Benedini (CNR, Istituto di Ricerca sulle Acque, Rome, Italy) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 387-419 6 refs In Italian

The use of remote sensing data from such sources as Landsat for monitoring coastal pollution due to the discharge of solid wastes from rivers is discussed In addition, it is suggested that satellite imagery may provide assessments of thermal stratifications or petrochemical pollution in coastal waters Aerial reconnaissance and surface ship monitoring of pollution are also considered J M B

A78-12971 **The growth of aerosol in an urban plume** A J Alkezweeny (Battelle Pacific Northwest Laboratories, Richland, Wash) In Atmospheric pollution, Proceedings of the Twelfth International Colloquium, Paris, France, May 5-7, 1976 Amsterdam, Elsevier Scientific Publishing Co , 1976, p 233-242

Time changes of aerosol particle size distributions in the range of 0 01 to 5 0 micron diameter and concentrations of O3, NO, NO2, SO2, several hydrocarbons, and sulfate were measured in an urban plume The investigation was conducted in a Lagrangian frame of reference using instrumented aircraft The air parcel trajectory was identified by the movement of a tetroon launched from the ground to an altitude within the plume This study was carried out in metropolitan St Louis, during the Metromex program A pronounced change in the aerosol particle size distribution and an increase in the total volume of the aerosol were observed Gas to particle transformation involving existing nuclei is responsible for the aerosol growth (Author)

A78-12975 **The arrangement of atmospheric pollution detectors by means of a minicomputer and a multicomponent chemical unit (L'étalonnage de détecteurs de pollution atmosphérique au moyen d'un miniprocesseur et d'une unité chimique multicomposante)** H Bultynck, J Kretzschmar, M Loos, and H Peperstraete (Centre d'Etude de l'Energie Nucléaire, Mol, Belgium) In Atmospheric pollution, Proceedings of the Twelfth International Colloquium, Paris, France, May 5-7, 1976 Amsterdam, Elsevier Scientific Publishing Co , 1976, p 279-296 In French

A telemonitoring network for measuring atmospheric SO2, total S, NOx, total hydrocarbons other than methane, and dust is described The testing of the pollution detectors and the role of the minicomputer are explained Data processing and the detector-minicomputer interface are considered A detailed detector analysis of data obtained by a flame photometric SO2 detector is provided M L

A78-12981 **Remote optical sensing of the concentration and mass flow of particulate and gaseous pollutants in smoke plumes discharged through chimneys.** P Morel C Vavasseur (Commissariat à l'Energie Atomique, Centre d'Etudes Nucléaires de Saclay, Gif-sur-Yvette, Essonne, France), and P Zettwoog (Commissariat à l'Energie Atomique, Centre d'Etudes Nucléaire de Fontenay-aux-Roses, Fontenay-aux-Roses, Hauts-de-Seine, France) In Atmospheric pollution, Proceedings of the Twelfth International Colloquium, Paris, France, May 5-7, 1976 Amsterdam, Elsevier Scientific Publishing Co , 1976, p 395-402

A78-12982 **The remote sensing of atmospheric pollutants by a CO2 laser apparatus** M M H Moreau (Institut National de Recherche Chimique Appliquée, Vert-le-Petit, Essonne, France) In Atmospheric pollution, Proceedings of the Twelfth International Colloquium, Paris, France, May 5-7, 1976 Amsterdam, Elsevier Scientific Publishing Co , 1976, p 405-418 Research supported by the Ministère de la Qualité de la Vie

The principle of the device described is the absorption of an IR beam in the 9 to 11 micron window by sulfur dioxide and some other pollutants The device consists of a transmitter-receiver and a reflector The transmitter incorporates two tunable CO2 lasers, whose beams are chopped at different frequencies This makes it possible to separate the reflected beams at the receiver The range between the transmitter receiver and the reflector is 1000 to 2000 meters V P

A78-13616 **Atmospheric particulate properties inferred from lidar and solar radiometer observations compared with simultaneous in situ aircraft measurements - A case study** J A Reagan, J D Spinhirne, D M Byrne (Arizona, University, Tucson, Ariz), D W Thomson, R G de Pena, and Y Mamane (Pennsylvania State University, University Park, Pa) *Journal of Applied Meteorology,* vol 16, Sept 1977, p 911-928 48 refs NSF Grants No GA-31916X2, No DES-72-01309-A03, No DES-75-15551

Particulate size and height distributions, complex refractive index and mass loading have been measured and inferred from direct aircraft and indirect lidar-solar radiometer observations made during a unique joint experiment conducted the week of 18 November 1974 in Tucson, Ariz The aircraft and lidar-solar radiometer measurements were first analyzed independently and the results were then intercompared Vertical profiles of particulate extinction obtained from the lidar (monostatic) and aircraft measurements were found to be in excellent agreement on both a relative and absolute basis Lidar (bistatic and monostatic) inferences of particulate mass loading agreed favorably with the aircraft mass monitor measurements The aircraft and lidar (bistatic) size distribution determinations were found to be similar in shape and agreed in absolute value within an order of magnitude The mean particle refractive index inferred from the lidar (bistatic) measurements (n = 1 40-i0 000) agreed with the index of a significant fraction of the particles identified by electron microscope analysis of impactor samples collected with the aircraft (Author)

A78-13617 **Estimation of the daytime and nighttime distribution of atmospheric ozone from ground-based millimeter wavelength measurements** F I Shimabukuro, P L Smith, and W J Wilson (Aerospace Corp , Los Angeles, Calif) *Journal of Applied Meteorology,* vol 16, Sept 1977, p 929-934 13 refs Research supported by the Aerospace Corp

The daytime and nighttime distribution of the ozone density in the atmosphere has been determined from ground-based measurements of the emission spectra of the strong 4(0,4) = 4(1,3) rotational line of ozone at 101 737 GHz (wavelength = 2 9 mm) using a least-squares parameter estimation technique The inversion procedure is described, and a linearized model is used to obtain approximate error bounds on the ozone parameter estimates (Author)

A78-13837 * Comment on 'Relative atmospheric aerosol content from ERTS observations' by Yu Mekler, H Quenzel, G Ohring, and I Marcus. M Griggs (Science Applications, Inc, La Jolla, Calif) *Journal of Geophysical Research,* vol 82, Oct 20, 1977, p 4972 Contract No NAS5-20899

A78-13843 * Evaluation of a hydrogen chloride detector for environmental monitoring G L Gregory (NASA, Langley Research Center, Hampton, Va) and R H Moyer (GEOMET, Inc, Pomona, Calif) *Review of Scientific Instruments,* vol 48, Nov 1977, p 1464-1468 8 refs

The paper describes a hydrogen chloride detector designed to monitor concentrations of hydrogen chloride gas in the ambient environment The detector was developed for NASA for use in launch vehicle effluent monitoring The detector operates on chemiluminescence principles with a lower detection limit of less than 5 x 10 to the -3rd ppm (by volume) The hydrogen chloride in the air sample reacts with a bromide-bromate coating in the inlet tube of the instrument producing bromine Bromine is then quantitated by chemiluminescent oxidation of luminol The visible light generated in the chemiluminescent reaction is proportional to the hydrogen chloride concentration of the sampled airstream The detector is most suited to laboratory or field studies where hydrogen chloride is the dominant pollutant, as compared to the interfering species Interferences include strong acids, acid-forming gases, and halogen gases Of the interferences investigated the most serious in these groups are hydrochloric and sulfuric acid, sulfur dioxide, and chlorine, respectively The detector has been in use since 1974 and has been found to be highly portable, rugged, and stable under extreme environmental conditions (Author)

A78-14082 Tunable dual-line CO2 laser for atmospheric spectroscopy and pollution monitoring. S O Kanstad, A Bjerkestrand, and T Lund (Forsvarets Forskningsinstitutt, Kjeller, Norway) *Journal of Physics E - Scientific Instruments,* vol 10, Oct 1977, p 998-1000 17 refs

Using two rear reflectors coupled via a common grating into the amplifying medium, two independently tunable lines are selected from the same laser Piezoelectric transducers length-tune the rear mirrors to produce intermittent pulses at lambda-1 and lambda-2 at any suitable frequency. Details of the resonator design are given, including a folded path in a rigid Invar structure. Signal changes down to 0.1% can be identified by means of real-time ratioing and synchronous detection. Across a 1200 m path, 0 5 and 2 ppb densities of ethylene can be measured in a calm and a turbulent atmosphere, respectively (Author)

A78-14174 Photochemical reactions among formaldehyde, chlorine, and nitrogen dioxide in air P L Hanst and B W Gay, Jr. (U S Environmental Protection Agency, Environmental Sciences Research Laboratory, Research Triangle Park, N.C) *(American Chemical Society, Centennial Meeting, San Francisco, Calif, Sept 1976.) Environmental Science and Technology,* vol 11, Nov 1977, p 1105-1109 16 refs.

Photochemical reactions among chlorine, nitrogen dioxide, and formaldehyde were studied, using parts-per-million concentrations in 1 atm of air The reactant mixtures were irradiated by ultraviolet fluorescent lamps and simultaneously analyzed by the Fourier transform infrared technique by use of folded light paths of up to 504 m With an excess of NO2 over Cl2, the reaction products included O3, CO, HNO3, N2O5, HCl, and nitryl chloride (ClNO2) When chlorine exceeded NO2, the principal product was peroxy nitric acid (HOONO2) Peroxy formyl nitrate, nitrous acid, and chlorine nitrate were not seen The nitryl chloride was stable even with the ultraviolet lights on The peroxy nitric acid disappeared from the cell with a half-life of about 10 min Formyl radicals (HCO), unlike acetyl radicals, did not combine with O2 and NO2 by addition HCO reacted with O2 to yield CO and HO2 The HO2 will then add to NO2 to yield HOONO2 If NO is present, the HO2 will prefer to react with it, oxidizing it to NO2 (Author)

A78-14199 Plants as indicators of photochemical oxidants in the USA. J S Jacobson (Boyce Thompson Institute for Plant Research, Inc, Yonkers, N Y) *(Verein Deutscher Ingenieure, Tagung uber Ozon und Begleitsubstanzen im photochemischen Smog, Dusseldorf, West Germany, Sept. 22-24, 1976) VDI-Berichte,* no 270, 1977, p 191-196 6 refs

The article discusses the use of plants as indicators of photochemical oxidants in terms of land-use planning and the evaluation of air pollution effects on agriculture, forestry, and regional vegetation A historical review of plants used as indicators is presented along with current applications in air pollution problems Advantages of plant indicators are identified, such as simplicity in use, low cost, and lack of need for electrical power Limitations in the use of plant indicators are also described, including limited regional zones for their cultivation, the effects of environmental conditions on the susceptibility to oxidants of plant indicators, and the presence of chemical pesticides S C S

A78-14448 # Ozone sounding correction procedures and their implications A B Pittock (Commonwealth Scientific and Industrial Research Organization, Div of Atmospheric Physics, Aspendale, Victoria, Australia) *Royal Meteorological Society, Quarterly Journal,* vol 103, Oct 1977, p 809, 810 5 refs

Two methods of correction to obtain agreement between integrated plus extrapolated direct sounding ozone data and the total amount of ozone, as found by the Dobson spectrophotometer, are evaluated The methods are those of Dutsch et al (1970) and Pittock (1968) It is suggested that the Dutsch correction is better for climatological applications, although large anomalies may be observed between individual flights In using this method the addition of a small correction to the apparent mean annual cycle of ozone concentrations may yield the true annual cycle This may be important in validating the photochemical theory by reference to observational data S C S

A78-14783 # The impact of remote sensing on United States' geography - The past in perspective, present realities, future potentials J E Estes, J R Jensen, and D S Simonett (California, University, Santa Barbara, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich, Environmental Research Institute of Michigan, 1977, p 101-121 61 refs

The history of applying remote sensing to geographical studies in the period 1920-1977 is reviewed with attention given to contributions from the academic, industrial and government sectors and to the roles of publications and research funding A review is presented of the theoretical and practical roles of remote sensing in geography with attention given to cognitive morphometric analysis, cause-and-effect analysis, temporal modes of explanation, and functional and ecological systems analysis B J

A78-14797 # Remote sensing of air pollutants J A Eckert and R B Evans (U S Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, Nev) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich, Environmental Research Institute of Michigan, 1977, p 353-359 7 refs

The U S program for reducing air pollution is discussed with attention to the air monitoring requirements at different stages in the abatement process Some remote sensing techniques for detecting air pollutants are surveyed One technique involves the use of an earth reflected differential absorption system, ozone would be measured on an airborne platform equipped with lasers directed to the earth's surface The uses of airborne down-looking lidar, compliance monitoring and opacity measurements, and photographic measurements are also described M L

A78-14798 # **Remote sensing of environmental impact of land use activities.** C K Paul (Agency for International Development, Washington, D C) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 363-377 16 refs

Aircraft and spacecraft multispectral scanning sensors are used to monitor land cover for environmental studies By means of digital image processing the system provides classification, rectification, rapid color rendition of scene data, and computer storage of image data for rapid retrieval and composite overlays with other sources of data Case studies of the system include the Central Atlantic Regional Ecological Test Site, begun by the U S Geological Survey Geography Program and NASA's Office of Applications in 1970, the Association of Bay Area Governments, and the North Dakota Regional Environmental Assessment Program S C S

A78-14800 # **Remote monitoring and Tennessee Valley Authority programs** A R Stevens and A W Voss (Tennessee Valley Authority, Mapping Services Branch, Chattanooga, Tenn) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 385-392

Attention is given to the historical background of the Tennessee Valley Authority noting its three primary tasks power production, flood control, and navigation The Mapping Services Branch is described in terms of its basic subsections, such as the photogrammetry and remote sensing section, the cartographic and land approvals section, and the map information, records and reprographics section Research and testing in the field of remote sensing is discussed along with the application of remote sensing techniques to areas such as forestry, geology, water resources, and environmental biology S C S

A78-14801 # **Corps of Engineers applications for remote sensing of the environment** M K Kurtz, Jr (U S Army, Engineer Topographic Laboratories, Fort Belvoir, Va) and J W Jarman (U S Army, Office of the Chief of Engineers, Washington, D C) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 393-399

Remote sensing applications developed by the U S Army Corps of Engineers are discussed, attention is given to planning for government installations, soil investigations, flood plain analyses, dam safety assessments, and monitoring of navigable waterways Emphasis is placed on the use of a combination of aerial photography and satellite data to provide the environmental impact statements required by the National Environmental Policy Act A digital interactive analysis laboratory capable of producing near real-time interpretations of satellite data is also mentioned J M B

A78-14802 * # **Atmospheric sounding with passive microwaves - Review and prognosis** D H Staelin (MIT, Cambridge, Mass) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 401-406 14 refs Contracts No NAS5-21980, No NAS5-23677

Global maps of temperature profiles 0-20 km and of total water vapor and liquid water over ocean have been obtained from satellite-borne microwave spectrometers Future satellites should extend the altitude range above 100 km and permit monitoring of H2O, O3, CO, N2O, and other trace constituents Operational microwave temperature-sounding spectrometers are scheduled for launch on both military and civilian U S satellites, and future improvements can be expected (Author)

A78-14810 # **Influence of ground level SO2 on the diffuse to direct irradiance ratio in the middle ultraviolet** K F Klenk and A E S Green (Florida, University, Gainesville, Fla) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 525-533 7 refs NSF Grant No ATM-75-21962

We examine the dependence of the ratio of the diffuse to direct irradiances at the ground for a wavelength of 315 1 nm and propose a passive remote sensing method based on ratio measurements for obtaining the optical thickness of SO2 in the vertical column If, in addition to the ratio measurements, the SO2 density at the ground is determined using an appropriate point-sampling technique then some inference on the vertical extent of SO2 can be drawn We present an analytic representation of the ratio for a wide range of SO2 and aerosol optical thicknesses and solar zenith angles which can be inverted algebraically to give the SO2 optical thickness in terms of the measured ratio, aerosol optical thickness and solar zenith angle (Author)

A78-14837 # **Production of a map of land-use in Iowa through manual interpretation of Landsat imagery.** R R Anderson (Iowa Geological Survey Remote Sensing Laboratory, Iowa City, Iowa) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 827-836. 6 refs

A land-use map of Iowa has been prepared based on manual photointerpretation of Landsat 1 images The map, prepared at a scale of 1 250,000 and printed at a scale of 1 500,000, displays nine categories of land use urban residential, urban commercial/industrial, urban open, transportation network, extractive land, agricultural land, forest land, water, and reservoir flood pool Interpretations were verified through the use of Skylab and high altitude aerial photography B J

A78-14841 # **Landsat digital data for water pollution and water quality studies in southern Scandinavia** U Hellden (Lund, Universitet, Lund, Sweden) and I Akersten (Forsvarets Forsknings-anstalt, Stockholm, Sweden) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 875-884 11 refs Research supported by the Swedish Environment Protection Board and Statens Naturvetenskapliga Forskningsrad

Spectral diagrams, illustrating the spectral characteristics of different water types, were constructed by means of simple statistical analysis of the various reflectance properties of water areas in southern Scandinavia as registered by Landsat-1 There were indications that water whose spectral reproduction is dominated by chlorophyllous matter (phytoplankton) can be distinguished from water dominated by non-chlorophyllous matter Differences between lakes, as well as the patchiness of individual lakes, concerning secchi disc transparency could be visualized after classification and reproduction in black and white and in color by means of Line Printer, Calcomp Plotter (CRT) and Ink Jet Plotter respectively (Author)

A78-14852 # **Necessity to adapt land use and land cover classification systems to readily accept radar data.** B Drake (Old Dominion University, Norfolk, Va) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 993-1000 10 refs

A hierarchial, four level, standardized system for classifying land use/land cover primarily from remote-sensor data (USGS system) has been proposed for national acceptance by Anderson et al (1976) The USGS system clearly has been developed for non-microwave imaging sensors such as camera systems and line scanners Studies

have shown that the classification system is compatible with aircraft and spacecraft photography and line-scanner imagery obtained at various altitudes The USGS system commonly is not compatible with the land use/land cover classifications at different levels that can be made from radar imagery, and particularly from synthetic-aperture radar (SAR) imagery The lack of compatibility exists because of the special capabilities of radar, particularly SAR, for data gathering that are not duplicated by the imaging optical sensors. The use of radar imagery for classifying land use/land cover at different levels is discussed, and a possible revision of the USGS system to more readily accept land use/land cover classifications from radar imagery is proposed. (Author)

A78-14862 # **Remote sensing in operational range management programs in Western Canada** M D Thompson (INTERA Environmental Consultants, Ltd , Calgary, Alberta, Canada) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1101-1110 5 refs Department of Energy, Mines and Resources Contract No DSS-OSZ76-00183

A78-14871 # **Land utilization and ecological aspects in the Sylhet-Mymensingh Haor region of Bangladesh - An analysis of Landsat data** M I Chowdhury and K M. Elahi (Jahangirnagar University, Dacca, Bangladesh) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1183-1195 8 refs

A78-14896 # **Prototype active scanner for nighttime oil spill mapping and classification.** G A Sandness and S B Ailes (Battelle Pacific Northwest Laboratories, Richland, Wash). In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 43) .Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1445-1452. Research supported by the U S Environmental Protection Agency and U S Coast Guard

The prototype active aerial scanner system described was developed for nighttime water pollution detection and nighttime multispectral imaging of the ground Xenon and mercury-xenon arc lamps were used to produce the transmitted light. Four detector channels provided a multispectral measurement capability In nighttime flight tests, a two-gallon slick of motor oil (40 micron thick) was successfully imaged from a height of 300 m A sequence of three intensity-sliced active images of the oil slick provided information on the spreading of the slick over a period of 20 minutes. Rhodamine B (a fluorescent tracer dye) was imaged from 300 m at a concentration of less than 1 ppm V P

A78-14913 * # **Multispectral analysis of ocean dumped materials.** R. W. Johnson (NASA, Langley Research Center, Hampton, Va.) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1619-1627 11 refs

Remotely sensed data were collected in conjunction with sea-truth measurements in three experiments in the New York Bight Pollution features of primary interest were ocean dumped materials, such as sewage sludge and acid waste Sewage-sludge and acid-waste plumes, including plumes from sewage sludge dumped by the 'line-dump' and 'spot-dump' methods, were located, identified, and mapped Previously developed quantitative analysis techniques for determining quantitative distributions of materials in sewage sludge dumps were evaluated, along with multispectral analysis techniques developed to identify ocean dumped materials Results of these experiments and the associated data analysis investigations are presented and discussed V P

A78-14914 # **Detection, identification, and quantification techniques for spills of hazardous chemicals.** J. F. Washburn and G A. Sandness (Battelle Pacific Northwest Laboratories, Richland, Wash) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings. Volume 2. Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1629-1635 Research supported by the U S Coast Guard and U S Environmental Protection Agency, U S Department of Transportation Contract No CG-54323A

In the study described, the first 400 chemicals listed in the Coast Guard's Chemical Hazards Response Information System (CHRIS) handbook were evaluated with respect to their detectability, identifiability, and quantifiability, using currently available pollution sensing instruments An attempt was made also to identify some of the key areas in the technology of water pollution in which further research and development work is required The analysis approach employed, made use of generalized sensing system characteristics and of the gross physical, chemical, and optical properties of the CHRIS chemicals to sort out those amenable to investigation by each of 12 sensing methods V P

A78-14992 * # **Remote estimation of surface temperature in pollution measurement experiments.** S K Gupta and S N. Tiwari (Old Dominion University, Norfolk, Va) In Conference on Aerospace and Aeronautical Meteorology, 7th, and Symposium on Remote Sensing from Satellites, Melbourne, Fla , November 16-19, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 214-218 13 refs Grant No NsG-1282

The procedure described was developed for inferring the effective brightness temperature (EBT) of the underlying surface (at a given altitude) from the computed value of the radiance corresponding to a known surface temperature A standard temperature correction to EBT (termed 'base correction') is first determined by using a 'base model atmosphere' for computing the upwelling radiance Additional temperature corrections are then determined by considering several variations of the different surface and atmospheric parameters from their 'base model' values Empirical relations are derived between the deviations of various surface and atmospheric parameters (from their base model values) and the additional corrections required for the EBT as a result of these variations Use of such relations for large-scale data reduction, instead of radiative transfer calculations, is expected to result in drastic cost decrease V P

A78-15370 **Detection of a plume 400 km from the source.** M M Millan and Y S. Chung (Department of the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada) *Atmospheric Environment,* vol 11, no. 10, 1977, p 939-944 15 refs

An unexpected SO2 reading over the northern edge of Toronto, Canada, by means of a COSPEC remote sensor, and the posterior trajectory analysis of the air parcel over Toronto at the time of the measurement, indicate that the INCO Sudbury plume was observed at 400 km from its source Some estimates of the mass flux in the plume and of its horizontal dimensions are presented (Author)

A78-15890 * **The vertical distribution of HCl in the stratosphere** O F Raper, C B Farmer, R A Toth, and B D Robbins (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) *Geophysical Research Letters,* vol 4, Nov 1977, p 531-534 7 refs Contract No NAS7-100

The vertical distribution of HCl in the stratosphere has been measured from infrared solar absorption spectra recorded with a balloon-borne interferometer The flights were made in September, 1975, and May, 1976 at float altitudes of 40 km and 37 km, respectively, near Palestine, Texas Concentration profiles derived from the data show an increase from 0 6 ppbv at 20 km to 1 7 plus or minus 5 ppbv in the region of 37 km Above 37 km, the data permit only the total abundance to be determined, this value is found to be equivalent to 1 6 plus or minus 6 ppbv if the gas were

uniformly mixed The results from the two flights are closely similar, and no significant seasonal variation in the HCl concentrations can be discerned The balloon data are consistent with the profile in the 14-21 km altitude region of the stratosphere reported earlier from U-2 observations (Author)

A78-16214 Simultaneous measurements of nitrogen dioxide and nitric acid in the lower stratosphere (Mesures simultanées du dioxyde d'azote et de l'acide nitrique dans la basse stratosphère) A Girard, J -C Fontanella, R Giraudet, and N Louisnard (ONERA, Châtillon-sous-Bagneux, Hauts-de-Seine, France) *(Journal de Chimie Physique,* vol 74, no 7-8, 1977, p 809-813) *ONERA, TP* no 1977-154, 1977 (p 809-813) 6 p 17 refs In French

Simultaneous measurements of nitrogen dioxide and nitric acid were made at various seasons and northern latitudes by means of an airborne infrared spectrometer At sunset in the lower stratosphere the concentration ratio of NO2 to HNO3 is around 0 1 An estimate of the OH concentration was deduced from this ratio on the basis of reactions in which nitric acid plays a part P T H

A78-16506 # An investigation of natural resources from orbital station 'Salyut-4' L A Kashin, Iu P Kienko, and P I Klimuk (National Committee of Photogrammetrists, Moscow, USSR) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 11 p

Investigations of tectonic structure, studies of the hydrology and lithology of large areas, and land use surveys based on the analysis of imagery from the Soviet Salyut 4 orbital station are reported The photographic systems on board the Salyut 4 are briefly described, and problems in data analysis are mentioned Detection of a drained area of the Aral Sea, evaluation of oil and gas resources, a survey of phytoplankton populations, and the prediction of earthquakes on the basis of Salyut 4 data are considered J M B

A78-16529 # Description of landform patterns on air photos J G Speight (Commonwealth Scientific and Industrial Research Organization, Div of Land Use Research, Canberra, Australia) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 18 p 15 refs

A technique of landform description from aerial-photographic data was developed that is capable of specifying a considerable range of types of terrain in Papua New Guinea and of discriminating between them with some precision Some sixty terrain attributes are used to characterize the landform features of a region These attributes, for example, relate to grain variability, relief variability, connectedness of crest networks, and variability of dimensions of summit surfaces, crests, slopes, plains, streams, rises In this way, landform classifications can be constructed on the basis of explicit attributes, and the possibility is provided of drawing mapping boundaries that enclose regions that are internally homogeneous with respect to the chosen attributes, but differ from each other in terms of the same attributes P T H

A78-16530 # Monitoring of polluted rivers by remote sensing methods (Gewässeruberwachung durch Fernerkundung). S. J Schneider (Bundesforschungsanstalt fur Landeskunde und Raumordnung, Bad Godesberg, West Germany). *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 19 p In German.

The possibility of using multispectral photography, infrared scanning, and infrared thermography from aircraft for monitoring discharges of polluted and heated water in rivers was investigated in a test program on the narrow Saar river and on the wide Upper Rhine Valley Over the Saar, the helicopter flew along the center of the river bed, while for the much wider Rhine, 38 flights over transverse axes were performed, and the trends of the recorded quantities were plotted along the center of the river and along two lines 15 m from either shore. All important pollutants were detected, although it was generally necessary to combine the various measurement types to get a complete picture The size and shape of discharge plumes depended strongly on the flow rate. High sensitivity in the IR region enabled clear distinction between healthy chlorophyll-containing matter and unhealthy growth. P T.H

A78-16539 # Analysis of some models of atmospheric optical properties according to space photo surveys G B Gonin, N V Kravchuk, and P V Stepanov (National Committee of Photogrammetrists, Moscow, USSR) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 9 p 18 refs

A number of transfer functions are given in compact form, characterizing various types of atmospheric influence on optical landscape characteristics The specific features of different models characterizing the optical properties of the atmosphere are mentioned Some features of computer programs used to compute different transfer functions are briefly described P T H

A78-16550 # Land-use change detection from Landsat and Skylab satellites R Ellefsen and D Peruzzi (San Jose State University, San Jose, Calif) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper.* 6 p 5 refs

Data from Skylab and Landsat are used to update existing traditionally drawn land-use maps Visual photographic imagery returned to earth by Skylab 4 is manually interpreted to detect land-use change Also, land-use maps are made with the aid of computers employing pattern recognition programs to process Landsat 1 and 2 digital reflectance data. These maps are compared to manual products to determine land-use change It is shown that data from manned and unmanned satellites are suitable for monitoring land-use changes and that Skylab can detect type and quantity of land-use change by means of traditional interpretation techniques S D

A78-16771 Unique ambient carbon monoxide monitor based on gas filter correlation - Performance and application L W Chaney (Michigan, University, Ann Arbor, Mich) and W A McClenny (U S Environmental Protection Agency, Environmental Sciences Research Laboratory, Research Triangle Park, N C.) *Environmental Science and Technology,* vol 11, Dec 1977, p 1186-1190 20 refs

A78-17000 * Quantitative remote measurements of pollutants from stationary sources using Raman lidar S K Poultney (Perkin-Elmer Corp , Norwalk, Conn), M L Brumfield, and J H Siviter, Jr (NASA, Langley Research Center, Hampton, Va) *Applied Optics,* vol 16, Dec 1977, p 3180-3182 8 refs Grant No NsG-1060

The several advantages of Raman lidar for remote measurements of stationary source emissions were quantitatively evaluated using a calibration tank at a distance of 300 m at night Measurements of approximately 10 to the 3rd ppm SO2 with a 12% accuracy were demonstrated in an observation time of 15 min using a 1 5-J ruby laser at 30 pulses/min, 6-m range resolution, interference filters, photon counting detection, and a 20-cm receiver Measurement accuracy was checked by measuring known concentrations of SO2 in the tank, by tuning the interference filters through the SO2 Raman line, and by varying the CO2 concentration to very high levels during the SO2 measurements Evaluation of the seriousness of induced fluorescence from plume aerosols failed due to the inability to simulate the plume aerosols (Author)

A78-17061 * # Observation of the development of individual clear air convective cells A Arnold (Johns Hopkins University, Laurel, Md) In Conference on Radar Meteorology, 17th, Seattle, Wash , October 26-29, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 338-341 USAF-NASA-supported research, NSF Grant No ATM-75-15791

A series of radar observations has been used to monitor the development of clear air convective cells It is suggested that an airfield may be a source of such cells The cells first appear at a distance of about 11 km, and are observed to be produced every four minutes The emergence of separate cells supports the bubble theory of convection After reaching maximum height, a typical decrease of 100-200 m occurs Various methods used to estimate convective cell energy yield values of 10 to the 12th, 4 x 10 to the 11th, and 10 to the 11th J S C S

A78-17197 Radar detection of surface oil slicks S P Kraus, J E Estes, S G Atwater (California, University, Santa Barbara, Calif), J R Jensen (Georgia, University, Athens, Ga), and R R Vollmers (U S Coast Guard, Washington, D C) *Photogrammetric Engineering and Remote Sensing,* vol 43, Dec 1977, p 1523-1531 10 refs Research supported by the University of California, U S Department of Transportation Contract No CG-63898-A

The United States Coast Guard currently is developing AIREYE, an all-weather, day/night airborne surveillance system, for installation aboard future medium range surveillance (MRS) aircraft As part of this program, a series of controlled tests was conducted off southern California during May, 1976 in order to evaluate the oil slick and surface target detection capabilities of two Motorola-developed side-looking radars The systems, a real-aperture AN/APS-94D and a synthetic-aperture coherent-on-receive (COR), were flown over the Santa Barbara Channel on May 19, 1976 Targets imaged during the coincident overflights included natural oil seepage, simulated oil spills, oil production platforms, piers, mooring buoys, commercial boats and barges, small pleasure craft, and coastal kelp beds This paper describes the test program and compares oil and surface target detection results for the two systems Based on an analysis of imagery from the coincident radar runs, COR provided better detection of natural and man-made oil slicks, whereas the AN/APS-94D consistently exhibited higher surface target detection results (Author)

A78-17574 Benefit assessment of ozone monitoring satellites. F E Gramling, P G Sassone, and R D Wilkins (Georgia Institute of Technology, Atlanta, Ga) In Imaginative engineering thru education and experience, Proceedings of the Southeast Region 3 Conference, Williamsburg, Va , April 4-6, 1977 New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 427-429

The reported study emphasizes the methodology of assessing benefits of pollution monitoring satellites and extends some of the findings of the climatic impact assessment program which was organized 1971 to investigate the effects of aircraft engine emission on the chemical composition of the stratosphere A graph is presented to illustrate the overall procedure for assessing the benefits of an alternative approach to stratospheric ozone monitoring The first step involves a characterization of the performance of the baseline and alternative monitoring systems The approach is concerned with a generic performance characterization of the alternate system which may include satellites and ground stations G R

A78-17575 Design and operation of an airborne air quality measurement system J B Tommerdahl, R B Strong, J H White (Research Triangle Institute, Research Triangle Park, N C), and J C Mulligan (North Carolina State University, Raleigh, N C) In Imaginative engineering thru education and experience, Proceedings of the Southeast Region 3 Conference, Williamsburg, Va , April 4 6, 1977 New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 430-433 U S Environmental Protection Agency Contract No 68-02-2048

An instrumentation system for use in a light, twin-engine aircraft for ambient air quality measurements in the lower troposphere is described The system includes equipment for the measurement of ozone, oxides of nitrogen, temperature and the collection of grab samples for hydrocarbon analysis The air sampling system design, the evaluation of pressure effects on the analyzers, supporting measurements such as altitude and air speed, field operational procedures, and data validation techniques are discussed A brief description of a four-month flight program, conducted during the summer of 1975, which involved around 300 hours of flight time is presented (Author)

A78-17576 * Aircraft versus spacecraft for remote monitoring of water quality in U S coastal zones W L Darnell (NASA, Langley Research Center, Hampton, Va) In Imaginative engineering thru education and experience, Proceedings of the Southeast Region 3 Conference, Williamsburg, Va , April 4-6, 1977 New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 435-441 11 refs

To provide guidance for conducting future water monitoring missions over U S coasts, aircraft and spacecraft approaches were defined and quantitatively compared Sensors, aircraft and spacecraft were selected from current or developmental types for the hardware concepts and monitoring was assumed to begin in 1981-1983 Comparative data are presented on capabilities and costs to monitor both recognized pollution sites and broad shelf areas For these mission requirements, a large fleet of light aircraft provided better coverage and at lower costs generally than one spacecraft, assuming a single, multi-spectral sensor on each platform This result could change, however, should additional useful sensors with low cost penalties be found for the spacecraft (Author)

A78-18240 Remote sensing of pollutant plumes from Landsat P Brimblecombe, A Armstrong, and T Davies (East Anglia, University, Norwich, England) *British Interplanetary Society, Journal (Remote Sensing),* vol 31, Jan 1978, p 11-15

The use of computer-compatible tapes from Landsat imagery for the analysis of industrial pollutant smoke plumes is discussed Difficulties may arise in defining contours for the smoke plumes, which often depart from the expected Gaussian distributions because they are products of instantaneous imagery However, gray scale histograms are found to be effective for mapping probability contours Techniques for discriminating between clouds and smoke plumes, based on spectral signatures or shadows cast, are also mentioned Probability contours and intensity gradients of a plume emanating from a power station cooling tower are analyzed in a test of the methodology J M B

A78-18270 Measurement of atmospheric composition at the Australian baseline atmospheric monitoring station G I Pearman (Commonwealth Scientific and Industrial Research Organization, Melbourne, Australia) In Analytical techniques in the determination of air pollutants, Proceedings of the Symposium, University of Melbourne, Melbourne, Australia, May 1977 Symposium sponsored by the Clean Air Society Melbourne, Commonwealth Scientific and Industrial Research Organization, 1977, p 16-22 55 refs

Baseline or background monitoring of the composition of the atmosphere is an attempt to establish the composition of large sections of the global atmosphere and to observe whether the concentration of selected components is changing with time During the early part of 1976 measurements of baseline atmospheric composition were commenced at Cape Grim, Tasmania The Cape Grim station is to obtain data regarding the composition of southern hemisphere westerly maritime air The data represent air covering space scales of 1000-10,000 km horizontally and 10 km vertically The study of atmospheric particulates is considered, taking into account electrical conductivity, particle numbers, particle composition and mass, turbidity, and particle distribution Attention is also given to investigations related to carbon dioxide, ozone, precipitation chemistry, meteorology, and data selection G R

A78-18300 Monitoring air quality from satellites F C Parmenter (NOAA, Applications Group, Washington, D C) *Monthly Weather Review,* vol 105, June 1977, p 789-792

Imagery from the operational geostationary satellite (GOES-1) provided a means of monitoring a large area of smoke originating in forest fires in Ontario and Quebec and drifting across New York and New England in June, 1976 Due to differential surface heating caused by the haze band, convective clouds were formed at the edge of the smoky region, resulting in conditions hazardous to low-level aircraft operations The usefulness of the satellite data for forecasting such local summertime convection phenomena is suggested J M B

A78-18456 Measurement and the law - Monitoring for compliance with the Clean Air Amendments of 1970 S M Blacker, W R Ott, and T W Stanley (U S Environmental Protection Agency, Office of Research and Development, Washington, D C) *International Journal of Environmental Studies,* vol 11, no 3, 1977, p 169-185 28 refs

Regulatory approaches established by the Clean Air Amendments of 1970 are explained The approaches include attainment of National Ambient Air Quality Standards (NAAQS) through State Implementation Plans, control of stationary sources, and control of mobile sources Attention is focused on one regulatory approach - control of air pollution through State Implementation Plans - which is depicted as a feedback control system The NAAQS are inputs to the system, the Plans are the control mechanism, and air monitoring is the 'feedback loop' by which to gauge compliance with the NAAQS Six component systems within the feedback loop are described monitoring site selection, sampling frequency, measurement methods, reference materials, data acquisition, and data analysis and presentation M L

A78-18476 Preliminary results from the Lidar system at the University of L'Aquila A D'Altorio and G Visconti (L'Aquila, Università, L'Aquila, Italy) *Rivista Italiana di Geofisica e Scienze Affini,* vol 4, Sept-Dec 1977, p 270, 271 Research supported by the Consiglio Nazionale delle Ricerche

The Lidar system of the University of Aquila, Italy, intended primarily for studies of stratospheric aerosols and NO2 fluorescence, is described Sample analyses of backscattering signals from the 8 to 15 and the 12 to 18 km altitude ranges are presented In addition, comparison of the sample analyses with data from the U S Standard Atmosphere indicates adequate accuracy for the Lidar system up to an altitude of about 25 km J M B

A78-18508 Mass appearance of marine blue algae in the Baltic Sea detected in satellite images (Massenauftreten mariner Blaualgen in der Ostsee auf Satellitenaufnahmen erkannt) K A Ulbricht (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Nachrichtentechnik, Oberpfaffenhofen, West Germany) and D Schmidt (Deutsches Hydrographisches Institut, Hamburg, West Germany) *DFVLR-Nachrichten,* Dec 1977, p 913-915 In German

Landsat multispectral images of the Baltic Sea were processed by a digital image interpretation system, revealing in the Arkona Basin north and south of the island of Mon certain bright, irregularly broken lines, occasionally several kilometers in length These lines have been identified with the mass appearance of marine blue algae Elevated concentrations of phosphate promote the formation of the algae, which accordingly are an indicator of the eutrophication of the water The spectral regions used (0 4-0 6 microns and 0 6-0 7 microns) have a depth of penetration into the sea water of 2-3 m, and appear to be well-suited to observation of the upper water layer which is irradiated by the sun P T H

A78-18795 * # Remote sensing and laboratory techniques for monitoring ocean dumping C W Ohlhorst, R W Johnson (NASA, Langley Research Center, Hampton, Va), and E R Meyer (NOAA, National Ocean Survey, Rockville, Md) *American Geophysical Union, Fall Meeting, San Francisco, Calif , Dec 5-9, 1977, Paper* 11 p 9 refs

Results of field experiments conducted in the Atlantic Coastal Zone indicate that plumes resulting from ocean dumping of acid waste and sewage sludge have distinguishable spectral characteristics when the radiance of the pollutant is normalized (ratioed to) background ocean water Acid waste spectra peak between 550-650 nm while sewage sludge spectra have peak values at wavelengths of about 700 nm or greater Results indicate that identification of acid waste and sewage sludge plumes may be independent of geographical location in the Atlantic Coastal Zone Radiance ratio curves obtained in the laboratory qualitatively agree with those obtained from field experiments Results from the July 25, 1977, Galveston Deep Ocean Dump Site experiment show the radiance ratio curve of the biodigested industrial waste to be fairly flat and similar to the radiance ratio curves of sewage sludge line dumps and sewage sludge spot dumps that have been in the water for several hours (Author)

A78-19616 Energy resource development - The monitoring components G B Morgan (U S Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Las Vegas, Nev) *Environmental Science and Technology,* vol 12, Jan 1978, p 34-43

In connection with the continuing development of energy resources, it is very important to keep environmental pollutant concentrations at acceptable levels In order to achieve this objective it is necessary to have information with respect to exposure pollutant effect relations, pollutant sources and the effectiveness of the considered controls Monitoring systems and techniques for obtaining the needed information are considered, taking into account papers from eight different Federal agencies Attention is given to aspects of water monitoring, the use of remote sensing data for a detection of SO2-produced vegetation damage, models for the prediction of the radiological impact of releases to the atmosphere from nuclear power, and the tracking of particulate pollutants by Doppler lidar G R

A78-20067 Use of lidar to detect oil pollution of the sea surface O I Abramov, V I Eremin, L I Lobov, and V V Polovinko (Vsesoiuznyi Elektrotekhnicheskii Institut, Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Gosudarstvennyi Okeanograficheskii Institut, Moscow, USSR) *(Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana,* vol 13, Mar 1977, p 331-334) *Academy of Sciences, USSR, Izvestiya, Atmospheric and Oceanic Physics,* vol 13, Oct 1977, p 232-234 5 refs Translation

A backscattering lidar technique using a laser emitting at a wavelength of 0 3472 micron was used to study the pollution of the sea surface by oil products Backscattering spectra were obtained under laboratory conditions and for the Bosphorus region, and used to determine the thickness of oil-product films on the water surfaces B J

N78-10526*# Old Dominion Univ Research Foundation, Norfolk, Va

A MODULAR RADIATIVE TRANSFER PROGRAM FOR GAS FILTER CORRELATION RADIOMETRY

Joseph C Casas and Shirley A Campbell Washington NASA Oct 1977 71 p refs

(Grant NsG-1127)

(NASA-CR-2895, PGSTR-AP77-49) Avail NTIS HC A04/MF A01 CSCL 04A

The fundamentals of a computer program, simulated monochromatic atmospheric radiative transfer (SMART), which calculates atmospheric path transmission, solar radiation, and thermal radiation in the 4 6 micrometer spectral region, are described A brief outline of atmospheric absorption properties and line by line transmission calculations is explained in conjunction with an outline of the SMART computational procedures Program flexibility is demonstrated by simulating the response of a gas filter correlation radiometer as one example of an atmospheric infrared sensor Program limitations, input data requirements, program listing, and comparison of SMART transmission calculations are presented Author

N78-10531*# Science Applications, Inc La Jolla, Calif

DETERMINATION OF AEROSOL CONTENT IN THE ATMOSPHERE FROM LANDSAT DATA Progress Report, 25 Jul - 28 Oct. 1977

M Griggs, Principal Investigator 28 Oct 1977 8 p ERTS (Contract NAS5-20899)
(E78-10004, NASA-CR-155208, SAI-77-911-lj, PR-11) Avail NTIS HC A02/MF A01 CSCL 04A

N78-10540*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
URBAN AREA DELINEATION AND DETECTION OF CHANGE ALONG THE URBAN-RURAL BOUNDARY AS DERIVED FROM LANDSAT DIGITAL DATA
Jerrold W Christenson and Henry M Lachowski (GE, Beltsville, Md) Oct 1977 10 p refs
(NASA-TM-X-71413 X-923-77-245) Avail NTIS HC A02/MF A01 CSCL 08B

LANDSAT digital multispectral scanner data in conjunction with supporting ground truth, were investigated to determine their utility in delineation of urban-rural boundaries The digital data for the metropolitan areas of Washington, D C , Austin, Texas, and Seattle, Washington were processed using an interactive image processing system Processing focused on identification of major land cover types typical of the zone of transition from urban to rural landscape, and definition of their spectral signatures Census tract boundaries were input into the interactive image processing system along with the LANDSAT single and overlayed multiple date MSS data Results of this investigation indicate that satellite collected information has a practical application to the problem of urban area delineation and to change detection Author

N78-10608# Coast Guard Research and Development Center, Groton, Conn
FIELD INFRARED METHOD TO DISCRIMINATE NATURAL SEEPS FROM NON-SEEPS, SANTA BARBARA, CALIFORNIA AREA Final Report
DeLyle Eastwood and Douglas F Grant Dec 1976 25 p
(AD-A042861, CGR/DC-15/76, USCG-D-32-77) Avail NTIS HC A02/MF A01 CSCL 20/6

A field infrared method has been developed to distinguish oil due to natural seepage in the Santa Barbara (California) Channel region from closely similar oils derived from spills at offshore drilling platforms or from shipping accidents Differences between seep and non-seep oils have been found to persist in weathering studies carried out in outdoor tanks for one week This method involving simple infrared instrumentation and a minimum of sample preparation It permits rapid on-site analysis without special training The major differences between seep and non-seep oils appear in the comparison between the 13 8 micrometers and 13 5 micrometers peaks (for both weathered and unweathered oils) and in the carbonyl region at 5 85 micrometers (for unweathered oils only) GRA

N78-10619# Battelle Columbus Labs , Ohio
THE FATE OF NITROGEN OXIDES IN THE ATMOSPHERE
Chester W Spicer, James L Gemma, Philip M Schumacher, and Gerald F Ward Aug 1976 122 p refs Sponsored by EPA, Research Triangle Park, N C
(PB-267784/7, CRC-APRAC-CAPA-9-71, Rept-2) Avail NTIS HC A06/MF A01 CSCL 07D

The second year of a continuing study to determine the distribution and fate of nitrogen oxides in the atmosphere is described Analytical methods developed in the first year were refined and validated and results from the first year study were reexamined with the aid of additional data collected simultaneously by other research groups An instrumental technique for nitric acid was refined, tested for interference, and verified against a long-path infra-red technique under simulated smog conditions The interference by PAN and nitric acid with the chemiluminescent determination of NO2 was studied with a view toward reducing or minimizing the interference Nitric acid interference was eliminated by the use of a nylon prefilter on the chemiluminescent instrument The interaction of gaseous nitric acid with alkaline glass-fiber filters was shown to yield artifact particulate nitrate GRA

N78-10621# California Univ , Riverside Statewide Air Pollution Research Center
FORMATION OF PHOTOCHEMICAL AEROSOLS Final Report
Edgar R Stephens and Monty A Price May 1977 78 p refs (Grant EPA-R-80068)
(PB-268895/0, EPA-600/3-77-044) Avail NTIS HC A05/MF A01 CSCL 07E

Counting of particles by light scattering was the principle physical technique while infrared analyses were the major source of chemical information A new reflectance spectroscopy technique was also developed Infrared spectra of ambient aerosols have bands assigned to sulfate, nitrate, ammonium, and water which are completely removed by water washing of the sample but not by benzene Synthetic aerosols generated by mixing ammonia with sulfuric and nitric acids produce similar spectra Many ambient aerosol particles are hygroscopic or deliquescent so that they swell as the relative humidity increases and shrink as it decreases It is concluded that direct control of aerosol emissions will not markedly improve visibility in Southern California GRA

N78-10623# Environmental Research and Technology, Inc , Concord, Mass
ANALYSIS OF PHOTOCHEMICAL OXIDANT AND PARTICULATE POLLUTION PATTERNS IN NEW ENGLAND USING REMOTE SENSING DATA Final Report
Clinton J Bowley, Joseph L Horowitz, and James C Barnes Jun 1977 52 p refs
(Contract EPA-68-02-2533)
(PB-268996/6 ERT-P-2273, EPA-901/9-77-002) Avail NTIS HC A04/MF A01 CSCL 13B

Imagery from earth surveillance satellites was examined to assess the potential usefulness of satellite data for monitoring air pollutant patterns and defining the associated meteorological conditions in sourthern New England Imagery from various satellite systems were visually interpreted Results indicate a good correlation between certain types of high pollutant load and haze and smoke, with accompanying reductions in visibility Satellite imagery can display differences in reflectance or temperature due to some combination of haze, smoke and atmospheric pollutant load, on a regional basis GRA

N78-11634 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany) Inst fuer Physik der Atmosphaere
CONCEPT FOR AN AIRBORNE MULTIDISCIPLINARY LIDAR SYSTEM [KONZEPT FUER DEN FLUGZEUGEINSATZ EINES MULTIDISZIPLINAEREN LIDAR-SYSTEMS]
W Renger and G H Ruppersberg *In* Deut Wetterdienst Annals of Meteorol No 12 1977 p 234-235 refs In GERMAN ENGLISH summary
Avail Issuing Activity

It is planned to operate a combination of an aerosol and a differential absorption lidar onboard a meteorological research aircraft for different model-missions within the Federal Republic of Germany These missions which have nearly the same difficulties and solutions as future Spacelab experiments shall demonstrate to which degree the intended objectives may be met In cooperation with different groups actual problems shall be treated at the regional scale Three-dimensional extent of haze and smog and penetrating plumes, detection of fresh air channels mass concentration and mass fluxes of aerosols, detection of increased emission of bad or toxic substances comparison to ground data immission control of different spurious gases, and verification of models for simulation Author (ESA)

N78-12554*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
LABORATORY MEASUREMENTS OF RADIANCE AND REFLECTANCE SPECTRA OF DILUTE PRIMARY-TREATED SEWAGE SLUDGE
J W Usry, William G Witte Charles H Whitlock, and E A Gurganus Nov 1977 27 p refs
(NASA-TP-1038, L-11767) Avail NTIS HC A03/MF A01 CSCL 13B

The feasibility of remotely monitoring ocean dumping of waste products such as acid and sewage sludge is evaluated

The laboratory arrangement, solar simulator, and test results from three experiments conducted in the laboratory are described Radiance and reflectance spectra are presented for primary-treated sewage sludge mixed with two types of base water Results indicate that upwelled reflectance varies in a near-linear manner with concentration and that the sludge has a practically flat signal response between 420 and 970 nm Well-defined upwelled reflectance spectra were obtained for the sewage-sludge mixtures at all wavelengths and concentrations The spectral-reflectance values appeared to be influenced by the type of base water, but this influence was small, especially for the mixtures with low concentrations of sewage sludge Author

N78-12555*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
LABORATORY MEASUREMENTS OF RADIANCE AND REFLECTANCE SPECTRA OF DILUTE SECONDARY-TREATED SEWAGE SLUDGE
William G Witte J W Usry Charles H Whitlock, and E A Gurganus Dec 1977 23 p refs
(NASA-TP-1089 L-11870) Avail NTIS HC A02/MF A01 CSCL 13B

The National Aeronautics and Space Administration (NASA), in cooperation with the Environmental Protection Agency (EPA) and the National Oceanic and Atmospheric Administration (NOAA), conducted a research program to evaluate the feasibility of remotely monitoring ocean dumping of waste products such as acid and sewage sludge One aspect of the research program involved the measurements of upwelled spectral signatures for sewage-sludge mixtures of different concentrations in an 11600-liter tank This paper describes the laboratory arrangement and presents radiance and reflectance spectra in the visible and near-infrared ranges for concentrations ranging from 9 7 to 180 ppm of secondary-treated sewage sludge mixed with two types of base water Results indicate that upwelled radiance varies in a near-linear manner with concentration and that the sludge has a practically flat signal response between 420 and 970 nm Reflectance spectra were obtained for the sewage-sludge mixtures at all wavelengths and concentrations Author

N78-12645*# National Aeronautics and Space Administration Langley Research Center, Langley Station, Va
LABORATORY MEASUREMENTS OF UPWELLED RADIANCE AND REFLECTANCE SPECTRA OF CALVERT, BALL, JORDAN, AND FELDSPAR SOIL SEDIMENTS
Charles H Whitlock J W Usry, William G Witte, and E A Gurganus Dec 1977 36 p refs
(NASA-TP-1039, L-11854) Avail NTIS HC A03/MF A01 CSCL 08J

An effort to investigate the potential of remote sensing for monitoring nonpoint source pollution was conducted Spectral reflectance characteristics for four types of soil sediments were measured for mixture concentrations between 4 and 173 ppm For measurements at a spectral resolution of 32 mm, the spectral reflectances of Calvert, Ball, Jordan, and Feldspar soil sediments were distinctly different over the wavelength range from 400 to 980 nm at each concentration tested At high concentrations, spectral differences between the various sediments could be detected by measurements with a spectral resolution of 160 nm At a low concentration, only small differences were observed between the various sediments when measurements were made with 160 nm spectral resolution Radiance levels generally varied in a nonlinear manner with sediment concentration, linearity occurred in special cases, depending on sediment type, concentration range, and wavelength Author

N78-13501*# West Virginia Dept of Natural Resources Charleston
CONTRIBUTIONS OF LANDSAT TO NATURAL RESOURCE PROTECTION AND FUTURE RECREATIONAL DEVELOPMENT IN THE STATE OF WEST VIRGINIA Final Report, Jun 1975 - Oct. 1977
Ira S Latimer, Jr and David C Callaghan, Principal Investigators 31 Oct 1977 116 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(Contract NAS5-22327)
(E78-10019, NASA-CR-155246) Avail NTIS HC A06/MF A01 CSCL 08B

N78-13506*# Mississippi State Univ , Mississippi State
APPLICATION OF REMOTE SENSING TO STATE AND REGIONAL PROBLEMS Semiannual Progress Report, 1 May - 31 Oct. 1977
W Frank Miller, Principal Investigator, Bradley D Carter, David E Pettry, Gary K Higgs, James L. Solomon, and Dale A Quattrochi 7 Nov 1977 92 p refs Original contains imagery Original photography maybe purchased from the EROS Data Center, Sioux Falls, S D ERTS
(Grant NGL-25-001-054)
(E78-10034, NASA-CR-155261, SAPR-8) Avail NTIS HC A05/MF A01 CSCL 08F

N78-13507*# Mississippi State Univ , Mississippi State Dept of Geology and Geography
TENNESSEE-TOMBIGBEE INDUSTRIAL SITING PROJECT. A STUDY OF PHYSICAL AND ENVIRONMENTAL FACTORS OF POTENTIAL INDUSTRIAL SITES
Gary K Higgs, Principal Investigator 31 Oct 1977 176 p refs ERTS
(Grant NGL-25-001-054)
(E78-10035, NASA-CR-155260) Avail NTIS HC A09/MF A01 CSCL 08H

N78-13636# Radian Corp , Austin, Tex
A QUALITY ASSURANCE PROGRAM FOR MONITORING OZONE AND CARBON MONOXIDE Final Report
David C Jones and Louis H Fowler Jun 1977 108 p refs
(Contract EPA-68-02-1383)
(PB-271204/0, RAD-TN-100-044-16, EPA-906/9-77-003) Avail NTIS HC A06/MF A01 CSCL 14B

A quality assurance program for monitoring ozone and carbon monoxide is described, which uses a chemiluminescent ozone monitor and a nondispersive infrared CO monitor Instrument selection criteria and site selection criteria are presented Step by step procedures are given discussing routine station operation, instrument multipoint calibrations, and quality assurance audits Record keeping procedures data reduction and data handling are discussed GRA

N78-13670*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
GLOBAL SENSING OF GASEOUS AND AEROSOL TRACE SPECIES USING AUTOMATED INSTRUMENTATION ON 747 AIRLINERS
Porter J Perkins and Leonidas C Papathakos 1977 11 p refs Presented at 4th Joint Conf on Sensing of Environmental Pollutants, New Orleans, La , 6-11 Nov 1977
(NASA-TM-73810, E-9396) Avail NTIS HC A02/MF A01 CSCL 04A

The Global Atmospheric Sampling Program (GASP) by NASA is collecting and analyzing data on gaseous and aerosol trace species in the upper troposphere and lower stratosphere Measurements are obtained from automated systems installed on four 747 airliners flying global air routes Advances were made in airborne sampling instrumentation Improved instruments and analysis techniques are providing an expanding data base for trace species including ozone, carbon monoxide, water vapor, condensation nuclei and mass concentrations of sulfates and nitrates Simultaneous measurements of several trace species obtained frequently can be used to uniquely identify the source of the air mass as being typically tropospheric or stratospheric A quantitative understanding of the tropospheric-stratospheric exchange processes leads to better knowledge of the atmospheric impact of pollution through the development of improved simulation models of the atmosphere Author

N78-14489*# Environmental Protection Agency, Las Vegas, Nev Environmental Monitoring and Support Lab
REMOTE SENSING OF AIR POLLUTANTS
J A Eckert and R B Evans *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977

p 353-359 refs
Avail NTIS HC A99/MF A01 CSCL 13B

Monitoring of pollutants within the troposphere is discussed Selected specific techniques were investigated and it was shown how the use of these techniques fits into the overall national strategy for air pollution abatement Author

N78-14490*# Agency for International Development, Washington, D C
REMOTE SENSING OF ENVIRONMENTAL IMPACT OF LAND USE ACTIVITIES
C K Paul *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 363-377 refs

Avail NTIS HC A99/MF A01 CSCL 08B

The capability to monitor land cover, associated in the past with aerial film cameras and radar systems, was discussed in regard to aircraft and spacecraft multispectral scanning sensors A proposed thematic mapper with greater spectral and spatial resolutions for the fourth LANDSAT is expected to usher in new environmental monitoring capability In addition continuing improvements in image clasification by supervised and unsupervised computer techniques are being operationally verified for discriminating environmental impacts of human activities on the land The benefits of employing remote sensing for this discrimination was shown to far outwweigh the incremental costs of converting to an aircraft-satellite multistage system Author

N78-14493*# Army Engineer Topographic Labs, Fort Belvoir Va
CORPS OF ENGINEERS APPLICATIONS FOR REMOTE SENSING OF THE ENVIRONMENT
Maurice K Kurtz Jr and John W Jarman *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 393-399
Avail NTIS HC A99/MF A01 CSCL 13B

An objective overview is presented of the application of remote sensing technology in the Corps of Engineers Examples are given of attempts to use the current state of the art to achieve particular disciplinary or mission oriented goals The Corps, presently engaged in both research and development and technology transfer has encountered some interesting situations Practical operational utilization depends not only on technology, but also economic benefit/cost factors and some unprecedented legal, political and social issues Yet, at a time when increased agency commitment to operational usage is being sought, an assessment of the state of the art reveals that sensor technology, data processing and analysis and models still require further development There is a challenge in synchronizing technology push with the demand pull of dimly perceived user needs They should complement each other rather than oppose The goal is to use the combined push-pull effect to lead to increased productivity and responsiveness by the Corps Author

N78-14502*# Florida Univ, Gainesville Dept of Physics and Astronomy
INFLUENCE OF GROUND LEVEL SO2 ON THE DIFFUSE TO DIRECT IRRADIANCE RATIO IN THE MIDDLE ULTRAVIOLET
K F Klenk and A E S Green *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 525-533 refs
(Grant NSF ATM-75-21962)
Avail NTIS HC A99/MF A01 CSCL 04A

The dependence of the ratio of the diffuse to direct irradiances at the ground were examined for a wavelength of 315 1 nm A passive remote sensing method based on ratio measurements for obtaining the optical thickness of SO2 in the vertical column was proposed If in addition to the ratio measurements, the SO2 density at the ground is determining using an appropriate point-sampling technique then some inference on the vertical extent of SO2 can be drawn An analytic representation is presented of the ratio for a wide range of SO2 and aerosol optical thicknesses and solar zenith angles which can be inverted algebraically to give the SO2 optical thickness in terms of the measured ratio aerosol optical thickness and solar zenith angle Author

N78-14504*# Hosei Univ, Tokyo (Japan) Dept of Civil Engineering
MULTI-SEASONAL DATA ANALYSIS AND SOME EXTENSIONS FOR ENVIRONMENTAL MONITORING
Sotaro Tanaka (Remote Sensing Technol Center of Japan, Tokyo), Yasushi Muranaka (Remote Sensing Technol Center of Japan, Tokyo) Hiroshi Miyazawa (Tokyo Aero Surv Co, Ltd Tokyo), and Yuzo Suga *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 545-561 refs
Avail NTIS HC A99/MF A01 CSCL 04A

Multispectral data analysis was incorporated with multiseasonal data analysis based on a spectral radiance data-set Concepts include comparing data types, exploring relationships between periodicity of LANDSAT and the seasonal sense of the Orientals, and derivation of a method to register the acquired data Examples include a quality investigation of a paddy field by seasonal LANDSAT data, a progress check of the field in harvest season, and a detailed survey of the vegetational environment by summer and winter LANDSAT data Author

N78-14511*# Fairey Surveys Ltd, Maidenhead (England)
TESTING THE ACCURACY OF REMOTE SENSING LAND USE MAPS
J L VanGenderen, B F Lock (Salisbury College, Australia), and P A Vass *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 615-623 refs

Avail NTIS HC A99/MF A01 CSCL 08B

Some of the main aspects that need to be considered in a remote sensing sampling design are (1) the frequency that any one land use type (on the ground) is erroneously attributed to another class by the interpreter, (2) the frequency that the wrong land use (as observed on the ground) is erroneously included in any one class by the remote sensing interpreter, (3) the proportion of all land (as determined in the field) that is mistakenly attributed by the interpreter, and (4) the determination of whether the mistakes are random (so that the overall proportions are approximately correct) or subject to a persistent bias A sampling and statistical testing procedure is presented which allows an approximate answer to each of these aspects The concept developed and described incorporates the probability of making incorrect interpretations at particular prescribed accuracy levels, for a certain number of errors for a particular sample size It is considered that this approach offers a meaningful explanation of the interpretation accuracy level of an entire remote sensing land use survey Author

N78-14534*# Lund Univ (Sweden) Dept of Physical Geography
LANDSAT DIGITAL DATA FOR WATER POLLUTION AND WATER QUALITY STUDIES IN SOUTHERN SCANDINAVIA
Ulf Hellden and Ingvar Akersten (Natl Defence Res Inst, Stockholm Sweden) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 875-884 refs
Avail NTIS HC A99/MF A01 CSCL 08H

Spectral diagrams, illustrating the spectral characteristics of different water types, were constructed by means of simple statistical analysis of the various reflectance properties of water areas in Southern Scandinavia as registered by LANDSAT-1 There were indications that water whose spectral reproduction is dominated by chlorophyllous matter (phytoplankton) can be distinguished from water dominated by nonchlorophyllous matter Differences between lakes as well as the patchiness of individual lakes, concerning secchi disc transparency could be visualized after classification and reproduction in black and white and in color by means of line printer calcomp plotter (CRT) and ink jet plotter respectively Author

N78-14546*# Old Dominion Univ, Norfolk, Va Remote Sensing Lab

NECESSITY TO ADAPT LAND USE AND LAND COVER CLASSIFICATION SYSTEMS TO READILY ACCEPT RADAR DATA

Ben Drake *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 993-1000 refs

Avail NTIS HC A99/MF A01 CSCL 08B

A hierarchial four level, standardized system for classifying land use/land cover primarily from remote-sensor data (USGS system) is described The USGS system was developed for nonmicrowave imaging sensors such as camera systems and line scanners The USGS system is not compatible with the land use/land cover classifications at different levels that can be made from radar imagery, and particularly from synthetic-aperture radar (SAR) imagery The use of radar imagery for classifying land use/land cover at different levels is discussed, and a possible revision of the USGS system to more readily accept land use/land cover classifications from radar imagery is proposed Author

N78-14556*# INTERA Environmental Consultants Ltd, Calgary (Alberta)

REMOTE SENSING IN OPERATIONAL RANGE MANAGEMENT PROGRAMS IN WESTERN CANADA

M D Thompson *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1101-1110 refs

Avail NTIS HC A99/MF A01 CSCL 05A

A pilot program carried out in Western Canada to test remote sensing under semi-operational conditions and display its applicability to operational range management programs was described Four agencies were involved in the program two in Alberta and two in Manitoba Each had different objectives and needs for remote sensing within its range management programs, and each was generally unfamiliar with remote sensing techniques and their applications Personnel with experience and expertise in the remote sensing and range management fields worked with the agency personnel through every phase of the pilot program Results indicate that these agencies have found remote sensing to be a cost effective tool and will begin to utilize remote sensing in their operational work during ensuing seasons Author

N78-14565*# Jahangirnagar Univ, Dacca (Bangladesh) Dept of Geography

LAND UTILIZATION AND ECOLOGICAL ASPECTS IN THE SYLHET-MYMENSINGH HAOR REGION OF BANGLADESH AN ANALYSIS OF LANDSAT DATA

M I Chowdhury and K Maudood Elahi *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1183-1195 refs

Avail NTIS HC A99/MF A01 CSCL 08B

The use of remote sensing data from LANDSAT (ERTS) imageries in identifying, evaluating and mapping land use patterns of the Haor area in Bangladesh was investigated Selected cloud free imageries of the area for the period 1972-75 were studied Imageries in bands 4, 5 and 7 were mostly used The method of analysis involved utilization of both human and computer services of information from ground aerial photographs taken during this period and space imageries Author

N78-14584*# Toledo Metropolitan Area Council of Governments Ohio

DEVELOPMENT OF AN INTEGRATED DATA BASE FOR LAND USE AND WATER QUALITY PLANNING

John Adams Chris VanSchayk, and Laurence B Istvan (ERIM) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1381-1386

Avail NTIS HC A99/MF A01 CSCL 08B

To help understand the role played by different land resources in water quality management a computer based data system was created The Land Resource Information System (LRIS) allows data to be readily retrieved or statistically analyzed for a variety of purposes It is specifically formatted to perform coordination of water quality data with logy etc New understanding of the region gained through the use of LRIS has gone well beyond the initial purpose of assessing water quality conditions The land use and natural features information has provided a well defined starting point for a systematic evaluation of proposed land uses, transportation, housing, and other public investments It has laid the foundation for a comprehensive and integrated approach to many different planning and investment programs presently underway Author

N78-14587*# Wisconsin Univ, Madison

LAKE WATER QUALITY MAPPING FROM LANDSAT

James P Scherz *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1417-1425 refs

(Contract NAS5-20942, Grant NGL-50-002-127)

Avail NTIS HC A99/MF A01 CSCL 08H

The lakes in three LANDSAT scenes were mapped by the Bendix MDAS multispectral analysis system Field checking the maps by three separate individuals revealed approximately 90-95% correct classification for the lake categories selected Variations between observers was about 5% From the MDAS color coded maps the lake with the worst algae problem was easily located This lake was closely checked and a pollution source of 100 cows was found in the springs which fed this lake The theory, lab work and field work which made it possible for this demonstration project to be a practical lake classification procedure are presented Author

N78-14590*# Battelle Pacific Northwest Labs Richland, Wash

PROTOTYPE ACTIVE SCANNER FOR NIGHTTIME OIL SPILL MAPPING AND CLASSIFICATION

G A Sandness and S B Ailes *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1445-1452 Sponsored in part by EPA and Coast Guard

Avail NTIS HC A99/MF A01 CSCL 13B

A prototype active aerial scanner system was constructed for nighttime water pollution detection and nighttime multispectral imaging of the ground An arc lamp was used to produce the transmitted light and four detector channels provided a multispectral measurement capability The feasibility of the design concept was demonstrated by laboratory and flight tests of the prototype system Author

N78-14607*# National Aeronautics and Space Administration Langley Research Center, Langley Station Va

MULTISPECTRAL ANALYSIS OF OCEAN DUMPED MATERIALS

Robert W Johnson *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1619-1627 refs

Avail NTIS HC A99/MF A01 CSCL 14E

Experiments conducted in the Atlantic coastal zone indicated that plumes resulting from ocean dumping of acid wastes and sewage sludge have unique spectral characteristics Remotely sensed wide area synoptic coverage provided information on these pollution features that was not readily available from other sources Aircraft remotely sensed photographic and multispectral scanner data were interpreted by two methods First, qualitative analyses in which pollution features were located mapped, and identified without concurrent sea truth and second, quantitative analyses in which concurrently collected sea truth was used to calibrate the remotely sensed data and to determine quantitative distributions of one or more parameters in a plume Author

N78-14608*# Battelle Pacific Northwest Labs, Richland, Wash

DETECTION, IDENTIFICATION, AND QUANTIFICATION TECHNIQUES FOR SPILLS OF HAZARDOUS CHEMICALS

J F Washburn and G A Sandness *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1629-1635

(Contract DOT-CG-54323-A)

Avail NTIS HC A99/MF A01 CSCL 13B

The first 400 chemicals listed in the Coast Guard's Chemical Hazards Response Information System were evaluated with respect to their detectability, identifiability, and quantifiability by

12 generalized remote and in situ sensing techniques Identification was also attempted for some key areas in water pollution sensing technology Author

N78-14700# Environmental Protection Agency Washington, D C Office of Monitoring and Technical Support
QUALITY ASSURANCE RESEARCH PLAN, FISCAL YEAR 1978 - 1982
Thomas W Stanley Jul 1977 70 p
(PB-272421/9 EPA-600/8-77-008) Avail NTIS HC A04/MF A01 CSCL 13B

The Office of Research and Development (ORD) is responsible for developing a quality assurance program to enable the U S Environmental Protection Agency to implement its regulatory mission and associated monitoring functions The resources required by ORD to develop the quality assurance tools techniques, and services needed by other program offices, the Regions, and the States to generate valid data are identified and justified The quality assurance program is described in terms of goals objectives, and functional elements, the current status of ORD s ongoing quality assurance efforts is summarized, and Agency and program needs are discussed GRA

N78-14732# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt Oberpfaffenhofen (West Germany) Inst fuer Physik der Atmosphaere
ATMOSPHERIC PHYSICS AS A MEANS OF ENVIRONMENTAL RESEARCH [DIE PHYSIK DER ATMOSPHAERE ALS MITTEL DER UMWELTFORSCHUNG]
D Paffrath Apr 1975 31 p ref In GERMAN
(DLR-IB-553-75/7) Avail NTIS HC A03/MF A01

The activities at the Institute for Atmospheric Physics are reported The topics covered are atmospheric measurement techniques, atmospheric effects on traffic systems anthropogenic effects on the atmospheric environment, and atmospheric radiation and cloud physics ESA

N78-15549*# National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston Tex
PROCEDURES FOR GATHERING GROUND TRUTH INFORMATION FOR A SUPERVISED APPROACH TO A COMPUTER-IMPLEMENTED LAND COVER CLASSIFICATION OF LANDSAT-ACQUIRED MULTISPECTRAL SCANNER DATA
Armond T Joyce 1978 48 p refs
(NASA-RP-1015, JSC-12910, S-478) Avail NTIS HC A03/MF A01 CSCL 08F

Procedures for gathering ground truth information for a supervised approach to a computer-implemented land cover classification of LANDSAT acquired multispectral scanner data are provided in a step by step manner Criteria for determining size, number, uniformity and predominant land cover of training sample sites are established Suggestions are made for the organization and orientation of field team personnel, the procedures used in the field, and the format of the forms to be used Estimates are made of the probable expenditures in time and costs Examples of ground truth forms and definitions and criteria of major land cover categories are provided in appendixes Author

N78-15553# Fish and Wildlife Service Ft Collins, Colo Western Energy and Land Use Team
INTERIM HIERARCHICAL REGIONAL CLASSIFICATION SCHEME FOR COASTAL ECOSYSTEMS OF THE UNITED STATES AND ITS TERRITORIES
Terry T Terrell Sep 1977 44 p refs
(PB-272691/7, FWS/OBS-77/48) Avail NTIS HC A03/MF A01 CSCL 13B

The literature on coastal classifications is reviewed Those existing classifications classify coastal areas on functional structural, or regional (geographical) attributes The problem of predicting impacts on coastal ecosystems by various types of perturbations, such as offshore mineral development or reduced freshwater inflow into estuaries, at various levels of resolution is posed A hierarchical regional classification scheme for coastal ecosystems of the United States and its territories, based on the physical hydrological, chemical, biological, geological, and structural characteristics of those areas is presented GRA

N78-15592 Drexel Univ , Philadelphia, Pa
THE USE OF CANONICAL CORRELATION ANALYSIS FOR MEASURING URBAN ENVIRONMENTAL HEALTH QUALITY Ph.D. Thesis
Edward Joseph Duckett 1977 300 p
Avail Univ Microfilms Order No 77-22527

An improved method is demonstrated for analyzing relationships among environmental and health variables and for indexing the severity of urban environmental conditions related to health The principal analytic tool employed was canonical correlation analysis which identifies associations between two groups of variables Linear combinations of each of two groups were formed so as to maximize the correlation between each pair of linear combinations With environmental variables in one group and health variables in the other, the results suggested environmental health relationships Also, each linear combination of environmental variables provided an index of environmental conditions weighted according to their relationships with selected morbidity and mortality rates Dissert Abstr

N78-15593 Virginia Polytechnic Inst and State Univ , Blacksburg
AIR POLLUTANT MONITOR NETWORK DESIGN USING MATHEMATICAL PROGRAMMING Ph D Thesis
Erik Somers Hougland 1977 365 p
Avail Univ Microfilms Order No 77-22070

A mathematical programming model for the design of multipollutant air quality monitoring networks was developed The model assigns monitors to a subset of a large set of potential monitor sites so as to maximize a measure of monitoring capability An heuristic solution technique was developed to design multiple pollutant monitoring networks An analysis of the model's sensitivity to input parameters was performed and the application of the model to an actual design problem was demonstrated Resulting network designs are presented The network design model was shown to be a valuable addition to the tools available to those concerned with the design of air quality monitoring networks Needs for further research are discussed Dissert Abstr

N78-15601# New Orleans Univ , La Dept of Chemistry
A STUDY OF GAS SOLID REACTIONS AND AIR POLLUTION DETECTORS Final Report, 1 Mar 1974 - 30 Aug 1977
George G Guilbault 31 Oct 1977 12 p refs
(Contract DAHC04-74-G-0119)
(AD-A046646 ARO-11753 9-C) Avail NTIS HC A02/MF A01 CSCL 13/2

A basic research study was made for specific adsorbents which could be used for the detection of various air pollutants The most promising adsorbents for various compounds were placed as coatings on a piezoelectric crystal detector, and the device was evaluated as a possible detector for the identification and analysis of these compounds The nature of the basic reaction of the chemical compounds (solids) with these pollutants was studied using infrared spectroscopy and oscillating crystals, and the interaction parameters were studied Quadrol and triethanolamine were good adsorbents for SO2 Co-isonitrolo benzoyl acetone provided an excellent coating for organophosphorus compounds, ascorbic acid AgNO3 was used for assay of NH3, as were Ucon-75-H-90,000 and -Ucon-LB-300X, which were excellent for NH3 and NOx, latex and nujol with trans-IrCl (CO)(PPh3)2 were good coatings for aromatic hydrocarbons, an acetone extract of a CCl4 soot was excellent for the detection of H2S, and HCl was detected using trimethylamine Author (GRA)

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03

GEODESY AND CARTOGRAPHY

Includes mapping and topography

A78-11099 **Remote sensing as a tool in assessing the impact of topographical alterations on the microclimate.** R. A Sutherland and J F Bartholic (Florida, University, Gainesville, Fla) In Energy crisis An evaluation of our resource potential, Proceedings of the Third Annual UMR-MEC Conference on Energy, Rolla, Mo , October 12-14, 1976. North Hollywood, Calif , Western Periodicals Co , 1977, p 165-169

Results and analyses of remotely sensed data taken from a NASA aircraft are reported The study uses continuous data taken in the 8 - 14 micron region of the infrared spectrum which is directly related to surface temperature. The analysis is concentrated on the micrometeorological effects of lakes and hills during near-freezing conditions The impetus for the study is an economic one since proper selection of a site for certain freeze-susceptible crops, such as citrus, can result in huge savings of energy and resources (Author)

A78-13760 **Correlated errors in satellite altimetry geoids** R J Anderle and R L. Hoskin (U S Navy, Naval Surface Weapons Center, Dahlgren, Va) *Geophysical Research Letters,* vol 4, Oct 1977, p 421-423

The vertical component of position of the Geos-3 satellite has been computed to an accuracy of 2 m by analysis of Doppler observations Comparison of altimetry data from the satellite at the intersections of ground traces of the orbital path yielded corrections to the satellite position such that the contribution of the orbit error to the error in the geoid computed from the altimetry data would be as low as 20 to 30 cm if the original orbit errors were uncorrelated However, simulations of the effects of uncertainties in the gravity field have shown that the orbit errors are correlated over a distance of about 500 km normal to the direction of the satellite track As a consequence, the geoid based on the Geos-3 altimetry will have correlated errors which are estimated to be 50 cm with a wave length of 2500 km The results imply that the geoid based on Seasat-A altimetry data will have correlated errors over similar distance (Author)

A78-13766 * **Monitoring surface albedo change with Landsat.** J Otterman (NASA, Goddard Space Flight Center, Greenbelt, Md , Tel Aviv University, Tel Aviv, Israel) *Geophysical Research Letters,* vol 4, Oct 1977, p 441-444 11 refs Research supported by the United States-Israel Binational Science Foundation

A pronounced decrease of the surface albedo (reflectivity) has been observed in an area in the Northern Sinai, fenced-in in the summer of 1974 Analysis of the Landsat Multispectral Scanner System digital data from an April 1977 pass indicates a reduction in the albedo in the exclosure by 13%, as compared to the outside, which continues to be subjected to overgrazing and anthropogenic pressures The reduction of reflectivity is approximately the same in all the spectral bands, and is therefore attributable to accumulation of dead plants and plant debris, and not directly to live vegetation (Author)

A78-14815 # **Landsat detection of hydrothermal alteration in the Nogal Canyon Cauldron, New Mexico** R K Vincent (GeoSpectra Corp , Ann Arbor, Mich) and G Rouse (Earth Sciences, Inc , Golden, Colo) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 579-590

The use of Landsat imagery to detect zones of hydrothermal alteration in cauldrons, calderas and other volcanic features is discussed In particular, an iron-oxide anomaly detected in a Cenozoic cauldron in New Mexico was found to correlate with a hydrothermal alteration However, further analysis of Landsat imagery indicated that on a purely spectral basis the secondary iron oxides of the hydrothermal alteration could usually not be distinguished from unimportant primary ferric oxides It is suggested that spectral data and geologic information employed in coordination may provide a means of identifying some hydrothermal activity J M B

A78-14833 * # **Alteration mapping at Goldfield, Nevada, by cluster and discriminant analysis of Landsat digital data** G Ballew (Stanford University, Stanford, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 783-790 6 refs Grant No NsG-5050

The ability of Landsat multispectral digital data to differentiate among 62 combinations of rock and alteration types at the Goldfield mining district of Western Nevada was investigated by using statistical techniques of cluster and discriminant analysis Multivariate discriminant analysis was not effective in classifying each of the 62 groups, with classification results essentially the same whether data of four channels alone or combined with six ratios of channels were used Bivariate plots of group means revealed a cluster of three groups including mill tailings, basalt and all other rock and alteration types Automatic hierarchical clustering based on the fourth dimensional Mahalanobis distance between group means of 30 groups having five or more samples was performed using Johnson's HICLUS program The results of the cluster analysis revealed hierarchies of mill tailings vs natural materials, basalt vs non-basalt, highly reflectant rocks vs other rocks and exclusively unaltered rocks vs predominantly altered rocks The hierarchies were used to determine the order in which sets of multiple discriminant analyses were to be performed and the resulting discriminant functions were used to produce a map of geology and alteration which has an overall accuracy of 70 percent for discriminating exclusively altered rocks from predominantly altered rocks (Author)

A78-14849 # **Remote infrared spectroscopy of the earth.** C R Steinmann (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Cologne, West Germany) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 957-967 Research supported by the Bundesministerium fur Forschung und Technologie.

An experimental remote-sensing system using an infrared laser spectrometer for geological and petrological investigations of the earth surface has been developed, and lab simulations and the first flight tests have demonstrated its feasibility. It was found feasible to use laser differential measurements for the detection of most rock-forming minerals and clay-minerals The laser system, whose resolution is about 10 at an altitude of about 10,000 ft, was found to be well suited to light aircraft B J

A78-14850 # **Image analysis techniques with special reference to analysis and interpretation of geological features from Landsat imagery** D S Kamat, K L. Majumder, S D Naik, and V L Swaminathan (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 969-978 6 refs.

A78-14868 # **Evaluation of algorithms for geological thermal-inertia mapping** S H Miller and K Watson (U S. Geological Survey, Denver, Colo) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich ,

Environmental Research Institute of Michigan, 1977, p 1147-1160 13 refs

Three surface temperature algorithms used in the production of thermal inertia maps (linear Fourier series, finite difference and Laplace transform techniques) are compared Errors in measurement introduced by multispectral scanning systems, as well as errors related to transient effects, topography and surface coating effects, are examined For satellites, the uncertainty in thermal inertia is found to be 150 thermal inertia units (TIU) Uncertainties due to the algorithms range from 260 TIU (for the Laplace transform method) to 460 TIU (for the linear Fourier series technique) A sample problem involving the thermal inertia mapping of a river topography is given J M B

A78-15424 # **Radar measurement of stratified earth surface covers (Radiolokatsiia sloistykh zemnykh pokrovov)** M I Finkel'shtein, V L Mendel'son, and V A Kutev Moscow, Izdatel'stvo Sovetskoe Radio, 1977 176 p 167 refs In Russian

Data are presented on the general electrical parameters of various stratified earth surface layers Basic electrodynamic models of these media are given It is shown that airborne radar equipment may be used for measurements of the thickness of ocean and freshwater ice It is also suggested that airborne radar equipment may be used for the subsurface measurement of ground water and frozen soil Measurements of the electrical characteristics of various stratified media over a large area are presented S C S

A78-15589 **GDM/GPS receiver hardware implementation.** G L Bjornsen and W M Hutchinson (Rockwell International Corp , Collins Avionics Div , Cedar Rapids, Iowa) In NAECON '77, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, May 17-19, 1977 New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 303-309

This paper describes the receiver hardware implementation for the AFAL GDM/GPS equipment Included are descriptions of the RF receiver, frequency synthesizer, and signal channel processor Specific items discussed include receiver bandwidth, wide-band AGC performance, pseudonoise (PN) mixers, code correlation, PN code generator, and digital vco's Various system issues, as they relate to the GDM/GPS equipment are also addressed The GDM/GPS hardware has been partitioned such that it can be configured (under processor control) to represent various GPS equipment configurations for performance evaluation Also included in this paper is a brief description of an internally generated test signal and its use for system calibration (Author)

A78-15730 **The Gestalt Photomapping System.** R E Kelly, P R H McConnell, and S J Mildenberger (Gestalt International, Stittsville, Ontario, Canada) *Photogrammetric Engineering and Remote Sensing,* vol 43, Nov 1977, p. 1407-1417

The Gestalt Photomapping System is made up of the GPM II and the GPM Plotting System The GPM II is a computer-controlled, auto-correlating, analytical photomapper It is composed of two scanners, an automatic image correlator, a control computer, an operator's console, and one or two printers A typical stereomodel is completed automatically in less than an hour and a half after a 10 minute operator-assisted analytical orientation Principal topographic output consists of a 700,000-point digital terrain model (DTM) on magnetic tape planimetric output consists of an orthophoto on 20 x 25 cm stable-base film The GPM Plotting System is an off-line automatic DTM processing system. It consists of a disk-based minicomputer and plotter Smoothed contours and slope maps may be plotted at map scale with annotation in less than an hour and a half A GPM III orthophoto and GPM Plotting System contours may be combined without editing by using conventional photographic techniques to produce a reproduction-quality contoured orthophoto map in less than a day (Author)

A78-16510 **Applications of the ERTS 1 Satellite to traditional cartography (Applications du Satellite ERTS 1 à la cartographie traditionnelle)** C Cazabat (Institut Geographique National, Paris, France) *(Institut Géographique National, Bulletin d'Information,* no 31, 1976) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 7 p In French

The types of data obtained by Landsat 1 (ERTS 1) are described, and the use of Landsat data is considered with reference to France Photographs at a scale of 1 1,000,000 can be used to update traditional maps, photographs at a scale of 1 500,000 provide more detail than generalized traditional maps Traditional and satellite photograph maps are compared Satellite cartography can be limited by a lack of clear weather In France, clear weather is more common in winter than in other seasons but the absence of leaves makes difficult the detection of some wooded areas M L

A78-16534 # **Recent crustal movements registered by the aid of airphoto interpretation** O Radai (Hungarian Geodetic and Cartographic Society, Budapest, Hungary) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 11 p

Some concepts of global tectonics are reviewed, and procedures for monitoring crustal movements are examined The use of aerial photography to measure horizontal displacements is discussed with reference to the geology of Hungary, and the organization of a network of observation reference points is considered An inexpensive technique for detecting the tilt of rock masses is proposed Aerial photographs would be used to analyze drainage and overthrust patterns for the purpose of locating appropriate places for the installation of 'upturned' pendulums These devices would be moored on a liquid surface in boreholes, the data they supply could be applied to earthquake prediction M L

A78-16543 # **Objective terrain description and classification for digital terrain models** O Ayeni (Ohio State University, Columbus, Ohio) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 9 p 9 refs

Various quantitative methods for describing a terrain were investigated, these include gradient, curvature, vector strength, vector dispersion, bump frequency, direction cosine, surface area, harmonic vector magnitude, two-dimensional power spectrum, breaklines, and autocorrelation Based on these terrain characteristics four major classes of terrain which span the whole spectrum of terrain types were identified, using techniques of objective classification theory derived from multivariate statistical cluster analysis Suggestions are made as to how the reactions of various interpolation techniques can be properly evaluated in relation to the four major classes of terrain with a view to achieving automation (Author)

A78-16546 # **A system of remote sensing and mapping for developing countries** S Baker (North Carolina State University, Raleigh, N C) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 12 p 20 refs

It is suggested that developing countries require medium and large-scale topographic maps for economic development studies Black and white orthophotographs with overprinted names and symbols may be used for the production of orthophotomaps, suitable for such applications The aerial photographs used in the production of orthophotomaps may be used for resource projects by combining field work with photointerpretation Completed orthophotomaps have applications in remote sensing systems S C S

A78-16552 # **The use of satellite photography in the National Topographic Mapping Program of Canada** E A Fleming (Department of Energy, Mines and Resources, Ottawa, Canada) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 14 p

Consideration is given to Landsat imagery in Canadian topographic mapping programs Particular applications are described, such as (1) map revisions noting new roads, reservoirs, and transmission

lines, (2) the analysis of landscape physiography over large areas, (3) the compilation of photomaps, and (4) photogrammetric monitoring of offshore shoals S C S

A78-17195 **Temporal and dynamic observations from satellites** G A Rabchevsky (Rainbow Systems, Inc , Alexandria, Va) *Photogrammetric Engineering and Remote Sensing,* vol 43, Dec 1977, p 1515-1518 10 refs

The sampling of terrestrial features or environmental phenomena by an airborne or satellite sensor is especially significant when repetitive surveys are required Dynamic and short-lived natural events need to be detected rapidly and repeatedly for meaningful results A series of satellites now provide a hitherto unavailable capability for detecting and mapping dynamic terrestrial features and environmental events on a global, repetitive, and temporal basis The paper summarizes briefly some of the satellite missions and in a tabular form classifies the time-scale requirements for observing some of the dynamic events (Author)

A78-18102 **Environmental mapping of the French coastal zone by remote sensing** J M Monget, D Sarrat (Paris, Ecole Nationale Superieure des Mines, Paris, France), and F Verger (Ecole Normale Superieure, Paris, France) In Space research XVII, Proceedings of the Open Meetings of Working Groups on Physical Sciences, June 8 19, 1976 and Symposium on Minor Constituents and Excited Species, Philadelphia, Pa , June 9, 10, 1976 Oxford and New York, Pergamon Press, 1977, p 13-18 6 refs Research supported by the Centre National d'Etudes Spatiales, Centre National de la Recherche Scientifique Contract No RCP 353

Coastal turbidity dynamics, the nature and mineralogy of tidal flats, and coastal land use and vegetation were studied using Landsat data for the French Atlantic littoral The coastal turbidity dynamics deduced from the Landsat imagery were correlated with thermal imagery from NOAA satellites, the resultant composite assessment may be useful in designing nuclear power plants The investigation of tidal flats provided automatic cartography of the flats as a function of flooding frequency Damage to beaches and coastal recreational areas due to human influence may also be monitored with the aid of the satellite data J M B

A78-18108 **Intercosmos laser ranging stations** A G Masevich (Akademiia Nauk SSSR, Astronomicheskii Sovet, Moscow, USSR) and K Hamal (Ceske Vysoke Uceni Technicke, Prague, Czechoslovakia) In Space research XVII, Proceedings of the Open Meetings of Working Groups on Physical Sciences, June 8-19, 1976 and Symposium on Minor Constituents and Excited Species, Philadelphia, Pa , June 9, 10, 1976 Oxford and New York, Pergamon Press, 1977, p 73 76 7 refs

Laser ranging stations of the Intercosmos network, designed to provide satellite tracking data for geodesy and geophysics, are described The Intercosmos network presently includes stations in Bolivia, Poland, Egypt, the German Democratic Republic and the Soviet Union The transportable Q-switched ruby laser transmitters employed by the ranging system have an accuracy of + or 1 5 m Laser observations within an Arctic-to Antarctic satellite tracking program are also reported J M B

A78-18183 **The use of balloons for geodetic research** J Kakkuri (Finnish Geodetic Institute, Helsinki, Finland) In Space research XVII, Proceedings of the Open Meetings of Working Groups on Physical Sciences, June 8-19, 1976 and Symposium on Minor Constituents and Excited Species, Philadelphia, Pa , June 9, 10, 1976 Oxford and New York, Pergamon Press, 1977, p 795-800 6 refs

The article discusses using balloons for various areas of geodetic research It is suggested that balloons may be employed in conjunction with classical and satellite triangulations in order to establish a geodetic network which may be used to assess terrestrial first-order triangulation, and to test satellite techniques Geodetic networks may also be used by developing countries for mapping and construction projects S C S

A78-18992 # **Method of obtaining and analyzing the spectral characteristics of natural formations (Metod poluchenia i analiza spektral'nykh kharakteristik prirodnykh obrazovanii)** I A Petrakovskii and R G Khlebopros (Akademiia Nauk SSSR, Institut Lesa i Drevesiny, Krasnoyarsk, USSR) *Akademiia Nauk SSSR, Sibirskoe Otdelenie, Izvestiia, Seriia Tekhnicheskikh Nauk,* June 1977, p 126-131 10 refs In Russian

The variability of the spectral characteristics of an underlying surface due to the height of the sun is investigated A method is proposed for recording reflected radiation, thereby reducing noise caused by the change in the reflection coefficient of a natural formation as the sun's position changes, and also reducing the noise caused by a redistribution of areas which are illuminated by the direct beam and those which are shadowed Ideas are put forward on how to resolve the components when the spectral characteristics of multicomponent formations are being analyzed P T H

A78-19236 # **A mathematical theory of equivalent transformations during the equalizing of geodesic networks (Matematicheskaia teoriia ekvivalentnykh preobrazovanii pri uravnivanii geodezicheskikh setei)** N D Drozdov (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR) and I A Liseev *Geodeziia i Aerofotos'emka,* no 4, 1977, p 26 34 5 refs In Russian

A78-19243 # **Models for the identification of topographic objects during the deciphering of aerial photographs (Modeli raspoznavaniia topograficheskikh ob'ektov pri vizual'nom deshifrirovanii aerosnimkov)** A N Zhivichin *Geodeziia i Aerofotos'emka,* no 4, 1977, p 95-101 In Russian

The article discusses various processes involved in the visual deciphering of simple natural and artificial topographic objects as recorded by aerial photographs Mathematical expressions, describing the statistical probabilities of decipherment, are derived on the basis of model and actual photographs The data necessary for such calculations are discussed S C S

N78-10543# Stanford Research Inst , Menlo Park, Calif
INTERACTIVE AIDS FOR CARTOGRAPHY AND PHOTO INTERPRETATION Semiannual Technical Report 12 Nov 1976 - 12 May 1977
Harry G Barrow May 1977 37 p refs
(Contract DAAG29-76-C-0057 ARPA Order 2894 SRI Proj 5300)
(AD-A043418) Avail NTIS HC A03/MF A01 CSCL 08/2

This report describes the status of the SRI Image Understanding project at the end of twelve months The central scientific goal of the research program is to investigate and develop ways in which diverse sources of knowledge may be brought to bear on the problem of interpreting images The research is focused on the specific problems entailed in interpreting aerial photographs for cartographic or intelligence purposes A key concept is the use of a generalized digital map to guide the process of image interpretation Author (GRA)

N78-10544# Army Engineer Topographic Labs , Fort Belvoir, Va
AN ANALYSIS OF LANDSAT SYSTEMS FOR CARTOGRAPHIC AND TERRAIN INFORMATION Report No 9 in ETL Series on Remote Sensing Technical Report, Aug - Dec 1976
Theodore C Vogel Jun 1977 62 p
(DA Proj 4A7-62707-A-855)
(AD-A044431, ETL-0103) Avail NTIS HC A04/MF A01 CSCL 15/4

The scientific and technical literature is reviewed to analyze the capabilities of LANDSAT Systems 1, 2, 3 and 4 for hydrographic, topographic, planimetric, and thematic map compilation The systems capabilities were analyzed according

to the following qualitative code for a selected list of map and chart requirements 0 Not detectable, the map element cannot be discerned or located from either type of LANDSAT data 1 - Detectable, map element can be detected but not identified from the type of LANDSAT data indicated, 2 - Identifiable, map element can be detected and recognized as a particular type of feature from the LANDSAT data indicated, E G road, canal, etc , collateral information may be required to reach this analysis level, 3 - Classifiable LANDSAT data, with the use of all available collateral information can provide the information required for the map element including all required measurements, e g width, length and areas It was concluded that LANDSAT 1, 2, 3 MSS data is compatible with National Map Accuracy Standards and can be used to update the map elements on map scales 1/ 1,000,000 through 1/ 250,000, although many of the cultural, hydrographic and botanical elements may be unclassifiable GRA

N78-11452*# National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt, Md
A METHOD OF INVERSION OF SATELLITE MAGNETIC ANOMALY DATA
M A Mayhew Oct 1977 19 p refs Presented at IAGA Meeting, Seattle Aug 1976 Submitted for publication
(NASA-TM-78039 X-922-77-260) Avail NTIS HC A02/MF A01 CSCL 05B

A method of finding a first approximation to a crustal magnetization distribution from inversion of satellite magnetic anomaly data is described Magnetization is expressed as a Fourier Series in a segment of spherical shell Input to this procedure is an equivalent source representation of the observed anomaly field Instability of the inversion occurs when high frequency noise is present in the input data, or when the series is carried to an excessively high wave number Preliminary results are given for the United States and adjacent areas Author

N78-11498# Central Intelligence Agency Washington D C Office of Geographic and Cartographic Research
CAM-CARTOGRAPHIC AUTOMATIC MAPPING PROGRAM DOCUMENTATION, 5TH EDITION
Jun 1977 138 p Supersedes BGI-D-75-1
(PB-270304/9, GC-77-10126 CIA/DF-77/006A BGI-D-75-1) Avail NTIS HC A07/MF A01 CSCL 08B

CAM is an IBM System/360 Fortran level H or G and Assembly Language Code (ALC) program that performs a wide variety of cartographic functions Included are 16 map projections, the Universal Transverse Mercator (UTM) grid system, and an XY (One for One) data display routine CAM connects points with straight lines or circles and draws line grids range rings, ellipses, cones symbols azimuths and elevation rings Included is a World Coastline file of 8200 points, but CAM is also used in conjunction with World Data Bank I, a 100 000 point file separately contained on Accession No PB-223 178 A significant new feature of CAM-5th Edition also allows its use in conjunction with World Data Bank II which contains approximately 6 million points GRA

N78-11550*# National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt Md
NATIONAL GEODETIC SATELLITE PROGRAM, PART 1
J H Berbert J Brownd T Felsentreger D Harris T S Johnson, M A Khan F Lerch J Marsh J Murphy, B Putney et al *In its* Natl Geodetic Satellite Program Pt 1 refs

Avail NTIS MF A01 SOD HC CSCL 04A

The contribution of the Goddard Space Flight Center to the National Geodetic Satellite Program is reported All of the major types of tracking systems including those employing optical electronic, range-and-range-rate and laser technologies which were developed and operated by Goddard are described The MINITRACK data were used to derive geodetic results The methods used for the analysis of these data are presented G D H

N78-11556*# California Univ Los Angeles
NATIONAL GEODETIC SATELLITE PROGRAM, PART 2
W M Kaula *In* NASA Washington Natl Geodetic Satellite Program, Pt 2 1977 p 943-948

(Contract NSR-05-007-060)
Avail NTIS MF A01 SOD HC CSCL 08F

Satellite orbit analyses are presented which were undertaken for (1) reasons of insight and economy (2) obtaining geophysically interesting tesseral harmonics, (3) comparing effects of tracking station location error drag radiation pressure and luni-solar attraction to tesseral harmonic effects, and (4) combination of satellite and terrestrial data The analyses were divided into the following phases (1) MINITRACK interferometry early Baker-Nunn camera directions (2) late Baker-Nunn camera directions and (3) combined Baker-Nunn camera and TRANET Doppler data G D H

N78-12503*# Geological Survey, Malaysia
GEOLOGICAL AND HYDROGEOLOGICAL INVESTIGATIONS IN WEST MALAYSIA Technical Report, Apr 1976 - Feb 1977
Jaafar Bin Ahmad, Principal Investigator and Shu Yeoh Khoon Jun 1977 30 p refs Sponsored by NASA Original contains color imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(E78-10027, NASA-CR-155252, MP KB/E/038/RS) Avail NTIS HC A03/MF A01 CSCL 08G

The author has identified the following significant results Large structures along the east coast of the peninsula were discovered Of particular significance were the circular structures which were believed to be associated with mineralization and whose existence was unknown The distribution of the younger sediments along the east coast appeared to be more widespread than previously indicated Along the Pahang coast on the southern end, small traces of raised beach lines were noted up to six miles inland The existence of these beach lines was unknown due to their isolation in large coastal swamps

N78-12510*# Battelle Columbus Labs , Ohio
IMPROVED GROUND TRUTH GEOID FOR THE GEOS-3 CALIBRATION AREA
A George Mourad, S Gopalapillai, M Kuhner, and D M Fubara Nov 1977 76 p refs
(Contract NAS6-2451)
(NASA-CR-141431) Avail NTIS HC A05/MF A01 CSCL 08B

The purpose of this investigation is to develop methods and procedures are reported for computing a detailed geoid to be used as geodetic ground truth for the calibration and verification of GEOS-3 altimeter data The technique developed is based on rectifying the best available detailed geoid so that the rectified geoid will have correct scale, orientation, shape and position with respect to the geocenter The approach involved the development of a mathematical model based on a second degree polynomial, in rectangular Cartesian coordinates, describing the geoid undulations at the control stations A generalized least squares solution was obtained for the polynomial which describes the variation of the undulation differences between the control stations geoid and the gravimetric geoid Three rectified geoids were determined These geoids correspond to three sets of tracking station data (1) WFC/C-band data, (2) GSFC/C-band data, and (3) OSU-275 data The absolute accuracy of these rectified geoids is linearly correlated with the uncertainties of the tracking station coordinates and, to a certain extent with those of the detailed geoid being rectified Author

N78-12553*# National Aeronautics and Space Administration, Washington, D C
LOCALIZATION OF AN EXPERIMENTAL ECOLOGICAL UNIT IN THE MARADI REGION OF NIGERIA
M Mainguet, L Canon, and A M Chapelle Nov 1977 325 p refs Transl into ENGLISH of "Localization d'une Unite Ecologique Experiments dans la Region de Maradi (Niger)", Reims Univ , France, Jun 1977 p 1-300 Transl by Kanner (Leo) Associates, Redwood City, Calif
(Contract NASw-2790)
(NASA-TM-75085) Avail NTIS HC A14/MF A01 CSCL 13B

A detailed topographical and geomorphological description of a specific ecological unit in the Maradi region of the Sahel in the Niger Republic is presented Sandy structures are classified into active dunes and covered dunes and an extensive vocabulary is developed to describe sub-categories The descriptions are based on meteorological data (anemometric and rainfall) from local weather stations, ground observations, aerial photographs and LANDSAT picturers The problem of dune reactivation and desertification is discussed both from the standpoint of causes and possible counter measures Author

N78-13514# Air Force Systems Command Wright-Patterson AFB, Ohio Foreign Technology Div

UPDATED SYSTEM FOR CALCULATIONS OF COORDINATES FOR LOCATING POINTS ON COMPUTER GEO 2

W Gedymin 12 May 1977 10 p Transl into ENGLISH from Przeglad Geodezyjny (Poland), v 47, no 12, 1975 p 499-500 (AD-A045434, FTD-ID(RS)I-0667-77) Avail NTIS MF A01 CSCL 09/2

In the majority of Geodesy Information Centers in Poland, the machine GEO 2 is a basic computer This computer, relatively well programmed for Geodesy is used for various typical calculations and in particular to Geodetic workout of detailed plans for utilizing the terrain land survey and ensuing work Programs enabling one to carry out this type of calculations are incorporated in two systems system PG 4 and system MAPA 1, as well as different versions of them modified by the users GRA

N78-14453 British Library Lending Div Boston Spa (England)

THE TRANSFER OF THE CONTENTS OF SATELLITE PICTURES ONTO GEOGRAPHIC MAPS

K A Zvonarev [1977] 11 p Transl into ENGLISH from Vestnik Ser Geol Geog (Leningrad), v 1, no 6 1976 p 104-114

(BLLD-M-24900-(5828 4F) BLLD-Trans-1287) Avail British Library Lending Div Boston Spa Engl

Techniques in using cartographic grids to transfer satellite photographs onto meteorology Mercator projections were studied Formulae were derived for use in stereographic, azimuthal equiangular conical and central projections Relative accuracies were discussed for each map type Author

N78-14503*# South Australian Inst of Technology, Ingle Farm

THE VECTOR CLASSIFIER

K R McCloy *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 535-543 refs

Avail NTIS HC A99/MF A01 CSCL 12A

A linear classifier is developed The classifier algorithm derives from the picture element (pixel) response values, the response values for a point (called footpoint) consisting of determined proportions of distinct and operator defined land surfaces The algorithm decides whether the pixel contains the content of the defined surfaces by testing the footpoint to pixelpoint distance against an operator specified threshold value The test can be either of statistical or geometric form Those pixels which give a positive result to the test are subclassified according to the proportions of the distinct land surfaces The practical characteristics of the classifier are discussed and the classification results achieved, in a number of test areas, are described The artificial nature of the classifier assumptions relate to certain land surface conditions Testing the suitability of the classifier for other conditions is discussed Author

N78-13516# Army Engineer Waterways Experiment Station, Vicksburg, Miss

ACQUISITION OF TERRAIN INFORMATION USING LANDSAT MULTISPECTRAL DATA REPORT 2, AN INTERACTIVE PROCEDURE FOR CLASSIFYING TERRAIN TYPES BY SPECTRAL CHARACTERISTICS

Horton Struve, Warren E Grabau, and Harold W West Sep 1977 142 p refs

(AD-A045871 WES-TR-M-77-2-2) Avail NTIS HC A07/MF A01 CSCL 15/4

Developed in the study reported herein was a semiautomated procedure for classifying LANDSAT radiance data in terms of preselected land-use categories The procedure is an interim solution to the problem of mapping very large areas in terms of relatively crude categories in very short periods of time Operation of the procedure requires an analyst to direct a computer by means of interactive instructions to search for all the 3 by 3 pixel arrays exhibiting spectral signatures that conform to a selected criterion of homogeneity The computer then retrieves these signatures from within the array of LANDSAT radiance values and groups them into spectrally similar clusters The clusters are then displayed on a color coded map overlay from which the analyst must provide the final interpretation and classification The area selected for study is centered approximately 40 km northeast of Vicksburg, Mississippi The area includes a representative section of loess hills, forming the eastern wall of the Mississippi floodplain and a section of the floodplain, including an oxbow lake and a number of other floodplain features Author (GRA)

N78-15622 Cornell Univ Ithaca, N Y

RECENT VERTICAL CRUSTAL MOVEMENTS FROM GEODETIC MEASUREMENTS ALASKA AND THE EASTERN UNITED STATES Ph D Thesis

Larry Douglas Brown 1976 194 p

Avail Univ Microfilms Order No 77-19988

Precise leveling and tide gauge measurements were used to estimate rates of recent vertical crustal movement along a number of profiles across the eastern United States and along one profile in south-central Alaska These rates were analyzed in order to determine if they reflect neotectonic activity in these very different tectonic regions and if so to discover the cause of such activity Examination of the data along the east coast of the United States shows that leveling and tide gauge results yield significantly different estimates of vertical crustal movement and suggest that one or both of the methods contain systematic error It was found that the movements indicated by leveling can be correlated with geologic structure in the eastern United States strongly suggesting that the vertical motions derived from leveling reflect neotectonic activity Dissert Abstr

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04
GEOLOGY AND MINERAL RESOURCES

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

A78-12934 # **Application of the 'DIBIAS' image processing system on Landsat pictures of central Morocco and Southern Germany** K A Ulbricht (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Luft- und Raumfahrt, Institut fur Nachrichtentechnik, Oberpfaffenhofen, West Germany) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 81-89

The configuration of 'DIBIAS', an interactive digital image processing system, is explained Application of processing programs on a mountainous testing site in central Morocco as well as the Lake of Constance in Southern Germany shows formerly hidden contents to geologists and limnologists A few examples of the work are presented (Author)

A78-13069 **Seasonal color-infrared photographs for mapping inland wetlands on U S Geological survey 7 5-minute quadrangles** V Carter (U S Geological Survey, National Center, Reston, Va) In Color aerial photography in the plant sciences and related fields, Proceedings of the Fifth Biennial Workshop, Sioux Falls, S Dak., August 19-21, 1975 Falls Church, Va , American Society of Photogrammetry, 1977, p 143-161 18 refs

A78-13082 **Pulsating aurora - Local and global morphology** O Royrvik and T N Davis (Alaska, University, Fairbanks, Alaska) *Journal of Geophysical Research,* vol 82, Oct 1, 1977, p 4720-4740 30 refs NSF Grant No GP-5246

Extensive observations with all-sky TV cameras supplemented by observations with narrow-field TV cameras, conventional all-sky cameras and images from DMSP satellites have shown that pulsating auroras are broadly distributed along the auroral oval throughout much of the auroral substorm Intensity variations in pulsating auroras may be repetitive, quasi-periodic or occasionally periodic with a time scale ranging from less than 1 sec to several tens of seconds Pulsations occur in auroral arcs, arc segments and patches of fixed and variable area The temporal and spatial characteristics are highly variable over a broad and continuous spectrum, rapid changes from one set of characteristics to another frequently occur, as do reversible changes from pulsating to nonpulsating auroras B J

A78-13492 **A comparative study of the amount and types of geologic information received from visually interpreted U-2 and Landsat imagery** J V Gardner (Indiana University, Fort Wayne, Ind.) and V C Miller (Indiana State University, Terre Haute, Ind) *ITC Journal,* no 3, 1977, p 384-405 Research supported by Indiana State University and Purdue University

Standard refraction and nonmagnifying mirror stereoscopes were used in a comparative study of stereoscopic black and white U-2 photographs, and multispectral scanner (MSS) and color-composite Landsat imagery of the Grand Canyon area The study was aimed at assessing the amount of geologic information that could be obtained from the various types of imagery through use of inexpensive visual interpretation It was concluded that when general rock unit differentiation and distribution are sought, Landsat MSS imagery suffices, when more detailed geologic mapping is desired, stereoscopic photography, supplemented by the color-composite Landsat imagery, may be preferable J M B

A78-13932 **Analysis of infrared reflectivity in the presence of asymmetrical phonon lines.** J L Servoin and F Gervais (Orléans, Université, CNRS, Centre de Recherches sur la Physique des Hautes Températures, Orléans, France) *Applied Optics,* vol 16, Nov 1977, p 2952-2956 15 refs

The temperature dependence of the ir reflection spectrum (A1-type modes) of LiTaO3 is reported from room temperature up to about 1300 K, that is 400 K above the ferroelectric-paraelectric phase transition Results for the isomorphic compound LiNbO3 are also presented Certain phonon resonance lines are found asymmetric Several dielectric function models are discussed Certain advantages of ir reflectivity spectroscopy are emphasized (Author)

A78-14787 # **Industrial use of geological remote sensing from space** F B Henderson, III (Geosat Committee, Inc , San Francisco, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 183-187

The utilization of satellite remote sensing of geological resources by the oil, gas and mineral industries is discussed It is noted that present and planned NASA systems, as well as geologically dedicated supplemental systems, can materially improve the process of making requisite maps for geological industries efficiently and economically B J

A78-14825 # **Remote sensing exploration for metallic mineral resources in central Baja California** R N Baker (General Electric Co , Reltsville, Md) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25 29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 683-691 17 refs

A78-14867 # **Integration of remote sensing and surface geophysics in the detection of faults** P L Jackson, R A Shuchman, H Wagner (Michigan, Environmental Research Institute, Ann Arbor, Mich), and F Ruskey (U S Bureau of Mines, Denver Mining Research Center, Denver, Colo) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1137-1146

Possible faults indicated by remote sensing can be quickly confirmed by resistivity surveys Anomalous resistivity values occur within the fault crush zone In a sedimentary region in Rio Blanca County, northwest Colorado, a fault zone was inferred from Landsat imagery Subsequent resistivity surveys indicated substantial resistivity highs associated with the faults Seismic data and the drilling of an observation well confirmed the main fault (Author)

A78-14887 # **Application of Landsat satellite imagery for iron ore prospecting in the western desert of Egypt** E M El Shazly, M A Abdel Hady, M A El Ghawaby, and S M Khawasik (Academy of Scientific Research and Technology, Remote Sensing Centre, Atomic Energy Establishment, Cairo, Egypt) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1355-1364 8 refs

A78-16502 # **Image data application, obtained from space, to geological investigations in the USSR** V K Eremin, S I Strelnikov, B N Moshaev, and V G Trifonov (National Committee of Photogrammetrists, Moscow, USSR) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 8 p

The paper discusses various types of geological information that can be gathered from satellite imagery For example, in the Tien Shan region, two types of neotectonic structures have been distinguished (1) the folded uplift in blocks and zones of sinking, which form ranges and intermountain depressions, and (2) lineaments of

different length and direction From preliminary data obtained over Kazakhstan and Central Asia, four series of faults can be distinguished, which can be combined into two systems (1) series of meridional and latitudinal faults, and (2) series of northwest and northeast faults P T H

A78-16503 # **Engineering geological interpretation of black and white, color and false color air photos** L K Kauranne (Geological Survey of Finland, Otaniemi, Finland) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 17 p

The results of engineering geological interpretation of black and white (1 6000), color and false color (1 8500) stereo air photos from a 3 sq km area glaciated terrain in South Finland were compared with the results of field observations and with each other The constant error in repeated measurements of areas of formations was plus or minus 5%, and difference (error) in repeated interpretation about 8%, except for silt, for which it was greater The reliability of the geological interpretation for black and white air photos controlled by field observations was from 67 to 86%, that for color air photos from 69 to 89% and that for false color air photos from 70 to 88%, depending on drift formation Errors in drift mapping mean that mistakes are made in planning and these may lead to a considerable increase in the cost of foundations An index for the orientation of formations was developed This may be used both for characterizing the terrain as well as for planning follow up investigations (Author)

A78-16511 **ERTS topology of France /First results/ (Topologie ertsienne de la France /Premiers résultats/)** C Cazabat (Institut Geographique National, Paris, France) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 17 p 12 refs In French

Linear and circular geological features on the land surface of France are detected in Landsat photographs whose scale is 1 1,000,000 Straight lines several kilometers in length result from hydrologic or orogenic influences The number, dimension, frequency, and orientation of these lines are considered Circular features, whose diameters might be several kilometers in length, are divided into three categories on the basis of size, and their distribution is examined The scale 1 1,000,000 was selected because the overlap in satellite photographs of this scale permits the use of stereoscopic and pseudo-stereoscopic techniques for analyzing the data The satellite photographs can also be correlated with other maps of the same scale, and the work of analysis is far less than it would be if the scale were 1 500,000 M L

A78-16553 **Analysis of Landsat-1 data for mapping of surficial deposits - Test area in Alta commune, Finnmark county, Norway** B A Follestad (Norges Geologiske Undersokelse, Trondheim, Norway) and D W Levandowski (Purdue University, West Lafayette, Ind) *(Kart og Plan,* no 2, 1976, p 66-74) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper.* 10 p 9 refs Research sponsored by the Norges Geologiske Undersokelse and Norges Teknisk-Naturvitenskapelige Forskningsrad

There is an urgent need in North Norway for obtaining geologic data for resource policy and planning Landsat data analyzed using the LARSYS computer software system can provide such data corrected to a scale of 1 50,000 The results of this study show that the spectral-reflectivity of the vegetative canopies for different surficial deposits can be used to distinguish between coarse grained (marginal) stratified deposits and finer grained (proglacial and fluvial) stratified deposits (Author)

A78 20097 * **Rare earth and trace element geochemistry of metabasalts from the Point Sal ophiolite, California** M Menzies (California, University, Davis, Calif), D Blanchard (NASA, Johnson Space Center, Houston, Tex), and J Jacobs (Lockheed Electronics Co , Inc , Houston, Tex) *Earth and Planetary Science Letters,* vol 37, no 2, Dec 1977, p 203-215 43 refs

N78-10537*# Helsinki Univ (Finland) Dept of Geology
INVESTIGATION OF LANDSAT IMAGERY ON CORRELATIONS BETWEEN ORE DEPOSITS AND MAJOR SHIELD STRUCTURES IN FINLAND Final Report, Jun. 1975 - Sep 1977
Heikki V Tuominen, Principal Investigator and Viljo Kuosmanen Sep 1977 59 p refs Sponsored by NASA Original contains *color imagery Original photography may be purchased from* the EROS Data Center, Sioux Falls S D ERTS
(E78-10012, NASA-CR-155216) Avail NTIS HC A04/MF A01 CSCL 08G

The author has identified the following significant results Several regional lineaments appear to correlate with the distribution of ore deposits and showings Combined study of LANDSAT summer and winter mosaics and color composites of geological, geomorphological, and geophysical maps makes the correlation more perceptible The revealed pattern of significant lineaments in northern Finland is fairly regular The most significant lineaments seen in LANDSAT mosaics are not detectable in single images

N78-10545# Netherland, Sewell and Associates Inc Dallas, Tex
PRELIMINARY STUDY OF THE PRESENT AND POSSIBLE FUTURE OIL AND GAS DEVELOPMENT OF AREAS IMMEDIATELY SURROUNDING THE INTERIOR SALT DOMES UPPER GULF COAST SALT DOME BASINS OF EAST TEXAS, NORTH LOUISIANA, AND MISSISSIPPI
17 Dec 1975 48 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-75/87988) Avail NTIS HC A03/MF A01

Present and possible future oil and gas development was investigated for the purpose of locating those salt domes where such oil and gas development would not interfere with the possible storage of radioactive waste material in the core of the salt dome Preliminary findings indicate that several of the salt domes in each of the three basins under study are hydrocarbon barren and that the present and/or possible future oil and gas development on or in the areas immediately surrounding the salt domes should not interfere with the possible storage of radioactive waste material in the core of these salt domes ERA

N78-10992*# Hawaii Univ , Honolulu Inst for Astronomy
ASTEROID SURFACE MATERIALS MINERALOGICAL CHARACTERIZATIONS FROM REFLECTANCE SPECTRA
Michael J Gaffey and Thomas B McCord 1977 147 p refs Submitted for publication
(Grant NsG-7310)
(NASA-CR-154510, Publ-151) Avail NTIS HC A07/MF A01 CSCL 03B

Mineral assemblages analogous to most meteorite types, with the exception of ordinary chondritic assemblages, have been found as surface materials of Main Belt asteroids C1- and C2-like assemblages (unleached, oxidized meteoritic clay minerals plus opaques such as carbon) dominate the population throughout the Belt, especially in the outer Belt A smaller population of asteroids exhibit surface materials similar to C3 (CO CV) meteoritic assemblages (olivine plus opaque probably carbon) and are also distributed throughout the Belt The majority of remaining studied asteroids (20) of 65 asteroids exhibit spectral reflectance curves dominated by the presence of metallic nickel-iron in their surface materials The C2-like materials which dominate the main asteroid belt population appear to be relatively rare on earth-approaching asteroids Author

N78-11454*# Mississippi State Univ Mississippi State Mechanical Engineering Dept
NUCLEONIC COAL DETECTOR WITH INDEPENDENT, HYDROPNEUMATIC SUSPENSION Final Report
E William Jones and Kim Handy 10 Jun 1977 49 p refs
(Contract NAS8-32214)
(NASA-CR-150465) Avail NTIS HC A03/MF A01 CSCL 08I

The design of a nucleonic coal interface detector which measures the depth of coal on the roof and floor of a coal mine is presented The nucleonic source and the nucleonic detector are on independent hydropneumatic suspensions to reduce the measurement errors due to air gap Author

N78-12494*# Geological Survey, Reston, Va
PREPARATION OF A GEOLOGIC PHOTO MAP AND HYDROLOGIC STUDY OF THE YEMEN ARAB REPUBLIC Final Report
M J Grolier Principal Investigator W C Overstreet, G C Tibbitts, Jr, D F Davidson and M M Ibrahim (Mineral and Petroleum Authority, Yemen) 30 Sep 1977 20 p refs ERTS
(NASA Order G-21990)
(E78-10008, NASA-CR-155212) Avail NTIS HC A02/MF A01 CSCL 08H

N78-12506*# Tennessee Univ Space Inst, Tullahoma Remote Sensing Div
THE APPLICATION OF LANDSAT-1 IMAGERY FOR MONITORING STRIP MINES IN THE NEW RIVER WATERSHED IN NORTHEAST TENNESSEE, PART 2 Final Report
F Shahrokhi, Principal Investigator and Leslie A Sharber [1977] 80 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(Contract NAS8-31980)
(E78-10032, NASA-CR-150423) Avail NTIS HC A05/MF A01 CSCL 08I

The author has identified the following significant results LANDSAT imagery and supplementary aircraft photography of the New River drainage basin were subjected to a multilevel analysis using conventional photointerpretation methods, densitometric techniques, multispectral analysis, and statistical tests to determine the accuracy of LANDSAT-1 imagery for measuring strip mines of common size The LANDSAT areas were compared with low altitude measurements The average accuracy over all the mined land sample areas mapped from LANDSAT-1 was 90% The discrimination of strip mine subcategories is somewhat limited on LANDSAT imagery A mine site, whether active or inactive, can be inferred by lack of vegetation, by shape, or image texture Mine ponds are difficult or impossible to detect because of their small size and turbidity Unless bordered and contrasted with vegetation, haulage roads are impossible to delineate Preparation plants and refuge areas are not detectable Density slicing of LANDSAT band 7 proved most useful in the detection of reclamation progress within the mined areas For most state requirements for year-round monitoring of surface mined land, LANDSAT is of limited value However, for periodic updating of regional surface maps, LANDSAT may provide sufficient accuracies for some users

N78-13508*# Stanford Univ, Calif Dept of Applied Earthsciences
APPLICATION OF HCMM SATELLITE DATA TO MINERAL EXPLORATION Progress Report, 1 Jul. - 31 Oct. 1977
R J P Lyon, Principal Investigator 1 Nov 1977 5 p ERTS
(Contract NAS5-24106)
(E78-10036 NASA-CR-155258) Avail NTIS HC A02/MF A01 CSCL 08G

N78-13517# Texas Instruments, Inc, Dallas
AERIAL GAMMA-RAY AND MAGNETIC SURVEY OF THE RED RIVER AREA, BLOCK C, TEXAS AND OKLAHOMA, VOLUME 2
Mar 1977 198 p
(Contract EY-76-C-13-1664)
(GJBX-17(77)-Vol-2) Avail NTIS HC A09/MF A01

Aerial gamma and magnetic survey maps are presented for Block C of the Red River area of Texas and Oklahoma Histograms of U, Th, and K deposits are included ERA

N78-13622# Utah Univ, Salt Lake City
GEOPHYSICS APPLIED TO DETECTION AND DELINEATION OF NON-ENERGY NON-RENEWABLE RESOURCES: WORKSHOP ON MINING GEOPHYSICS
S H Ward, R Campbell (US Steel Corp Pittsburgh), J D Corbett (Cities Serv Minerals Corp) G W Hohmann (Kennecott Exploration, Inc), C K Moss (ASARCO, Inc), and P M Wright (Bear Creek Mining Co) Mar 1977 314 p refs Workshop held at Salt Lake City, 6-8 Dec 1976
(Grant NSF AER-76-80802)
(PB-271952/4 NSF/RA-770173) Avail NTIS HC A14/MF A01 CSCL 08I

The needs for research in mining geophysics related to nonenergy, nonrenewable resources were explored Participants included mining geophysicists who were concerned with exploration of base metals State of the art reports were presented in the areas of induced polarization, resistivity and self-potential methods, electromagnetic methods, remote sensing methods,

N78-13688# Sandia Labs, Albuquerque, N Mex Geomechanics Research Div
COMPRESSION WAVE STUDIES IN SOLENHOFEN LIMESTONE
K W Schuler and D E Grady May 1977 56 p refs
(Contract EY-76-C-04-0789)
(SAND-76-0279) Avail NTIS HC A04/MF A01

Dynamic compression wave studies were conducted on Solenhofen limestone in the stress range of 0 to 3 0 GPa Plate impact techniques were used to provide a transient stress input and diffuse reflector laser interferometry was used to study the evolution of these pulses through various thicknesses of limestone Both the loading and unloading stress-strain response was determined from the measured particle velocity profiles A dynamic yield stress of 0 67 plus or minus 05 GPa was observed which is consistent with static failure envelope data However there is a marked difference between the dynamic and hydrostatic stress-strain curves at stress levels where the calcite I yields II yields III phase transitions occur It appears that the phase transitions which occur during shock wave loading do not take the material fully into the high pressure phase but instead reach a metastable mixed phase condition ERA

N78-14452* National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio
IN-SITU LASER RETORTING OF OIL SHALE Patent
Harvey S Bloomfield, inventor (to NASA) Issued 6 Dec 1977 5 p Filed 28 Jan 1977

(NASA-Case-LEW-12217-1, US-Patent-4,061,190, US-Patent-Appl-SN-762753 US-Patent-Class-166-259 US-Patent-Class-166-248) Avail US Patent Office CSCL 08I

Oil shale formations are retorted in situ and gaseous hydrocarbon products are recovered by drilling two or more wells into an oil shale formation underneath the surface of the ground A high energy laser beam is directed into the well and fractures the region of the shale formation A compressed gas is forced into the well that supports combustion in the flame front ignited by the laser beam thereby, retorting the oil shale Gaseous hydrocarbon products which permeate through the fractured region are recovered from one of the wells that were not exposed to the laser system Official Gazette of the U S Patent Office

N78-14474*# Geosat Committee, Inc San Francisco, Calif
INDUSTRIAL USE OF GEOLOGICAL REMOTE SENSING FROM SPACE
Frederick B Henderson III *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 183-187
Avail NTIS HC A99/MF A01 CSCL 08G

NASA s remote sensing technology as exemplified by ERTS-1 and LANDSAT 2 developed far more rapidly than they could have been reasonably absorbed with proved results by geological industries This under-utilization of available technology is due to the ingrown infrastructure of exploration and engineering programs and techniques, and the inherent indirectness and long term effectiveness of the application of remote sensing to geological needs The value of four dimensional geologic maps and the capabilities of various sensors are discussed Author

N78-14507*# GeoSpectra Corp Ann Arbor, Mich
LANDSAT DETECTION OF HYDROTHERMAL ALTERATION IN THE NOGAL CANYON CAULDRON, NEW MEXICO
Robert K Vincent and George Rouse (Earth Sci, Inc Golden Colo) *In* ERIM Proc of the 11th Intern Symp on Remote

Sensing of Environment Vol 1 1977 p 579-590 refs

Avail NTIS HC A99/MF A01 CSCL 08H

In 1974 a circular-shaped iron oxide anomaly was observed in an image of a LANDSAT frame centered near Truth or Consequences, New Mexico Field examination of the anomaly has shown that it coincides with a zone of hydrothermal alteration on the northern edge of the Nogal Canyon Cauldron The altered area contains clay minerals ranging in colors from white to vivid red, the latter presumably resulting from hematite staining In situ gas measurements showed no evidence of active hydrogen sulfide seepage Preliminary geochemical analyses of grab samples have detected no significant amounts of mineralization Whereas this area does not at present appear to be economically important, it provides an example of how LANDSAT can be utilized in reconnaissance mapping for cauldrons calderas, and other volcanic features which display hydrothermal alteration Author

N78-14517*# General Electric Co , Beltsville Md
REMOTE SENSING EXPLORATION FOR METALLIC MINERAL RESOURCES IN CENTRAL BAJA CALIFORNIA
Ralph N Baker *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 683-691 refs

Avail NTIS HC A99/MF A01 CSCL 08G

Remote sensor data (primarily LANDSAT) was analyzed by photogeologic and computer-assisted enhancement techniques to evaluate the metallic mineral potential of Baja California Overlays were prepared at 1 1,000 000 and 1 500,000 and included known geologic relationships and mineral occurrences lineament, drainage and structural patterns tonal anomalies, and enhancement results Computer-assisted enhancement and classification of the test sites was performed using the IMAGE 100 system to identify subtle tonal anomalies thought related to mineralization using known sites as analysis guides Mineral potential maps of Baja California were generated from these analyses and the ten highest priority targets visited Preliminary assay results (atomic absorption analysis) for the samples recovered showed moderate to high geochemical anomalies for Copper (10 of 12 samples) Zinc (3 of 12 samples) and Lead (4 of 12 samples) Author

N78-14525*# Stanford Univ Calif Remote Sensing Lab
ALTERATION MAPPING AT GOLDFIELD, NEVADA, BY CLUSTER AND DISCRIMINANT ANALYSIS OF LANDSAT DIGITAL DATA
Gary Ballew *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 783-790

Avail NTIS HC A99/MF A01 CSCL 08B

The ability of Landsat multispectral digital data to differentiate among 62 combinations of rock and alteration types at the Goldfield mining district of Western Nevada was investigated by using statistical techniques of cluster and discriminant analysis Multivariate discriminant analysis was not effective in classifying each of the 62 groups, with classification results essentially the same whether data of four channels alone or combined with six ratios of channels were used Bivariate plots of group means revealed a cluster of three groups including mill tailings, basalt and all other rock and alteration types Automatic hierarchical clustering based on the fourth dimensional Mahalanobis distance between group means of 30 groups having five or more samples was performed The results of the cluster analysis revealed hierarchies of mill tailings vs natural materials basalt vs non-basalt, highly reflectant rocks vs other rocks and exclusively unaltered rocks vs predominantly altered rocks The hierarchies were used to determine the order in which sets of multiple discriminant analyses were to be performed and the resulting discriminant functions were used to produce a map of geology and alteration which has an overall accuracy of 70 percent for discriminating exclusively altered rocks from predominantly altered rocks Author

N78-14526*# Minnesota Univ St Paul
QUATERNARY GEOLOGIC MAP OF MINNESOTA
J E Goebel *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 791-794

Avail NTIS HC A99/MF A01 CSCL 08G

The Quaternary Geologic Map of Minnesota is a compilation based both on the unique characteristics of satellite imagery and on the results of previous field investigations, both published and unpublished The use of satellite imagery has made possible the timely and economical construction of this map LANDSAT imagery interpretation proved more useful than expected Most of the geologic units could be identified by extrapolating from specific sites where the geology had been investigated into areas where little was known The excellent geographic registry coupled with the multi-spectral record of these images served to identify places where the geologic materials responded to their ecological environment and where the ecology responded to the geologic materials Units were well located on the map at the scale selected for the study Contacts between till units could be placed with reasonable accuracy The reference points that were used to project delineations between units (rivers, lakes, hills, roads and other features), which had not been accurately located on early maps could be accurately located with the help of the imagery The tonal and color contrasts the patterns reflecting geologic change and the resolution of the images permitted focusing attention on features which could be represented at the final scale of the map without distraction by other interesting but site-specific details Author

N78-14543*# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt Cologne (West Germany)
REMOTE INFRARED SPECTROSCOPY OF THE EARTH
C R Steinmann *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 957-967 refs

Avail NTIS HC A99/MF A01 CSCL 08G

The infrared reflexion-spectra of minerals and rocks are used for remote sensing of targets The reflexion-spectra of silicate rocks vary quite significantly from mineral to mineral in the wave length region from 8 to 12 micrometers The rock forming m nerals like quartz feldspar mica and the clay minerals show very different spectral shapes and positions of their maximum of the spectral reflexion The presence of a good atmospherical window in that spectral region makes the method of differential-reflexion measurement feasible for remote sensing application A tunable CO2-laser was used as transmitter for infrared radiation Laboratory tests showed the feasibility of the method under different simulated environmental conditions Because of the very narrow bandwidth of the laser-emission lines, reflexion-spectra with extremely high spectral resolution were obtained Author

N78-14544*# Indian Space Research Organization Admedabad Remote Sensing Area
IMAGE ANALYSIS TECHNIQUES WITH SPECIAL REFERENCE TO ANALYSIS AND INTERPRETATION OF GEOLOGICAL FEATURES FROM LANDSAT IMAGERY
D S Kamat K L Majumder S D Naik and V L Swaminathan *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 969-978 refs

Avail NTIS HC A99/MF A01 CSCL 08G

The principal component analysis enhances the contrast existing between the different cover types present in an imagery A procedure is presented with regards to the determination of the principal components The method is tested for a portion of the LANDSAT imagery pertaining to Anantapur region Another technique using the concept of non-linear contrast stretching is defined and developed and carried out on the same imagery The results are presented as photographs An interpretation of the geology of the region is derived from these photographs Author

N78-14561*# Environmental Research Inst of Michigan Ann Arbor
INTEGRATION OF REMOTE SENSING AND SURFACE GEOPHYSICS IN THE DETECTION OF FAULTS

P L Jackson, R A Shuchman, H Wagner and F Ruskey (Bureau of Mines, Denver) *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1137-1146

Avail NTIS HC A99/MF A01 CSCL 08G

Remote sensing was included in a comprehensive investigation of the use of geophysical techniques to aid in underground mine placement The primary objective was to detect faults and slumping features which due to structural weakness and excess water, cause construction difficulties and safety hazards in mine construction Preliminary geologic reconnaissance was performed on a potential site for an underground oil shale mine in the Piceance Creek Basin of Colorado LANDSAT data black and white aerial photography and 3 cm radar imagery were obtained LANDSAT data were primarily used in optical imagery and digital tape forms both of which were analyzed and enhanced by computer techniques The aerial photography and radar data offered supplemental information Surface linears in the test area were located and mapped principally from LANDSAT data A specific relatively wide, linear pointed directly toward the test site but did not extend into it Density slicing, ratioing, and edge enhancement of the LANDSAT data all indicated the existence of this linear Radar imagery marginally confirmed the linear while aerial photography did not confirm it Author

N78-14562*# Geological Survey, Denver Colo
EVALUATION OF ALGORITHMS FOR GEOLOGICAL THERMAL-INERTIA MAPPING
S H Miller and Kenneth Watson *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1147-1160 refs
Avail NTIS HC A99/MF A01 CSCL 08B

The errors incurred in producing a thermal inertia map are of three general types measurement analysis and model simplification To emphasize the geophysical relevance of these errors, they were expressed in terms of uncertainty in thermal inertia and compared with the thermal inertia values of geologic materials Thus the applications and practical limitations of the technique were illustrated All errors were calculated using the parameter values appropriate to a site at the Raft River, Id Although these error values serve to illustrate the magnitudes that can be expected from the three general types of errors, extrapolation to other sites should be done using parameter values particular to the area Three surface temperature algorithms were evaluated linear Fourier series finite difference and Laplace transform In terms of resulting errors in thermal inertia the Laplace transform method is the most accurate (260 TIU) the forward finite difference method is intermediate (300 TIU) and the linear Fourier series method the least accurate (460 TIU) Author

N78-14581*# Atomic Energy Establishment Cairo (Egypt) Remote Sensing Center
APPLICATION OF LANDSAT SATELLITE IMAGERY FOR IRON ORE PROSPECTING IN THE WESTERN DESERT OF EGYPT
E M ElShazly M A AbdelHady M A ElGhawaby and S M Khawasik *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1355-1364 refs

Avail NTIS HC A99/MF A01 CSCL 08G

Prospecting for iron ore occurrences was conducted by the Remote Sensing Center in Bahariya Oasis-El Faiyum area covering some 100 000 km squared in the Western Desert of Egypt LANDSAT-1 satellite images were utilized as the main tool in the regional prospecting of the iron ores The delineation of the geological units and geological structure through the interpretation of the images corroborated by field observations and structural analysis led to the discovery of new iron ore occurrences in the area of investigation Author

N78-14610# Instituto de Pesquisas Espaciais Sao Jose dos Campos (Brazil)
APPLICATION OF REMOTE SENSING TO GEOTHERMAL ANOMALY MAPPING IN THE CALDAS NOVAS COUNTY, GOIAS M S Thesis [APLICACAO DE SENSORIAMENTO REMOTO NO ESTUDO DE ANOMALIA GEOTERMAL NO MUNICIPIO DE CALDAS NOVAS, GOIAS]
Celio Eustaquio DosAnjos Oct 1977 173 p refs In PORTUGUESE ENGLISH summary
(INPE-1129-TPT/070) Avail NTIS HC A08/MF A01

The geothermal anomaly of Caldas Novas county in the state of Goias was mapped Systematic research was carried out combining geological mapping with surface and subsurface temperature measurements LANDSAT-1 images of the region were studied allowing the placement of the area in regional geological context The origins and evolution of the geothermal anomaly were also considered Geological mapping was done to the scale of 1 60 using USAF aerial photography Regional temperature mapping was done using trend surface analysis Through the correlation of these data four different areas were localized which have a high potential for hot water prospecting Author

N78-14611# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)
APPLICATION OF REMOTE SENSING TO GEOLOGICAL AND MINERAL DEPOSITS SURVEYS OF THE NORTHERN MINAS GERAIS STATE, UTILIZING IMAGES FROM LANDSAT [APLICACAO DE SENSORES REMOTOS PARA LEVANTAMENTOS GEOLOGICOS E DE RECURSOS MINERAIS COM BASE NAS IMAGENS LANDSAT NO NORTE DE MINAS GERAIS]
Roberto Pereira DaCunha and Juercio Tavares DeMattos Aug 1977 70 p refs In PORTUGUESE ENGLISH summary Presented at the 7th Simp Brasil de Mineracao Porto Alegre Brazil 31 Jul - 5 Aug 1977
(INPE-1096-PE/073) Avail NTIS HC A04/MF A01

Results are presented from a study of application of remote sensing to the survey of regional geology of the northern Minas Gerais state and part of the state of Goias Images from LANDSAT RADAR aerophotographs magnetometric maps and automatic interpretation of computer compatible tapes (CCT s) of the LANDSAT were used Regional geology mineral resources of a 143 000 sq km area, and results obtained with the help of different sensors are presented for the area under the study Author

N78-14615# California Univ Berkeley Lawrence Berkeley Lab
GEOLOGICAL REMOTE SENSING FROM SPACE
F B Henderson III and G A Swann 1976 74 p
(Contract W-7405-eng-48)
(TID-27689) Avail NTIS HC A04/MF A01

Remote sensing from space, offering many advantages to assist in the geological and geophysical mapping of the earth was investigated Geological parameters, including structural interpretation, rock mineral, soil and vegetation discrimination and identification and alteration studies were considered Present or potential space sensing capabilities were compared to these parameters for maximum geological utilization Application capabilities were differentiated from experimental capabilities Geological parameters for oil, gas and mineral exploration and for engineering and environmental geology were delineated Major potential applications not available from current or past space technology were recognized while geological parameters and corresponding potential GEOSAT capabilites were summarized ERA

N78-14622# Earth Satellite Corp , Washington D C
DEVELOPMENT OF AIRBORNE ELECTROMAGNETIC SURVEY INSTRUMENTATION AND APPLICATION TO THE SEARCH FOR BURIED SAND AND GRAVEL, A SUMMARY REPORT
O R Russell, J R Everett and J A Uncapher Jan 1977 27 p refs
(Contract DOT-FH-11-9144)
(PB-271331/1 FHWA-RD-77-35) Avail NTIS HC A03/MF A01 CSCL 08I

Airborne electromagnetic survey systems, developed 30 years ago in Canada, have mostly been used in exploration for metallic mineral deposits In the last 10 years there has been some use of the systems for looking at surface material types and exploring for sand and gravel The results of this work are extremely

encouraging however the body of experience is as yet limited The three systems which appear to have the greatest potential in exploration for sand and gravel are E-Phase INPUT, and Dighem All of these rely on radio frequencies in the very low frequency range Each has been used to locate sand and gravel under specific sets of conditions GRA

N78-15552# Watkins and Associates, Lexington, Ky
ONSITE CONTROL OF SEDIMENTATION UTILIZING THE MODIFIED BLOCK-CUT METHOD OF SURFACE MINING Feasibility Study, Dec 1974 - Apr 1976
Jul 1977 103 p refs Prepared in cooperation with Ky Dept of Natural Resources and Environ Protection, Frankfort
(Grant EPA-S-802681)
(PB-272244/5, EPA-600/7-77-068) Avail NTIS HC A06/MF A01 CSCL 08I

The feasibility of a demonstration project for onsite control of sedimentation was determined using the modified block-cut method of surface mining A project site on Lower Lick Fork in Perry and Letcher Counties in Kentucky was selected Based on certain assumptions, a comparison of costs involved in the modified block-cut method of mining and in a method using the minimum acceptable requirements as set forth in the present regulations was prepared GRA

05

OCEANOGRAPHY AND MARINE RESOURCES

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

A78-10027 Satellite observations of mesoscale eddy dynamics in the eastern tropical Pacific Ocean. H. G Stumpf and R V Legeckis (NOAA, National Environmental Satellite Service, Washington, D C) *Journal of Physical Oceanography,* vol. 7, Sept. 1977, p. 648-658. 25 refs

Active mesoscale (300 km diameter) eddy formation off the Pacific coast of Central America was observed during February 1976 by a thermal infrared sensor aboard the NOAA 4 satellite These anticyclonic eddies, closely associated with wind-induced upwellings, propagate westward at an average speed of 13 km/day, which is approximately the speed of nondispersive baroclinic Rossby waves at latitude 12 deg N (Author)

A78-10161 * One-parameter characterization of the ocean's inherent optical properties for remote sensing H R Gordon (Miami, University, Coral Gables, Fla) *Applied Optics,* vol 16, Oct 1977, p 2627 6 refs Contract No NAS5-22963

A78-10344 Ocean surface currents mapped by radar D E Barrick, M W Evans, and B L Weber (NOAA, Wave Propagation Laboratories, Boulder, Colo) *Science,* vol 198, Oct 14, 1977, p 138-144 13 refs

The design of a coastally-located high-frequency radar remote-sensing system for the measurement and mapping of near-surface currents to ranges covering over 2000 sq km out to a distance of approximately 70 km from the shore is presented. Wave-scattered echoes are used to determine current velocity, and a minicomputer is used to control and process the radar signals From the data a current-vector map may be plotted after one half hour of operation A transportable prototype version has been constructed and tested The system utilizes two units powered by a portable power supply, and has average radiated power of 50 watts Estimates of the precision of current-velocity measurements are better than 30 cm/sec Applications of the system include current monitoring for offshore accidents, and the determination of the actual linear horizontal drift of particles such as oil S.C S

A78-10388 Monitoring open water and sea ice in the Bering Strait by radar W L Flock (Colorado, University, Boulder, Colo) *IEEE Transactions on Geoscience Electronics,* vol GE-15, Oct 1977, p 196-202 33 refs Research supported by the U S Fish and Wildlife Service

Observations made at the Bering Strait show the utility of employing radar systems providing both moving-target-identification (MTI) and short-time-constant video signals for monitoring sea-surface areas containing open water and sea ice. MTI video signals tend to emphasize returns from areas of open water and loose pack ice Short-time-constant or differentiated video signals tend to emphasize returns from boundaries between water and ice and record echoes from stationary as well as moving targets Large polynyas (area of open water) south of projecting points and islands in the Bering Strait area in May are vividly displayed by the combination of MTI and short-time-constant signals The use of the two types of signals constitutes a simple form of processing in the Doppler frequency domain. The results indicate that the use of MTI systems, or more sophisticated pulse-Doppler systems, could be advantageous for monitoring restricted areas of water in which ice may occur and present a limitation or hazard to navigation by boats and ships (Author)

A78-10389 Techniques for ocean bottom measurements of magnetic fields with a superconducting magnetometer R J Dinger, J R Davis, J A Goldstein (U S Navy, Naval Research Laboratory, Washington, D C), W D Meyers, S A Wolf, and M Cates (U S Naval Ocean Systems Center, San Diego, Calif) *IEEE Transactions on Geoscience Electronics,* vol GE-15, Oct 1977, p 228-231 6 refs

A superconducting quantum interference device (SQUID) magnetometer cooled by liquid helium was placed on the ocean floor at a depth of 100 m in order to receive extremely low frequency radio transmissions A nonmagnetic concrete and fiberglass platform anchored a fiberglass pressure vessel containing the magnetometer firmly to the ocean bottom. The helium gas evolved from the boiling liquid helium was vented through a hose to the surface Details of the apparatus and the techniques used to install and recover the SQUID magnetometer are given (Author)

A78-12615 * Active microwave measurement from space of sea-surface winds J D Young (General Dynamics Corp, Fort Worth, Tex) and R K Moore (University of Kansas Center For Research, Inc, Lawrence, Kan) *IEEE Journal of Oceanic Engineering,* vol OE-2, Oct 1977, p 309-317 26 refs Research supported by the University of Kansas, Contract No NAS9-13642

Radar backscatter measurements from the ocean were made at 13.9 GHz from Skylab The radar signal increased rapidly with wind speed over the entire range of winds encountered, and for angles of incidence of 30 deg larger Signals observed were normalized to a nominal incidence angle and to a nominal upwind observation direction, using a theoretical model that has been verified as approximately true with aircraft experiments Observations during the summer and winter Skylab missions were treated separately because of possible differences caused by an accident to the antenna between the two sets of observations The results are in general agreement with the theory in all cases The objective analysis method used for determining surface-truth winds in the Skylab experiment was tested by comparing results obtained at weather ships with the observations made by the weather ships themselves In most cases, the variance about the regression line between objective analysis and weather-ship data actually exceeded that about the regression line between objective analysis and backscatter data (Author)

A78-12827 Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C, September 13-15, 1976 Conference sponsored by the Marine Technology Society and Institute of Electrical and Electronics Engineers New York, Institute of Electrical and Electronics Engineers, Inc, Washington, D C, Marine Technology Society, 1976 762 p $34

Attention is given to sea law, marine mining, undersea cables, sea navigation, the economic potential of the oceans, marine information transfer and education, deep water mapping, and water quality and pollution control Consideration is also given to the applications of the Seasat A satellite, marine biology and fisheries, buoys, remote sensing of the sea, ocean acoustics, a study of the outer continental shelf, oceanographic instrumentation, offshore facilities, undersea vehicles, salvage, and coastal zone management B J

A78-12828 * Computer image processing in marine resource exploration P R Paluzzi (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif), W R Normark, G R Hess, H D Hess, and M J Cruickshank (U S Geological Survey, Menlo Park, Calif) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C, September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc, Washington, D C, Marine Technology Society, 1976, p 4D-1 to 4D-10 15 refs Contract No NAS7-100

Pictographic data or imagery is commonly used in marine exploration Pre-existing image processing techniques (software) similar to those used on imagery obtained from unmanned planetary exploration were used to improve marine photography and side-scan sonar imagery Features and details not visible by conventional photo

processing methods were enhanced by filtering and noise removal on selected deep-sea photographs Information gained near the periphery of photographs allows improved interpretation and facilitates construction of bottom mosaics where overlapping frames are available Similar processing techniques were applied to side-scan sonar imagery, including corrections for slant range distortion, and along-track scale changes The use of digital data processing and storage techniques greatly extends the quantity of information that can be handled, stored, and processed (Author)

A78-12829 * The Seasat-A project - An overview J A Dunne (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 10A-1 to 10A-5 11 refs Contract No NAS7-100

Scheduled for launch in the second quarter of calendar year 1978, the Seasat-A satellite is designed to provide all-weather global monitoring of sea surface temperature, significant wave height, surface wind speed and direction and departures from the marine geoid corresponding to ocean dynamic processes These data will be obtained from an array of microwave instruments, two active ones (short pulse radar altimeter and wind field scatterometer) and one passive (scanning multichannel microwave radiometer) An experimental L-band synthetic aperture radar, operated on a selected basis for approximately four percent of the time, will provide land and ocean images with a resolution of 25 meters and a swath width close to 100 km for the study of coastal processes, sea ice and ocean wave characteristics The mission objectives focus on an evaluation of the performance of the instruments in terms of their capabilities to characterize the desired geophysical quantities and the utility of such measurements to the study and exploitation of the world's oceans (Author)

A78-12834 * The Seasat surface truth experiments O H Shemdin (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 10F-1 to 10F-5

A surface truth program for Seasat A is formulated in two phases pre- and post-launch The pre-launch phase (which includes the Marineland experiments, the JONSWAP-75 experiment, the West Coast experiment, and the altimeter experiment) is designed to provide data from aircraft over instrumented ocean sites during desirable geophysical events The objective is to gather sufficient data for the development of algorithms which transfer space data into geophysical variables useful for applications In the post-launch phase, the surface truth program is designed to verify and improve the algorithms developed in the pre-launch phase and also to evaluate the performance of spaceborne sensors B J

A78-12837 Oceanic morphogenesis C L Kober and T K Chamberlain (Colorado State University, Fort Collins, Colo) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976
New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 15D-1 to 15D-4 6 refs

A *catastrophe-theory approach, using surface observables as* indications of boundary values, is employed to study ocean-current patterns (oceanic morphogenesis), Landsat observations of the Mediterranean Sea are the data used in the study It is shown that for low seastate at large scales (of the order of 100 sq miles), meaningful oceanographic data are derivable from satellite observations, indicating stable (for the time of observation) boundaries of different water masses The fine structure of the amplitude of reflected light allows interpretation as to relative flow directions, submergence and interactions B J

A78-12838 * Remote sensing of chlorophyll concentration from high altitude K C Leung (Computer Sciences Corp , Silver Spring, Md) and W A Hovis (NASA, Goddard Space Flight Center, Greenbelt, Md) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 15E-1 to 15E-4 13 refs

A series of remote sensing experiments, using an airborne Ocean Color Scanner (OCS), has been carried out to demonstrate the feasibility of detecting surface chlorophyll concentrations in coastal water from high altitude Upwelling radiance from the sea surface was recorded by 10 narrow bandwidth wavelength channels of the OCS, at an altitude of 19 8 km Measurements were made over areas with vastly different biological activities A strong correlation between the OCS radiance measurements and the surface chlorophyll measurements was found The extracted chlorophyll signature agreed qualitatively with results from low altitude observations, except in the blue region In addition, it was found that a simple algorithm could be used to estimate reliable chlorophyll distributions from OCS measurements (Author)

A78-12839 * Hydrographic charting from Landsat satellite - A comparison with aircraft imagery E M Middleton (Computer Sciences Corp , Silver Spring, Md) and J L Barker (NASA, Goddard Space Flight Center, Greenbelt, Md) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 15F-1 to 15F-6 12 refs

The relative capabilities of two remote-sensing systems in measuring depth and, consequently, bottom contours in sandy-bottomed and sediment-laden coastal waters were determined quantitatively The Multispectral Scanner (MSS), orbited on the Landsat-2 *satellite, and the Ocean Color Scanner (OCS), flown on U-2 aircraft,* were used for this evaluation Analysis of imagery taken simultaneously indicates a potential for hydrographic charting of marine coastal and shallow shelf areas, even when water turbidity is a factor Several of the eight optical channels examined on the OCS were found to be sensitive to depth or depth-related information The greatest sensitivity was in OCS-4 (0 544 plus or minus 0 012 micron) from which contours corresponding to depths up to 12 m were determined The sharpness of these contours and their spatial stability through time suggests that upwelling radiance is a measure of bottom reflectance and not of water turbidity The two visible channels on Landsat's MSS were less sensitive in the discrimination of contours, with depths up to 8 m in the high-gain mode (3 X) determined in MSS-4 (0 5 to 0 6 micron) (Author)

A78-12840 Accuracy of moored current measurements in shallow-water D Halpern (NOAA, Pacific Marine Environmental Laboratory, Seattle, Wash) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 20B-1 to 20B-5 12 refs NOAA-NSF-supported research

The Aanderaa current meter is widely used with a variety of platforms in different oceanographic and limnologic environments It was not intended to be used in regions where surface wave motions would influence the measurements Several examples are described to *show the effect of surface waves upon Aanderaa current measure*ments made near the surface and near the bottom in shallow-water environments (Author)

A78-12842 Temperature measurement array for internal wave observations L M Occhiello and R Pinkel (California, University, San Diego, Calif) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Tech-

nology Society, 1976, p 20E-1 to 20E-7 Contract No N00014-75-C-1023

During the last six years the Marine Physical Laboratory has been engaged in a study of the internal wavefield in the upper ocean Inasmuch as internal waves propagate horizontally, vertically, and in time, a four-dimensional (space-time) measurement was desired To meet these requirements, a three-element temperature sensor system in an array 40 meters on a side, was created by mounting 3 booms on the research platform FLIP (floating laboratory instrument platform) Repeated temperature profiles were made from each of these booms The system consists of temperature and depth profile sensors, winches to raise and lower the sensors, a computer to manage the data, and a central control unit (Author)

A78-12845 OCS environmental research technology in ice-covered water G Weller (NOAA, Fairbanks, Alaska) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 23D-1 to 23D-3

The presence of ice for nine to ten months each year over the continental shelves in the Arctic requires new methods and technology in environmental assessment programs As part of the Bureau of Land Management/National Oceanic and Atmospheric Administration Outer Continental Shelf Environmental Assessment Program in Alaska, biological and physical research is now carried out routinely throughout the year, by landing helicopters on the pack ice and lowering equipment through holes cut in the ice Moored current meters have been designed for use under perennial ice, from which data can be transmitted acoustically on command A number of ice buoys have been developed which are routinely interrogated by the Nimbus-6 satellite These and other new developments have made it possible to conduct research in the coastal arctic marine environment year round, in the past, practically all existing environmental data were taken there during the brief summer only (Author)

A78-12941 # Proposal for an extension of the CAMAC standard suitable to low power data acquisition systems for oceanographic stations on marine platforms and buoys G Aprilesi, L Balestri, M Menziani, M R Rivasi, R Salgari, and R Santangelo (Osservatorio Geofisico, Modena, Università, Modena, Italy) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 167-175 5 refs

A lower-power data acquisition system intended to operate on marine platforms or buoys is described, the system relies on complementary metal oxide semiconductor components instead of transistor-transistor logic Characteristics of the microprocessor which controls the system, as well as the autonomous crate controller and the accompanying software, are considered The data acquisition system is designed to conform to the computer-aided measurement and control standard J M B

A78-13108 The summertime stratus over the offshore waters of California R L Simon (San Jose State University, San Jose, Calif) *Monthly Weather Review,* vol 105, Oct 1977, p 1310-1314 13 refs NSF Grant No DES-71-00632-A01

The distribution of stratus clouds over the Pacific Ocean near California is studied via satellite photographs during the summer A line of minimum cloudiness, north-south oriented, is found off the northern and central coast This line is particularly well defined during July, and it may be caused by a strong surface wind divergence Clouds to the west of the line are primarily stratocumulus, forming in air streaming southward over warmer water, while those to the east are mainly smooth-topped stratus, forming in air cooled by the upwelled water near the coast A strong diurnal variation in low cloudiness is noted, with maximum cloud cover near sunrise and minimum in late afternoon These findings suggest that the variation is caused by the clouds' net radiative flux Upper-level synoptic-scale flow patterns seem to be poorly related to the low-cloud patterns over the ocean except in extreme cases S C S

A78-13116 Winter intrusions of the Loop Current R L Molinari, D W Behringer, G A Maul (NOAA, Atlantic Oceanographic and Meteorological Laboratories, Miami, Fla), S Baig (NOAA, National Environmental Satellite Service, Miami, Fla), and R Legeckis (NOAA, National Environmental Satellite Service, Suitland, Md) *Science,* vol 198, Nov 4, 1977, p 505-507 6 refs U S Bureau of Land Management Grant No D85-50-IA5-26

The circulation in the eastern Gulf of Mexico is dominated by the so-called Loop Current, which enters the Gulf through the Yucatan Straits and exits through the Straits of Florida A description is presented of recent observations, made between November 1974 and April 1977, which show the northern most intrusions of the Loop Current during the winter months The observed winter intrusions were all north of 26 deg N The considered data include sea-surface temperature data derived from satellite measurements and subsurface temperature data G R

A78-13312 A model for sea backscatter intermittency at extreme grazing angles L B Wetzel (U S Navy, Naval Research Laboratory, Washington, D C) *Radio Science,* vol 12, Sept -Oct 1977, p 749-756 21 refs

It is suggested that during radar backscatter at extreme grazing angles (0-1 deg) from the sea surface, most of the surface is in shadow and only an occasional peak is visible to the radar The conventional shadowing function is taken to define a scattering threshold whose height above the mean surface is a function of grazing angle and average surface slope The surface is found to be pockmarked by scattering islands of relatively constant size, but whose density is a sensitive function of grazing angle and sea state The model leads to the definition of a backscatter intermittency index, which describes the number of localized scattering regions within a given surface area as a function of wind speed and grazing angle, and to a modified shadowing function for grazing angles less than 1 deg B J

A78-13651 Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers Conference sponsored by AIAA, AMS, AGU, IEEE, MTS, and SEG New York, American Institute of Aeronautics and Astronautics, Inc , 1977 298 p Members, $30 , nonmembers, $40

Papers are presented which describe various satellite applications to marine operations such as advanced navigation techniques using multiple systems, data collection using satellites, and satellite-based maritime search and rescue Attention is given to monitoring various oceanic features via satellite, including water parameters in coastal zones, ocean temperature fluctuations, and sea ice forecasting Applications of the Seasat satellite for observations of offshore oil, gas, and mining industries are described along with prospects for using DMSP satellites for imagery of the marine environment and NOAA satellites for observations of ocean features Low cost reception, processing, and distribution of line-scan data from environmental satellites is reviewed and note is made of various space instruments used in oceanography applications S C S

A78-13656 # 1978 - A space focus for oceanology J A Ernst and J W Sherman, III (NOAA, National Environmental Satellite Service, Washington, D C) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 34-38 5 refs (AIAA 77-1564)

Remote sensing from space platforms for operational purposes began in 1960 with TIROS-1, the first full-time meteorological satellite Global cloud cover data never before available strongly intimated at the role of ocean-earth in effecting both large and small scale changes in man's environment The majority of earth-oriented sensors however, have been multi-discipline sensors With the launch of three new satellites in 1978, Seasat-A, Nimbus-G, and TIROS-N, sensors dedicated solely to obtaining oceanic measurements from space will be in earth orbit The six ocean-specific sensors that will be

on Seasat-A and Nimbus-G are described along with details of the on-going effort to develop techniques and applications designed to further understanding of air-sea interactions and processes The success of these instruments to adequately characterize sea surface wind speed and direction, shallow and deep ocean waves and spectra, sea surface temperature and geodesy, in the presence of clouds, will create a sharp focus on the potential of the space view in meeting specific oceanic data needs (Author)

A78-13657 * # A multispectral analysis of algal bloom in the Gulf of Mexico. W R Johnson (Lockheed Electronics Co , Inc , Houston, Tex) and D R Norris (Florida Institute of Technology, Melbourne, Fla) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 39-42 NASA-supported research (AIAA 77-1565)

Skylab multispectral scanner data acquired on January 21, 1974, were used to study the spectral characteristics of an algal bloom in the Gulf of Mexico west of Fort Myers, Florida Radiance profiles of the water and algae were prepared with data from ten bands of the S192 scanner covering the spectral range from 42 to 2 35 micrometers The high spectral response in the near-infrared spectral bands implies a possible classification and discrimination parameter for detection of blooms of phytoplankton concentrations such as the so-called red tides of Florida (Author)

A78-13658 * # Ocean current surface measurement using dynamic elevations obtained by the GEOS-3 radar altimeter. C D Leitao, N E Huang (NASA, Wallops Flight Center, Wallops Island, Va), and C G Parra (Washington Analytical Services Center, Inc , Pocomoke City, Md) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 43-49 7 refs (AIAA 77-1566)

Remote Sensing of the ocean surface from the GEOS-3 satellite using radar altimeter data has confirmed that the altimeter can detect the dynamic ocean topographic elevations relative to an equipotential surface, thus resulting in a reliable direct measurement of the ocean surface Maps of the ocean dynamic topography calculated over a one month period and with 20 cm contour interval are prepared for the last half of 1975 The Gulf Stream is observed by the rapid slope change shown by the crowding of contours Cold eddies associated with the current are seen as roughly circular depressions (Author)

A78-13660 # An overview of oceanic features and air-sea interaction processes as viewed from the NOAA operational satellites F C Parmenter (NOAA, National Environmental Satellite Service, Washington, D C) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 62-69 11 refs (AIAA 77-1569)

Geostationary and polar-orbiting satellites operated by the National Oceanic and Atmospheric Administration (NOAA) provide continuous monitoring of ocean surface temperatures and marine weather Changes in thermal patterns along the Gulf Stream and in the Gulf of Mexico Loop Current are operationally analyzed Likewise, the boundaries of cold upwelled waters along the equator and off the western coasts of Mexico and the United States can be monitored Local cloud cover, its formation, intensification, and dissipation are affected by the variations in underlying sea surface temperatures Thus, knowledge of detailed sea surface temperature fields can be important to those involved in marine activities (Author)

A78-13662 # 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) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 79-87 13 refs (AIAA 77-1571)

The GEOS-3 satellite carrying a short pulse radar altimeter was launched into orbit around the earth in April 1975 The paper is concerned with methods of determining waveheights from the shape of the GEOS-3 radar return pulse and the corrections that have to be taken into account The effects of timing variations on the shape of the average return pulse shape are discussed in detail Accurate calibration of the sampling gates that measure this shape is found to be particularly critical The waveheights deduced are compared with ground truth derived from ship reports on waveheights in the N E Pacific Ocean and routine measurements made at Ocean Weather Station PAPA It is found that with suitable calibration adjustments, the satellite measurements agree with surface observations to about 5 meters in H 1/3 Coverage from a single satellite is limited, but could still greatly increase the amount of data available for wave forecasting if it were available within a short time (less than 4 hours) of the satellite overpass (Author)

A78-13663 # Determination of design and operational criteria for offshore facilities. F W Rose (Continental Oil Co , Houston, Tex) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 122-125 (AIAA 77-1577)

Environmental data acquisition has become an important factor for the oil and gas industries in terms of offshore exploration, development, and production Oceanographic-meteorological data requirements and measurement techniques are discussed, noting both real time and historical requirements The application of satellite remote sensing to offshore design and operational criteria determination is suggested It is proposed that an operational remote sensing satellite system employing a few conventional measurement stations for ground truth verification may provide global oceanographic-meteorological climatology monitoring which would facilitate more precise forecasting capability S C S

A78-13664 # Satellite application to data buoy requirements J G McCall, E G Kerut (NOAA, Data Buoy Office, Bay St Louis, Miss), and G Haas (Sperry Rand Corp , Sperry Support Services, Bay St Louis, Miss) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 135-144 (AIAA 77-1580)

Satellites have been applied to data buoy projects by the NOAA Data Buoy Office (NDBO) using both geostationary and orbiting satellites for such applications Among the procedures carried out by such systems are actual data telemetry for drifting buoys and position determination for both moored and drifting buoys Various types of payloads are currently being operated by NDBO, including prototype environmental buoy payloads, Phase I-II payloads, and the CSBP payload Communications requirements for the NDBO programs are identified for various weather forecasting groups and for the needs of the scientific community Generally, conventional HF or satellite communications techniques are used for the NDBO satellites having over-the-horizon link requirements It is found that the GOES series adequately serves the needs of the general public, and that the NIMBUS-6/Tiros-N series is adequate for the scientific community S C S

A78-13665 # Ocean mining requirements B J Livesay, A Steen, and R L DeMott (Kennecott Exploration, Inc , San Diego, Calif) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 145-148 (AIAA 77-1581)

Deep ocean mining is discussed in terms of procedures to determine potential mine site locations, deep ocean mining equipment, nodule and plow-type collectors, lift systems, and port and

processing facilities Satellite support of deep ocean mining projects is presented, noting that such support may be developed in three areas navigation, weather observations and predictions, and communication The integration of satellite technology and deep ocean mining may have significant applications to global supplies of mineral resources S C S

A78-13666 * # Applications of Seasat to the offshore oil, gas and mining industries. A G Mourad and A C. Robinson (Battelle Columbus Laboratories, Columbus, Ohio) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers
New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 149-156 12 refs Contract No NASw-2800 (AIAA 77-1583)

The NASA satellite Seasat-A (to be launched in 1978) has applications to the offshore oil, gas, and mining industries including (1) improvements in weather and wave forecasting, (2) studies of past wind and wave statistics for planning design requirements, and (3) monitoring ice formation, breakup, and movement in arctic regions The primary geographic areas which will be monitored by Seasat-A include the Beaufort Sea, the Labrador Sea, the Gulf of Mexico, the U S east coast, West Africa, Equatorial East Pacific, the Gulf of Alaska, and the North Sea Seasat-A instrumentation used in ocean monitoring consists of a radar altimeter, a radar scatterometer, a synthetic aperture radar, a microwave radiometer, and a visible and infrared radiometer The future outlook of the Seasat program is planned in three phases measurement feasibility demonstration (1978-1980), data accessibility/utility demonstration (1980-1983), and operational system demonstration (1983-1985) S C S.

A78-13669 * # On the hysteresis of the sea surface and its applicability to wave height predictions C L Parsons (NASA, Wallops Flight Center, Wallops Island, Va) In Satellite applications to marine technology; Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers
New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 174-181 8 refs (AIAA 77-1588)

Because of the low dissipation rate of wave energy on the ocean's surface, the wave height at some location and time must be dependent upon wind fields in existence there at previous times and upon swell propagated there from other regions To study these relationships, significant wave height (SWH) measurements from the Geos-3 radar altimeter are used in conjunction with anemometer windspeed measurements from weather ships, L, C, and R During the passage of large cyclonic disturbances near the fixed locations of these vessels in the North Atlantic in February 1976, distinct hysteresis profiles that characterize the sea's memory during generation and dissipation conditions are observed Examples are given that demonstrate the influences of cyclone intensity, movement, velocity, and shape on the configuration of these profiles (Author)

A78-13670 # Some aspects of the mixed layer of the upper ocean J M Bergin (U S Navy, Naval Research Laboratory, Washington, D C) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 182-186 8 refs (AIAA 77-1590)

The main problem of satellite oceanography is to deduce from measurements of properties at the sea surface characteristics of the ocean below The near surface mixed layer is a prime candidate for study Data indicate that models of the mixed layer must include thermohaline forcing as well as wind forcing As an example of the conditions wherein these forces appear to control the spatial variation of the mixed layer depth, we consider a model of the mixed layer in the trade wind zone of the North Pacific during the summer heating period (Author)

A78-13671 # Analysis of the marine environment in DMSP imagery focusing on island barrier effects R W Fett (U S Naval Environmental Prediction Research Facility, Monterey, Calif) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 188-192 12 refs (AIAA 77-1596)

Analysis of Defense Meteorological Satellite Program (DMSP) visible data over oceanic areas reveals that many important features of the marine planetary boundary layer can often be directly determined or inferred from these data Low level moisture in hazy marine areas is well-revealed in DMSP visible data, although generally poorly revealed in data from other systems such as the NOAA and GOES series Island barrier effects, creating dry lee wakes are directly observed, as are dry areas in the other regions of pronounced subsidence In enhanced infrared imagery, the dry areas yield a warmer response than adjacent moist areas due to reduced cooling effects of water vapor absorption The island wake patterns have, in many recent papers, been ascribed to reduced sea state rather than decreased moisture This paper presents evidence that the sea state effect extends only a short distance to the lee of the island barrier and that the major portion of the wake effect is atmospheric in nature (Author)

A78-13672 * # The use of Landsat for monitoring water parameters in the coastal zone D E Bowker and W G Witte (NASA, Langley Research Center, Hampton, Va) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 193-198 5 refs (AIAA 77-1597)

Landsats 1 and 2 have been successful in detecting and quantifying suspended sediment and several other important parameters in the coastal zone, including chlorophyll, particles, alpha (light transmission), tidal conditions, acid and sewage dumps, and in some instances oil spills When chlorophyll a is present in detectable quantities, however, it is shown to interfere with the measurement of sediment The Landsat banding problem impairs the instrument resolution and places a requirement on the sampling program to collect surface data from a sufficiently large area A sampling method which satisfies this condition is demonstrated (Author)

A78-13673 # A low-cost system for reception, processing and distribution of line-scan data from environmental satellites. D W Seymour, D S Sloan, and N W Bowker (MacDonald, Dettwiler and Associates, Ltd , Vancouver, Canada) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers
New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 199-208 (AIAA 77-1598)

A small self-contained readout station for earth observation satellites has been developed for weather forecasting, oceanographic research and monitoring of Arctic ice conditions The system was designed to receive, digitize, store, process and distribute image data from a variety of sources, including the NOAA/VHRR series, and future environmental satellites, e g , Meteosat, GMS and Tiros-N/AVHRR Under the control of a single operator, it produces black and white images and computer-compatible tapes (CCT's) of all relevant data at real-time rates Processing facilities include electronic enlargement, geometric linearization and interactive radiometric enhancement, with distribution of data to remote users via standard 120 lpm facsimile output (Author)

A78-13674 # Remote sensing of ocean temperature. E P McClain and P G Abel (NOAA, National Environmental Satellite Service, Washington, D C) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p. 209-217 26 refs (AIAA 77-1599)

Operational environmental satellites take infrared measurements of ocean surface temperatures of two types hemispherically or globally mapped temperature fields of low spatial and temporal

resolution, and regionally or locally mapped temperature fields of high resolution in space and time Current NOAA sea-surface temperature products include Gulf Stream analysis, GOES image sectors, and Great Lakes surface temperature charts Future developments in satellite-derived sea-surface temperatures are identified, such as a polar-orbiting operational environmental satellite, the prototype of which is Tiros-N This satellite will carry an advanced *very high resolution radiometer designed for ocean surface temperature* mapping S C S

A78-13675 # **Real time satellite imagery for sea ice forecasting** E G Morrissey (Department of the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 218-223 (AIAA 77-1601)

The Atmospheric Environment Service has developed a flexible HRPT direct read-out/processing system to satisfy some of the satellite imagery requirements of weather and ice forecasting services and research programs The system digitizes the analogue HRPT signal and uses mini-computers to process the data and to convert it into a form suitable for land line transmissions The paper concentrates on the development of that part of the system which provides specially enhanced imagery to the Canadian Ice Central where the data are used in the production of sea ice analyses and forecasts (Author)

A78-13676 # **Sea surface temperature gradient analysis from digital meteorological satellite data** M P Waters, III (NOAA, National Environmental Satellite Service, Washington, D C) and S R Baig (NOAA, National Environmental Satellite Service, Miami, Fla) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 226-229 5 refs (AIAA 77-1604)

The two geostationary meteorological satellites operated by the National Environmental Satellite Service (NESS) view the earth's disk through *Visible and Infrared Spin Scan Radiometer* (VISSR) instruments The digital data from the VISSR on the Eastern and Western satellites (GOES-2 at 75 deg W longitude and SMS-2 at 135 deg W longitude both over the equator) are processed into an experimental VISSR digital Data Base (VDB) Data from the VDB are time-composited to produce a computer-formatted sea surface thermal display at 7-km resolution The product is produced on the National Oceanic and Atmospheric Administration (NOAA) computer in Maryland and printed at the Satellite Field Service Stations (SFSS) where the data are being evaluated for realtime application The technique of time compositing, samples of the gradient analysis, and results of its field use are presented (Author)

A78-13679 # **Space instruments for oceanography.** J J Horan (General Electric Co , Philadelphia, Pa) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 239-248 (AIAA 77-1612)

A number of major space programs (including Tiros, Nimbus, Seasat, and to a somewhat lesser extent GOES and Landsat) have earth observatory sensors on board that have been used to measure oceanographic parameters Some of the more recent sensors are specifically designed for the measurement of certain oceanographic parameters while other earlier instruments have, by the nature of the radiation that they measure, been able to be used in oceanographic studies This paper briefly describes each instrument, dwelling more heavily on the newer instruments as an introduction to the detailed paper in this and the next session A brief overview is also presented in this paper on the oceanographic parameters versus the measurable quantity (radiation) and some of the problems of radiometric calibration at the spacecraft level and the impact on the parameter of interest (Author)

A78-13681 # **Future onshore and offshore exploration by remote sensing from space** F B Henderson, III (Geosat Committee, Inc , San Francisco, Calif) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 264-275 (AIAA 77-1550)

Geological remote sensing from satellites is discussed in terms of its advantages such as synoptic perspective, global coverage, regional mapping, and improved efficiency The limitations of such programs are identified, including insufficient resolution, limited stereoscopic capability, and restricted number of available spectral bands Future additions to geological remote sensing programs are expected to consist of a Stereosat system, the inclusion of the 2 2 micron band, a large format camera, and synthetic aperture and side looking radars Other satellite systems under development by NASA include Lageos, Seasat-A and B, SIR A and B, Heat Capacity Mapping Missions, Magsat, SMIRR, and a Global Positioning Satellite S C S

A78-13682 * # **Seasat-A and the commercial ocean community** D R Montgomery (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) and P Wolff (Ocean Data Systems, Inc , Monterey, Calif) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 276-284 (AIAA 77-1591)

The Seasat-A program has been initiated as a 'proof-of-concept' mission to evaluate the effectiveness of remotely sensing oceanology and related meteorological phenomena from a satellite platform in space utilizing sensors developed on previous space and aircraft test programs The sensors include three active microwave sensors, a radar altimeter, a windfield scatterometer, and a synthetic aperture radar A passive scanning multifrequency microwave radiometer, visual and infrared radiometer are also included All weather, day-night measurements of sea surface temperature, surface wind speed/direction and sea state and directional wave spectra will be made Two key programs are planned for data utilization with users during the mission Foremost is a program with the commercial ocean community to test the utility of Seasat-A data and to begin the transfer of ocean remote sensing technology to the civil sector A second program is a solicitation of investigations, led by NOAA, to involve the ocean science community in a series of scientific investigations (Author)

A78-13683 * # **Marine decision aids from space** R G Nagler, R Durstenfeld (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif), and S W McCandless (NASA, Office of Applications, Washington, D C) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 285-294 5 refs Contract No NAS7-100 (AIAA 77-1611)

The article discusses satellite observation of marine environments via microwave sensors and visible/infrared measurements Specific applications include the monitoring of physical oceanography, weather and climate, coastal processes, ice processes, and resource use management Four types of information delivery systems are identified direct-to-user, regional/local user, global modeling user, and research user modes Current developments in the marine information system include onboard correlation of synthetic aperture radar images at 10 to 100 m resolutions, and the extraction of wave, ship, iceberg or areal feature information from the image or signal before correlation S C S

A78-13687 # **Application of satellite-borne synthetic aperture radar to marine operations** W T Eaton and A C Munster (Lockheed Missiles and Space Co , Inc , Sunnyvale, Calif) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers Conference sponsored by AIAA, AMS, AGU, IEEE, MTS, and SEG

New York, American Institute of Aeronautics and Astronautics, Inc , 1977 9 p 10 refs (AIAA 77-1610)

Synthetic Aperture Radar (SAR) is Seasat-A's most demanding, yet promising sensor providing all weather, high resolution images SAR differs from more conventional imaging sensors (operating in the visible/infrared spectra) It is an active microwave radar The data processing and image assembly is complex and differs from current imagers The ocean's dynamics and needs of the oceans' users require rapid data processing and dissemination Applications of SAR data for marine users are discussed The principles of SAR and the challenges of SAR processing are described Planned Seasat A SAR optical data processing plans are described and compared with digital data correlation techniques Real-time SAR image processing on the ground, at the user's facility or even on-board satellites for direct image transmission will be required in the future to satisfy the real needs of the marine using community (Author)

A78-13803 * Atmospheric transformation of solar radiation reflected from the ocean M S Malkevich, L G Istomina, and W A Hovis, Jr (NASA, Goddard Space Flight Center, Greenbelt, Md , Akademiia Nauk SSSR, Institut Fiziki Atmosfery, Moscow, USSR) *(Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana,* vol 13, Jan 1977, p 21-34) *Academy of Sciences, USSR, Izvestiya, Atmospheric and Oceanic Physics,* vol 13, Aug 1977, p 13-21 9 refs Translation

Airborne measurements of the brightness spectrum of the Atlantic Ocean in the wavelength region from 0 4 to 0 7 micron are analyzed These measurements were made over a tropical region of the Atlantic from an aircraft at heights of 0 3 and 10 5 km during the TROPEX-72 experiment The results are used to estimate the contribution of the atmosphere to the overall brightness of the ocean-atmosphere system It is concluded that (1) the atmosphere decreases the absolute brightness of the ocean by a factor of 5 to 10 and also strongly affects the spectral behavior of solar radiation reflected from the ocean surface, (2) the atmospheric contribution to overall brightness may vary considerably under real conditions, (3) finely dispersed particles and Rayleigh scattering affect the spectral distribution of solar radiation, and (4) the spectral composition of ocean-atmosphere brightness may be completely governed by the atmosphere F G M

A78-13899 # The floor structure of the southwest Pacific Ocean (Stroenie dna morei iugo-Zapadnoi chasti Tikhogo Okeana) A E Suziumov Moscow, Izdatel'stvo Nauka, 1977 76 p 135 refs In Russian

Research on island arc crustal structures and marginal seas in the southwestern part of the Pacific Ocean is summarized The distribution of geophysical field anomalies and regional deep structure and tectonics are described Geophysical data on deep-sea trenches are presented, and these trenches are classified Areas considered include New Guinea, New Zealand, the Tasman and Coral Seas, New Hebrides and South Fiji basins, and New Guinea structures and Solomon sea basin Mesocenozoic tectogenesis of the region is discussed, it was found that this later tectogenesis overlaps and destroys, on the outer side, the paleozoic pattern M L

A78-14126 * Ocean wave patterns under Hurricane Gloria - Observation with an airborne synthetic-aperture radar C Elachi, T W Thompson, and D King (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) *Science,* vol 198, Nov 11, 1977, p 609, 610 11 refs Contract No NAS7-100

Surface imagery of ocean waves under Hurricane Gloria (September 1976) has been obtained with an airborne synthetic-aperture imaging radar Observations were obtained over most of the area within a radius of 150 kilometers around the center of the eye These direct observations made it possible to derive the wave patterns in the region around a hurricane eye (Author)

A78-14793 # Current and future satellites for oceanic monitoring J W Sherman, III (NOAA, National Environmental Satellite Service, Washington, D C) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 279-297 17 refs

The remote sensing characteristics of current satellites used for oceanic monitoring are described, and the missions of future satellites, including Seasat-A, Nimbus-G, and Tiros-N are explained Availability of their data is considered Some oceanic monitoring instruments and the applications of their data are discussed, these instruments include the radar altimeter, scatterometer, radar imager, microwave radiometer, and colorimeter A survey of the goals of oceanic monitoring is presented M L

A78-14820 # Present and future operational NOAA satellite oceanographic products - An introduction J K Kalinowski, T L Signore, W G Pichel, C C Walton, R L Brower, S R Brown, and K G Bennekamper (NOAA, National Environmental Satellite Service, Suitland, Md) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 625-633 21 refs

A review of operational satellite-derived NOAA/NESS oceanographic products is presented and some current applications of these products are noted Recent improvements to procedures used in deriving sea surface temperature observations and fields are described Changes to data reduction techniques and products which will be incorporated with the advent of Tiros-N are outlined and some potential future developments are mentioned (Author)

A78-14821 # Polarimeter measures sea state characteristics using emitted infrared radiation W G Egan and T Hilgeman (Grumman Aerospace Corp , Bethpage, N Y) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 635-644 12 refs

An infrared polarimeter, capable of operating between 1 and 12 micrometers wavelength has been used to measure the polarization of emitted radiation from the sea The observed polarization at 10 6 micrometers from a smooth sea was found to be positive, indicating the dominance of reflected infrared sky radiation over the emitted With the appearance of waves, the percent polarization increased, as expected, for a zenith angle well above the Brewster angle for water This is qualitatively in accordance with a model presented to explain the behavior Initial analyses indicate that the polarized components of the sea's emitted and reflected radiation are affected by type and direction of waves, angle of viewing, and foam The effects of variations in these parameters require further delineation The infrared polarimetric technique appears to be a novel new passive method for remote monitoring of waves (Author)

A78-14822 # Scatterometer results from shorefast and floating sea ice L Gray, J Cihlar, S Parashar (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and R Worsfold (Centre for Cold Ocean Resources Engineering, St John's, Canada) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 645-657 19 refs

A78-14840 # Study of the Brazil and Falkland currents using THIR images of Nimbus V and oceanographic data in 1972 to 1973. Y C Tseng, H M Inostroza, and R Kumar (Instituto de Pesquisas Espaciais, São José dos Campos, São Paulo, Brazil) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 859-871 25 refs

A78-14855 # **Remote sensing of ocean color and detection of chlorophyll content** P Y Deschamps, P Lecomte, and M Viollier (Lille I, Université, Villeneuve-d'Ascq, Nord, France) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1021-1033 18 refs Translation Research supported by the Centre National pour l'Exploitation des Océans

The chlorophyll enrichment of the water in an equatorial upwelling was surveyed and described during two one month periods in 1975 and 1976 with the aid of a radiometer specially designed for the airborne measurement of ocean color Based upon the results of this experiment and some theoretical considerations, a relation is proposed between airborne measurement of difference of albedos at two wavelengths in the blue and green, and the concentration of cholorophyll in the ocean (Author)

A78-14875 * # **Evaluation of change detection techniques for monitoring coastal zone environments** R A Weismiller, S J Kristof, D K Scholz, P E Anuta, and S M Momin (Purdue University, West Lafayette, Ind) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1229-1238 11 refs Contract No NAS9-14016

Procedures for detecting changes in Landsat multispectral scanning imagery of coastal zone environments are discussed Four detection procedures are examined a comparison of independently produced spectral classifications, a classification of a multispectral difference data set, a single analysis of a multidate data set, and a maximum likelihood classification using multistage decision logic The relatively complex maximum likelihood classification technique was found to yield results closest to those obtained with the comparison of independently produced spectral classifications, the chosen standard J M B

A78-14878 * # **Airborne Oceanographic Lidar System** C Bressel, I Itzkan, J E Nunes (Avco Everett Research Laboratory, Inc , Everett, Mass), and F Hoge (NASA, Wallops Flight Center, Wallops Island, Va) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1259-1268

The Airborne Oceanographic Lidar (AOL), a spatially scanning range-gated device installed on board a NASA C-54 aircraft, is described The AOL system is capable of measuring topographical relief or water depth (bathymetry) with a range resolution of plus or minus 0 3 m in the vertical dimension The system may also be used to measure fluorescent spectral signatures from 3500 to 8000 A with a resolution of 100 A Potential applications of the AOL, including sea state measurements, water transparency assessments, oil spill identification, effluent identification and crop cover assessment are also mentioned J M B.

A78-14912 # **Surface temperatures and temperature gradient features of the U S Gulf coast waters** O K Huh, L J Rouse, Jr , and G W Smith (Louisiana State University, Baton Rouge, La) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1609-1618 Navy-supported research

Satellite thermal infrared data on the Gulf of Mexico show that a seasonal cycle exists in the horizontal surface temperature structure In the fall, the surface temperatures of both coastal and deep waters are nearly uniform With the onset of winter, atmospheric cold fronts, which are accompanied by dry, low-temperature air and strong winds, draw heat from the sea Penetrative convection and wind-driven mixing lower temperatures, first in the shallowest waters and then, as the winter season progresses, in deeper and deeper portions of the Gulf A band of cooler water forming on the inner shelf expands, until a thermal front develops seaward along the shelf break between the cold shelf waters and the warmer deep waters of the Gulf Digital analysis of the satellite data has been carried out in an interactive mode using a minicomputer and software developed at the Coastal Studies Institute A time series of temperature profiles illustrates the temporal and spatial changes in the sea-surface temperature field (Author)

A78-17198 * **Change detection in coastal zone environments** R A Weismiller, S J Kristof, D K Scholz, P E Anuta, and S A Momin (Purdue University, West Lafayette, Ind) *Photogrammetric Engineering and Remote Sensing,* vol 43, Dec 1977, p 1533-1539 11 refs Contract No NAS9-14016

A study was conducted with the objective to develop and evaluate various change detection techniques based upon computer-aided analysis of Landsat multispectral scanner (MSS) data to monitor coastal zone environments The study site selected includes a portion of the Matagorda Bay estuarine system located along the Texas Coast The principal data sources for the study were MSS data collected on November, 27, 1972 and February 25, 1975 The MSS data were processed and a multidata eight-channel data set at a scale of 1 24,000 was obtained A description is presented of four change detection techniques which were designed and implented for evaluation, taking into account postclassification comparison change detection, delta data change detection, spectral/temporal change classification, and layered spectral/temporal approach The results of the investigation are discussed G R

A78-17326 **Synoptic observations of the oceanic frontal system east of Japan** R E Cheney (U S Naval Oceanographic Office, Washington, D C) *Journal of Geophysical Research,* vol 82, Nov 20, 1977, p 5459-5468 14 refs

A78-17648 **Norwegian marine geodetic projects** J C Blankenburgh, B A Fossum, P A Osterholt, and H O Torsen (Continental Shelf Institute, Trondheim, Norway) *Marine Geodesy,* vol 1, no 2, 1977, p 125-145 11 refs

The hitherto promising finds of oil and gas on the Norwegian continental shelf have increased the general activity in this area considerably Consequently, the need for better charts and more precise navigational systems have become more pertinent During the past few years a number of marine geodetic projects have either been planned or embarked upon by various organizations within both the public and private sectors The article gives a brief review of the Norwegian projects which have special relevance to marine geodesy, this includes the following areas recommendations, requirements, precision navigation, satellite positioning, reference systems, boundary problems, bathymetry, geological mapping, marine geoid determination, and data base developments S C S

A78-17650 **Preliminary differences in mean water level between tide gauges along the South American Pacific coast** J A Bray (U S Defense Mapping Agency, Topographic Center, Washington, D C) *Marine Geodesy,* vol 1, no 2, 1977, p 177-197

A78-17982 **Objective analysis and classification of oceanographic data** J B Jalickee (NOAA, Center for Experiment Design and Data Analysis, Washington, D C) and D R Hamilton (NOAA, National Oceanographic Data Center, Washington, D C) *Tellus,* vol 29, Dec 1977, p 545-560 7 refs

A new approach to the analysis and classification of oceanographic data is presented The technique is an empirical one, based on the singular decomposition theorem, for characterizing temperature-salinity-depth profiles as in water mass analysis Complementary to the profiles are station or cast-dependent coefficients, which show similarities and differences according to the space-time distributions of the individual stations in the data set These coefficients are used for classifying the individual stations into groups having similar profiles Results of applying the new method to a set of data from ocean stations off the coast of Oregon are given (Author)

A78-18246 * **A multispectral analysis of the interface between the Brazil and Falkland currents from Skylab** W R Johnson (Lockheed Electronics Co , Inc , Houston, Tex) and D R Norris (NASA, Johnson Space Center, Houston, Tex) *Remote Sensing of Environment,* vol 6, no 4, 1977, p 271-288 15 refs NASA-supported research

Skylab multispectral scanner data acquired on September 2, 1973, were used to study the spectral signature of the water at the confluence of the Falkland and the Brazil currents off the east coast of Argentina The boundary between the two currents is sharply defined in the thermal band (10 2-12 5 microns), a gradient of 1 C per 67 m exists locally at the boundary Using the visible bands centered at 0 485 and 0 54 micron, this study establishes that water color analysis of boundary waters must first confirm that the sea states on both sides of the boundary do not contaminate the data with sun glitter (Author)

A78-19850 # **Soviet studies of the Arctic and Southern Oceans in the current stage (Sovetskie issledovaniia Severnogo Ledovitogo i luzhnogo okeanov na sovremennom etape)** A F Treshnikov (Glavnoe Upravlenie Gidrometeorologicheskoi Sluzhby SSSR, Arkticheskii i Antarkticheskii Nauchno-Issledovatel'skii Institut, Leningrad, USSR) *Meteorologiia i Gidrologiia,* Nov 1977, p 91-99 12 refs In Russian

Attention is given to Soviet oceanographic research in polar regions The first stage of research, 1920-1950, consisted of investigating the Arctic Basin, drifting masses of ice, and the hydrometeorological cycle of the Arctic Ocean and adjacent seas The second stage, 1951-1970, concentrated on the structure of water masses, the basic features or Arctic relief, the regularities in the formation, dynamics, and breakage of the ocean ice cover, ice drifts in the Arctic Basin, and the regularities and variations of thermal flow S C S

A78-20055 * **Spectral structure of the solar radiation field reflected by the ocean-atmosphere system** M S Malkevich, L G Istomina (Akademiia Nauk SSSR, Institut Fiziki Atmosfery, Moscow, USSR), and W A Hovis, Jr (NASA, Goddard Space Flight Center, Greenbelt, Md) *(Akademiia Nauk SSSR, Izvestiia, Fizika Atmosfery i Okeana,* vol 13, Feb 1977, p 153-162) *Academy of Sciences, USSR, Izvestiya, Atmospheric and Oceanic Physics,* vol 13, Sept 1977, p 107-113 6 refs Translation

The statistical characteristics of the spectral structure of the brightness field of the ocean/atmosphere system are determined from the spectra of incident radiation and the radiation reflected from the ocean, obtained from aircraft (Conveyor 990) at heights of 0 3 and 10 km above the Atlantic Ocean Analysis of the spectral structure reveals a weak correlation between atmospheric brightness variations in the 0 4 to 0 5 micron and 0 55 to 0 70 micron regions of the spectrum This is attributed to the possible influence of variations of the scattering coefficient or optical thickness on the brightness variations (whose sign depends on the predominance of damping or multiple scattering in a given spectral region) V P

A78-20169 # **Systems approach to ice reconnaissance - A study** J W Patchell (Computing Devices Co , Ottawa, Canada) and H G Hengeveld (Department of Fisheries and the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada) *(Canadian Remote Sensing Society, Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb 21 23, 1977) Canadian Journal of Remote Sensing,* vol 3, Dec 1977, p 28-39, Discussion, p 39, 40

Sensors used in ice reconnaissance aircraft are considered, and the assimilation of the data into an effective format for both real time applications in ship support as well as long-term ice information is discussed SLAR is thought to be the principal sensor because of its wide swath and all weather capability A simulation study of the integrated approach to ice map compilation is reported with attention to data compression techniques, data enhancement, and display integration Three systems, a digital television ice mapping system, a hybrid ice mapping system, and an analog ice mapping system, are compared The hybrid system, which provides both digital display technology and hard copy dry silver processed techniques, is regarded as the best approach M L

A78-20485 **Use of radio-controlled miniature aircraft for marine atmosphere sampling** F R Hess (Woods Hole Oceanographic Institution, Woods Hole, Mass) *Marine Chemistry,* vol 5, July 1977, p 297-302 NSF Grant No OCE-76-15627, Contract No E(11-1)-3563

The use of Radio-Controlled Miniature aircraft by the Woods Hole Oceanographic Institution for obtaining marine air samples is discussed The particular requirements for gaseous as well as large-volume particulate sampling are discussed and at-sea tests performed from the R/V 'Knorr' are described Handling and logistics of use as well as aircraft characteristics are discussed (Author)

N78-10344*# Kansas Univ , Lawrence Remote Sensing Lab

RADAR SYSTEMS FOR A POLAR MISSION, VOLUME 1 Final Report

R K Moore, J P Claassen, R L Erickson, R K T Fong, M J Komen, J McCauley, S B McMillan, and S K Parashar Feb 1977 88 p refs

(Contract NAS5-22325)

(NASA-CR-156640, RSL-TR-291-2-Vol-1) Avail NTIS HC A05/MF A01 CSCL 17I

Use of radar is indicated for observation of phenomena in the polar regions The present status is reviewed of radar observation of sea ice (quasi-operational from aircraft), glaciers (little known), and icebergs (feasible but little research, and problems in discriminating icebergs from ships) Techniques for satellite observation are presented, with emphasis on use of a Scanning Synthetic-Aperture Radar (SCANSAR) of modest resolution to achieve the wide swathwidth required for frequently repeated coverage Methods for processing SCANSAR data onboard the satellite were investigated and some 5 methods appear feasible at the present time although more research is needed Use of CCD and SAW devices appears particularly promising in the achievement of low-power-consumption processors but the rapid advancement of the digital art means that sampled-data analog processors using CCD and MOS devices must continually be compared with their digital competitors to determine which is best at the time a design decision must be made Author

N78-10527 Texas A&M Univ , College Station

MONITORING AQUATIC PLANTS IN TEXAS Ph D Thesis

Arthur Robert Benton, Jr 1976 331 p

Avail Univ Microfilms Order No 77-12526

Tandem 70mm aerial photography, using color and color infrared film was tested extensively Emersed aquatic plant species were found to be readily differentiable on color infrared film, the submersed species somewhat less so Areal spread of emersed species was easily delineated on color infrared imagery Equivalent results were obtained with submersed species delineation by using high-speed color film coupled with a 500mm filter for improved water penetration Color infrared photography was found to be particularly useful for recording sequential herbicide effects such as change in size of the stressed area, rate of stunting or killing off of the plant mat, period before regrowth and rate of regrowth into the cleared area The cost of a monitoring system for the state of Texas is shown to be quite low Dissert Abstr

N78-10532*# Norsk Polarinstitutt, Oslo

GLACIOLOGICAL AND MARINE BIOLOGICAL STUDIES AT PERIMETER OF DRONNING MAUD LAND, ANTARCTICA Final Report

Olav Orheim, Principal Investigator Jun 1977 20 p refs Sponsored by NASA Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls S D ERTS

(E78-10006, NASA-CR-155210) Avail NTIS HC A02/MF A01 CSCL 08L

The author has identified the following significant results A nearly complete map of the Dronning Land coastline from 10 deg W to 29 deg E was produced Based on this, it was determined that for the past 20 years, the minimum calving rate from this part of the coastline was 60 cu km/year The drift speeds were measured for ice floes and bergs between 9 and 20 km/day, and it was found that the number of ice floes of a given size decrease exponentially with size, so that each size class covers approximately the same area A large melt phenomena at blue ice fields around 70 deg 45' S and 26-29 deg E was discovered

N78-10674# Numerical Computational Corp , Stony Brook, N Y
A NUMERICAL ALGORITHM FOR REMOTE SENSING OF OCEAN DENSITY PROFILES BY ACOUSTIC PULSES Final Report, 1 Jun 1976 - 31 Jan. 1977
Yung Ming Chen and Dar Sun Tsien 1 Feb 1977 36 p refs
(Contract N00014-76-C-0804)
(AD-A042372, NCC-1) Avail NTIS HC A03/MF A01 CSCL 08/10

An iterative algorithm for solving nonlinear inverse problems in remote sensing of ocean density profiles by acoustic pulses is developed The basic idea of this new algorithm is that first, the original pulse problem in the time-domain is reduced to a continuous wave problem in frequency-domain and then the nonlinear inverse problem in frequency-domain is solved by a hybrid of a Newton-like iterative method, Backus and Gilbert linear inversion technique, and the finite difference method This new computational algorithm is tested by numerical simulations with given data from ten different frequencies and is found to give excellent results GRA

N78-10675# Naval Supply Systems Command, Washington, D C
PRELIMINARY EASTERN INDIAN OCEAN GEOID FROM GEOS-3 DATA
Samuel L Smith III and Alan C Chappell Jun 1977 31 p refs
(AD-A043788, NSWC/DL-TR-3668) Avail NTIS HC A03/MF A01 CSCL 08/5

Ninety-four passes of GEOS-3 short pulse radar altimetry data taken in July-August 1975 over the eastern Indian Ocean (by the DoD telemetry station at Perth, Australia) have been analyzed to arrive at a preliminary ocean geoid The self consistency of the data at track intersections has a mean geoid height difference of 75 cm with a standard deviation of 2 3 meters with normal processing Application of bias removal techniques reduced the mean geoid height difference to 9 cm and improves the self consistency of the results to a standard deviation of less than 1 m A comparison of the GEOS-3 Geoid is made with the NASA Marsh and Chang 1976 Geoid The GEOS-3 Geoid correlates well with the larger features of the local bottom topography Author (GRA)

N78-10678# Environmental Research Inst of Michigan, Ann Arbor Radar and Optics Div
ANALYSIS OF SYNTHETIC APERTURE RADAR OCEAN WAVE DATA COLLECTED AT MARINELAND AND GEORGES BANK Final Report
Robert A Shuchman, Robert F Rawson and Eric S Kasischke Apr 1977 171 p refs
(Grant NOAA-04-6-158-44078)
(PB-268675/6, Rept-123000-11-F, NOAA-77052503) Avail NTIS HC A08/MF A01 CSCL 08C

Processing and analysis of data collected by the ERIM X-L imaging radar was carried out to extract useful information about ocean waves A focusing algorithm was developed and backscatter measurements were made using an optical processor A number of conclusions were made, including (1) the 180 degrees wave-direction ambiguity can be resolved by a study of defocusing in the processor, (2) the modulation depth is greater for X-band than for L-band and greater for range-direction waves than for azimuth-direction waves, and (3) X-band (HH) L-band (HH), and L-band (HV) produce significant backscatter GRA

N78-11292# Helsinki Univ of Technology, Espoo (Finland) Radio Lab
MICROWAVE EMISSION FROM SEA ICE
Surendra K Parashar 1976 19 p refs
(Rept-S-90 ISBN-951-750-797-6) Avail NTIS HC A02/MF A01

The available literature on microwave emission from sea ice is reviewed Sections are included on the formation of sea ice and its relevant characteristics radiometry theory and theory of emission Some of the past radiometric measurements of sea ice are given In addition different methods which can be used to analyze the radiometric data are presented Author (ESA)

N78-11491# Naval Oceanographic Office Washington D C
AERIAL ICE RECONNAISSANCE AND SATELLITE ICE INFORMATION MICROFILM FILE 1976, SUPPLEMENT 1
Peter A Mitchell May 1977 17 p refs
(AD-A043046, NOO-RP-17(76)-Suppl-1) Avail NTIS HC A02/MF A01 CSCL 08/12

Between 1953 and 1974 the Naval Oceanographic Office (NAVOCEANO) presented historical synoptic ice data gathered during U S Navy U S Coast Guard, and Danish polar operations conducted from 1952 through 1971 in its annual reports of both the Arctic and Antarctic ice observing and forecasting programs (Naval Oceanographic Office 1953-1974) These publications provided in chart form ice conditions observed by aerial reconnaissance and interpreted from satellite imagery for the eastern and western sectors of the North American Arctic and in selected portions of the seas surrounding the Antarctic Continent These series of reports terminated with the 1969 and 1971 annual reports for the Antarctic and Arctic, respectively This supplement lists all available microfilm imagery of ice data gathered and subsequently added to the Aerial Ice Reconnaissance and Satellite Ice Information Microfilm File during calendar year 1976 GRA

N78-12492*# Delaware Univ, Newark Coll of Marine Studies
SKYLAB/EREP APPLICATION TO ECOLOGICAL,GEOLOGICAL, AND OCEANOGRAPHIC INVESTIGATIONS OF DELAWARE BAY Final Report, Jun. 1973 - Mar. 1976
Vytautas Klemas Principal Investigator, David S Bartlett, William D Philpot, Robert H Rogers (Bendix Aerospace Systems Div , Ann Arbor, Mich), and Larry E Reed (Bendix Aerospace Systems Div , Ann Arbor Mich) May 1976 68 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D EREP
(Contract NAS1-12304)
(E78-10003, NASA-CR-155207, CMS-NASA-1-76) Avail NTIS HC A04/MF A01 CSCL 08C

The author has identified the following significant results Skylab/EREP S190A and S190B film products were optically enhanced and visually interpreted to extract data suitable for mapping coastal land use, inventorying wetlands vegetation, monitoring tidal conditions, observing suspended sediment patterns charting surface currents, locating coastal fronts and water mass boundaries, monitoring industrial and municipal waste dumps in the ocean, and determining the size and flow direction of river, bay and man-made discharge plumes Film products were visually analyzed to identify and map ten land use and vegetation categories at a scale of 1 125,000 Thematic maps were compared with CARETS land use maps, resulting in classification accuracies of 50 to 98% Digital tapes from S192 were used to prepare thematic land use maps The resolutions of the S190A, S190B, and S192 systems were 20-40m, 10-20m, and 70-100m respectively

N78-12500*# National Marine Fisheries Service, Bay Saint Louis, Miss
LANDSAT MENHADEN AND THREAD HERRING RESOURCES INVESTIGATION Final Report
Andrew J Kemmerer, Principal Investigator J T Brucks, J A Butler, K H Faller (NASA National Space Technol Labs , Miss), H J Holley T D Leming, K J Savastano, and T M Vanselous Oct 1977 274 p refs Original contains color imagery Original

photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(NASA Order S-54114)
(E78-10024, NASA-CR-155248, SEFC-Contrib-77-16 MARMAP-Contrib-145) Avail NTIS HC A12/MF A01 CSCL 08A

The author has identified the following significant results The relationship between the distribution of menhaden and selected oceanographic parameters (water color turbidity, and possibly chlorophyll concentrations) was established Similar relationships for thread herring were not established nor were relationships relating to the abundance of either species Use of aircraft and LANDSAT remote sensing instruments to measure or infer a set of basic oceanographic parameters was evaluated Parameters which could be accurately inferred included surface water temperature salinity, and color Water turbidity (Secchi disk) was evaluated as marginally inferrable from the LANDSAT MSS data and chlorophyll-a concentrations as less than marginal These evaluations considered the parameters only as experienced in the two test areas using available sensors and statistical techniques

N78-12632# National Oceanic and Atmospheric Administration Ann Arbor Mich Great Lakes Environmental Research Lab
ON THE USE OF MICROWAVE RADIATION FOR GREAT LAKES ICE SURVEILLANCE
Brenda Blanton Hagman May 1976 18 p refs
(PB-271254/5, NOAA-TM-ERL-GLERL-13 NOAA-77072206) Avail NTIS HC A02/MF A01 CSCL 04B

A method using microwave remote sensing for ice surveillance was investigated Microwave systems were found to be advantageous because they can penetrate cloud cover operate day or night, and provide greater areal coverage at aircraft altitudes than can optical systems Microwave radar can detect a world of edges and interfaces that correspond to relative amounts of backscattered radiation Radar was shown effective in classifying certain ice types conditions, and features, and for aiding ships in ice-covered waters or during severe weather GRA

N78-12644# National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston, Tex
REMOTE SENSING OF OCEANIC PARAMETERS DURING THE SKYLAB/GAMEFISH EXPERIMENT
Kenneth H Faller Nov 1977 43 p refs
(NASA-RP-1012 JSC-S-468) Avail NTIS HC A03/MF A01 CSCL 08J

Efforts to demonstrate the feasibility of using remotely acquired information to assess and monitor the distribution of oceanic gamefish are described Data supplied by Skylab and aircraft surveying an area in the Gulf of Mexico with thermal and optical radiometers and cameras were used in conjunction with oceanographic data provided by surface vessels to explore a relationship between oceanographic parameters and remotely acquired data Thermal scanner imagery and precision radiometric thermometer data obtained by the two aircraft were combined to provide a composite surface temperature map of the test area Spectral radiometer data were studied in conjunction with surface measurements of chlorophyll-a and turbidity, and several models were developed which predicted these two oceanic parameters from the radiance data Contour maps of the chlorophyll-a content and turbidity were developed from the best chlorophyll and turbidity models and from surface measurements Basic problems concerning the remote measurement of the Secchi extinction depth are discussed and suggestions are made for improving the remote measurement turbidity Author

N78-13289# Physical Dynamics, Inc., McLean, Va
THE MAGNETIC FIELD AND MAGNETIC FIELD GRADIENTS OF THE NUC OCEANOGRAPHIC RESEARCH TOWER Final Technical Report, Jan - Dec. 1976
George H Gillespie and Walter N Podney Griffiss AFB, N Y RADC Mar 1977 63 p refs
(Contract F30602-72-C-0494 ARPA Order 1649)
(AD-A045161 PD-76-109, RADC-TR-77-101 FTR-2) Avail NTIS HC A04/MF A01 CSCL 17/6

Measurements were made of the ambient magnetic field and magnetic field gradients near the Naval Undersea Center (NUC) Oceanographic Research Tower This report summarizes the experiment and its results The NUC Tower is located approximately 0 7 miles off the California Coast, near San Diego, and is the proposed site for the shallow water trials of the ARPA Internal Wave Magnetic Sensing (IWMS) experiment The measurements described here were made in order to determine accurately the magnetic field and associated gradients of the NUC tower, so that their significance as a possible source of noise and interference during the IWMS experiment may be assessed An analytic model of the magnetic field of the NUC tower which accurately describes the field and associated gradients is also described GRA

N78-13313# European Space Agency, Paris (France)
MICROWAVE SCATTERING FROM THE SEA SURFACE
Volker Stein Oct 1977 88 p refs Transl into ENGLISH of 'Zur Streuung von Mikrowellen an Meeresoberflaechen' DFVLR, Oberpfaffenhofen, West Ger Report DRL-FB-77-09, 23 Mar 1977 Original report in GERMAN previously announced as N77-32373 Original German report available from DFVLR, Cologne DM 27 40
(ESA-TT-422, DLR-FB-77-09) Avail NTIS HC A05/MF A01

In sensing the ocean surface with microwave methods from a remote platform such as an aircraft, satellite or Spacelab, there arises the problem of describing, in an analytic form, the interaction between electromagnetic wave and water wave The total electrodynamic processes can be represented in compact form by the radar cross section For the derivation of this quantity a classification of surface models with different roughness scales is carried out This facet model is explained in more detail because it is suited to describe composite surfaces and hydrodynamic interaction processes The most important constituent in this model is the average radar cross section per unit area of a statistical surface with small scale roughness This quantity is derived for the case of a perfectly conducting time invariant surface by solving the boundary value problem under approximate realization of the boundary condition Only zero-order and first-order terms in the random coefficients of the surface function are taken into account The extended radar cross section formulas are cited from literature for a lossy and a time varying surface, as well as for depolarization phenomena Author (ESA)

N78-14381 Stanford Univ Calif
DESIGN OF A LASER INTERFEROMETER FOR MEASUREMENT OF EXTREMELY SMALL BIOLOGICAL MOTIONS APPLICATION TO CRAYFISH GIANT AXON Ph D. Thesis
Bruce Colman Hill 1977 118 p
Avail Univ Microfilms Order No 77-18217

The interferometer was used to measure diameter changes in a giant axon from the crayfish Procambarus clarkii which occurred whenever the axon was stimulated to produce an action potential The axon was removed from the animal and gold dust was placed on it to increase its reflectivity It was found that there is a mechanical pulse which has the same all-or-nothing threshold as that of the action potential and has the same velocity The average size of this motion is 10 Angstroms Although most observations showed a contraction in the diameter followed by an expansion, some preparations produced different results, and the exact form of the motion is therefore not yet determined Suggestions for improving the measurement technique were given Dissert Abstr

N78-14484*# National Environmental Satellite Service Washington, D C
CURRENT AND FUTURE SATELLITES FOR OCEANIC MONITORING
John W Sherman III *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 279-297 refs
Avail NTIS HC A99/MF A01 CSCL 08C

Current applications and products from existing operational satellites are reviewed The future data and information that will become available before the end of this decade are described with emphasis on global oceanic data Author

N78-14503*# Chiba Univ (Japan) Inst of Color Technology

ON THE PHOTOGRAPHIC PROCESSING AND DIGITAL TEXTURE FOR REMOTE SENSING OF KUJUKURI COAST OF CHIBA IN JAPAN

Hidesaburo Genda, Hiroshi Okayama, Takashi Ishiyama, and Kaname Takeda (Natl Inst of Resources, Tokyo, Japan) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 571-578 refs

Avail NTIS HC A99/MF A01 CSCL 14E

Remote sensing of various coastal phenomena on the Kujukuri Coast and Kashimanada Coast was done by the use of aircraft for the purpose of investigating the characteristics of shore reefs and floating sand, and the depth of the sea A multispectral camera and a video ITV camera were used as sensors The first flight was over the Kashimanada and Kujukuri Coasts and the next flight was over the Katsuura Bay The shape of shore reefs, the state of floating sand the depth of the sea, etc , are represented by equidensitographs using texture The interval of density slices is 0 05 Correlations between the textures represented by equidensitographs, digital graphs and analog display are estimated Author

N78-14512*# National Oceanic and Atmospheric Administration, Suitland Md

PRESENT AND FUTURE OPERATIONAL NOAA SATELLITE OCEANOGRAPHIC PRODUCTS AN INTRODUCTION

J Keith Kalinowski, Theodore L Signore, William G Pichel, Charles C Walton Robert L Brower Stanley R Brown, and Kenneth G Bennekamper *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 625-633 refs

Avail NTIS HC A99/MF A01 CSCL 08C

A review of operational satellite-derived National Oceanic and Atmospheric Administration/National Environment Satellite Service oceanographic products is presented and some current applications of these products are noted Recent improvements to procedures used in deriving sea surface temperature observations and fields are described Changes to data reduction techniques and products which will be incorporated with the advent of TIROS-N are outlined and some potential future developments are mentioned Author

N78-14513*# Grumman Aerospace Corp , Bethpage, N Y Research Dept

POLARIMETER MEASURES SEA STATE CHARACTERISTICS USING EMITTED INFRARED RADIATION

W G Egan and T Hilgeman *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 635-644 refs

Avail NTIS HC A99/MF A01 CSCL 08C

An infrared polarimeter, capable of operating between 1 and 12 micrometers wavelength has been used to measure the polarization of emitted radiation from the sea The observed polarization at 10 6 micrometers from a smooth sea was found to be positive, indicating the dominance of reflected infrared sky radiation over the emitted With the appearance of waves, the percent polarization increased as expected, for a zenith angle well above the Brewster angle for water This is qualitatively in accordance with a model presented to explain the behavior Initial analyses indicate that the polarized components of the sea s emitted and reflected radiation are affected by type and direction of waves, angle of viewing and foam The effects of variations in these parameters require further delineation The infrared polarimetric technique appears to be a novel new passive method for remote monitoring of waves Author

N78-14514*# Canada Centre for Remote Sensing Ottawa (Ontario)

SCATTEROMETER RESULTS FROM SHOREFAST AND FLOATING SEA ICE

J Cihlar, L Gray S Parashar and R Worsfold (Centre for Cold Ocean Resources Engineering, St John s Canada) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 645-657 refs

Avail NTIS HC A99/MF A01 CSCL 08L

Multipolarized scatterometer sea ice measurements at 13 3 GHz obtained during the winter and spring of 1975-76 from a number of flight lines off the east coast of Canada were analyzed Radar scattering coefficients sigma were calculated for several regions of sea ice as interpreted from aerial photographs The variation in sigma which incidence angle is presented for HH (Horizontal transmit - Horizontal receive) and HV (Horizontal transmit - Vertical receive) polarizations for the various ice regions The depolarization ratio (sigma HH/sigma HV) as a function of incidence angle is also given The sea ice regions studied included shorefast ice with varying degrees of snow cover and surface roughness and several varieties of floating sea ice with different thicknesses Author

N78-14530*# Army Engmeer Waterways Experiment Station, Vicksburg, Miss

REMOTE SENSING OF AQUATIC PLANTS

K S Long and L E Link, Jr *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 817-836 refs

Avail NTIS HC A99/MF A01 CSCL 02D

Various sensors were tested in terms of their ability to detect and discriminate among noxious aquatic macrophytes A survey of researchers currently studying the problem and a brief summary of their work is included Results indicated that the sensor types best suited to assessment of the aquatic environment are color color infrared, and black-and-white infrared film, which furnish consistently high contrasts between aquatic plants and their surroundings Author

N78-14533*# Instituto de Pesquisas Espaciais Sao Jose dos Campos (Brazil)

STUDY OF THE BRAZIL AND FALKLAND CURRENTS USING THEIR IMAGES OF NIMBUS 5 AND OCEANOGRAPHIC DATA IN 1972 - 1973

Y C Tseng, H M V Inostroza, and R Kumar *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 859-871 refs

Avail NTIS HC A99/MF A01 CSCL 05B

The Western Edge of the Sub-tropical Convergance of the South-western Atlantic Ocean called the Front which is a thermal discontinuity between the Brazil and Falkland Currents, was studied utilizing the Temperature Humidity Infrared Radiometer (THIR) of Nimbus V in the 10 5 to 12 5 micrometers channel and historical oceanographic data Some important results obtained are the oceanographic Front could be detected from Nimbus THIR data, oceanographic charts showed that the transition zone where the Brazil and the Falkland Currents meet was the Front detected from satellite data ocean current speeds calculated with THIR data were of the same order of magnitude as those calculated oceanographically fisheries statistics for Pargo Roseo showed that the maximum catches were in September of 1973, in the period when the Front was observed most distinctly and clearly The results showed the great potentiality of satellite data to study surface thermal structures surface currents and oceanic fisheries Author

N78-14549*# Universite des Sciences et Techniques de Lille (France) Laboratoire d Optique Atmospherique

REMOTE SENSING OF OCEAN COLOR AND DETECTION OF CHLOROPHYLL CONTENT

P Y Deschamps P Lecompte and M Viollier *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1021-1033 refs

05-43)

Avail NTIS HC A99/MF A01 CSCL 08J

The chlorophyll enrichment of the water in an equatorial upwelling was surveyed and described with the aid of a radiometer specially designed for the airborne measurement of ocean color A relation is proposed between airborne measurement of difference of albedos at two wavelengths in the blue and green, and the concentration of chlorophyll in the ocean Author

N78-14572*# National Aeronautics and Space Administration Wallops Station, Wallops Island, Va
AIRBORNE OCEANOGRAPHIC LIDAR SYSTEM
C Bressel (Avco-Everett Res Lab, Inc) I Itzkan (Avco-Everett Res Lab, Inc) J E Nunes (Avco-Everett Res Lab Inc) and F Hoge *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1259-1268 refs

Avail NTIS HC A99/MF A01 CSCL 17I

The characteristics of an Airborne Oceanographic Lidar (AOL) are given The AOL system is described and its potential for various measurement applications including bathymetry and fluorosensing is discussed Author

N78-14586*# Institute of Ocean Sciences Victoria (British Columbia)
USE OF AN INERTIAL NAVIGATION SYSTEM FOR ACCURATE TRACK RECOVERY AND COASTAL OCEANOGRAPHIC MEASUREMENTS
B M Oliver and J F R Gower *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1399-1413 refs
Avail NTIS HC A99/MF A01 CSCL 17G

A data acquisition system using a Litton LTN-51 inertial navigation unit (INU) was tested and used for aircraft track recovery and for location and tracking from the air of targets at sea The characteristic position drift of the INU is compensated for by sighting landmarks of accurately known position at discrete time intervals using a visual sighting system in the transparent nose of the Beechcraft 18 aircraft used For an aircraft altitude of about 300 m, theoretical and experimental tests indicate that calculated aircraft and/or target positions obtained from the interpolated INU drift curve will be accurate to within 10 m for landmarks spaced approximately every 15 minutes in time For applications in coastal oceanography, such as surface current mapping by tracking artificial targets, the system allows a broad area to be covered without use of high altitude photography and its attendant needs for large targets and clear weather Author

N78-14606*# Louisiana State Univ, Baton Rouge Coastal Studies Inst
SURFACE TEMPERATURES AND TEMPERATURE GRADIENT FEATURES OF THE US GULF COAST WATERS
Oscar K Huh Lawrence J Rouse, Jr, and Glenn W Smith *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1609-1618 ref

Avail NTIS HC A99/MF A01 CSCL 08C

Satellite thermal infrared data on the Gulf of Mexico show that a seasonal cycle exists in the horizontal surface temperature structure In the fall the surface temperatures of both coastal and deep waters are nearly uniform With the onset of winter atmospheric cold fronts, which are accompanied by dry, low temperature air and strong winds, draw heat from the sea A band of cooler water forming on the inner shelf expands until a thermal front develops seaward along the shelf break between the cold shelf waters and the warmer deep waters of the Gulf Digital analysis of the satellite data was carried out in an interactive mode using a minicomputer and software A time series of temperature profiles illustrates the temporal and spatial changes in the sea-surface temperature field Author

N78-14772# General Accounting Office Washington, D C Procurement and Systems Acquisition Div
THE SEASAT-A PROJECT WHERE IT STANDS TODAY NATIONAL AERONAUTICS AND SPACE ADMINISTRATION NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
16 Sep 1977 50 p
(PB-272004/3, PSAD-77-126) Avail NTIS HC A03/MF A01 CSCL 08J

It was recommended by GAO that Congress and NASA take several actions before the experimental SEASAT-A project is expanded to an operational program The SEASAT-A spacecraft scheduled for launch in 1978, will measure ice fields, winds, waves, ocean currents sea temperatures, and atmospheric water vapor NASA s January 1977 project cost estimate of $80 5 million excludes $12 3 million of related costs The cost estimate is continuing to be reviewed by NASA GRA

N78-15537*# General Land Office, Austin, Tex
DEVELOPMENT AND APPLICATION OF OPERATIONAL TECHNIQUES FOR THE INVENTORY AND MONITORING OF RESOURCES AND USES FOR THE TEXAS COASTAL ZONE. VOLUME 1 TEXT Final Report, Apr 1975 - Oct. 1977
Peggy Harwood, Principal Investigator Robert Finley (Texas Univ Austin), Samuel McCulloch (Texas Natural Resources Information System, Austin) Patricia A Malin (Texas A and M Univ College Station) and John A Schell Oct 1977 299 p refs Original contains color imagery Original photography may be purchased from the EROS Data Center Sioux Falls S D ERTS
(Contract NAS5-20986)
(E78-10042 NASA-CR-155342) Avail NTIS HC A13/MF A01 CSCL 08F

The author has identified the following significant results Image interpretation and computer-assisted techniques were developed to analyze LANDSAT scenes in support of resource inventory and monitoring requirements for the Texas coastal region Land cover and land use maps at a scale of 1 125 000 for the image interpretation product and 1 24 000 for the computer-assisted product, were generated covering four Texas coastal test sites Classification schemes which parallel national systems were developed for each procedure, including 23 classes for image interpretation technique and 13 classes for the computer-assisted technique Results indicate that LANDSAT-derived land cover and land use maps can be successfully applied to a variety of planning and management activities on the Texas coast Computer-derived land/water maps can be used with tide gage data to assess shoreline boundaries for management purposes

N78-15538*# General Land Office, Austin, Tex
DEVELOPMENT AND APPLICATION OF OPERATIONAL TECHNIQUES FOR THE INVENTORY AND MONITORING OF RESOURCES AND USES FOR THE TEXAS COASTAL ZONE VOLUME 2 APPENDICES Final Report, Apr 1975 - Oct 1977
Peggy Harwood, Principal Investigator Robert Finley (Texas Univ Austin) Samuel McCulloch (Texas Natural Resources Information System Austin) Patricia A Malin (Texas A and M Univ College Station) and John A Schell Oct 1977 156 p refs Original contains imagery Original photography may be purchased from the EROS Data Center Sioux Falls S D ERTS
(E78-10048 NASA-CR-155358) Avail NTIS HC A08/MF A01 CSCL 08F

N78-15550*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
THE ANALYSIS OF GEOS-3 ALTIMETER DATA IN THE TASMAN AND CORAL SEAS Technical Report, Apr - Nov 1975
R S Mather Nov 1977 40 p refs Presented at GEOS-3 Principal Investigator's Final Meeting, New Orleans, 18-19 Nov 1977 Submitted for publication
(NASA-TM-78032) Avail NTIS HC A03/MF A01 CSCL 05B

A technique was developed for preprocessing GEOS-3 altimetry data to establish a model of the regional sea surface The algorithms developed models for a 35,000,000 sq km area with an internal precision of + or - 1 m There were discrepancies between the sea surface model so obtained and GEM6 based geoid profiles with wavelengths of approximately 2500 km and amplitudes of up to 5 m in this region The amplitudes were smaller when compared with GEM10-based geoid determinations However, the comparison of 14 pairs of overlapping passes in the region indicated altimeter resolution of the + or - 25 cm level if the wavelength corresponding to the Nyquist frequency were 30 km The spectral analysis of such comparisons indicated the existence of significant signal strength in the discrepancies after least squares fitting, with wavelengths in excess of 200 km Author

N78-15662*# Environmental Research Inst of Michigan, Ann Arbor

NASA/COUSTEAU OCEAN BATHYMETRY EXPERIMENT REMOTE BATHYMETRY USING HIGH GAIN LANDSAT DATA Final Report, Aug 1975 - Apr 1976

Fabian C Polcyn Jul 1976 132 p refs

(Contract NAS5-22597)

(NASA-CR-156658, ERIM-118500-1-F) Avail NTIS HC A07/MF A01 CSCL 08C

Satellite remote bathymetry was verified to 22 m depths where water clarity was defined by alpha = 058 1/m and bottom reflection r(b), was 26% High gain band 4 and band 5 CCT data from LANDSAT 1 was used for a test site in the Bahama Islands and near Florida Near Florida where alpha = 11 1/m and r(b) = 20%, depths to 10 m were verified Depth accuracies within 10% rms were achieved Position accuracies within one LANDSAT pixel were obtained by reference to the Transit navigation satellites The Calypso and the Beayondan, two ships, were at anchor on each of the seven days during LANDSAT 1 and 2 overpasses LORAN C position information was used when the ships were underway making depth transects Results are expected to be useful for updating charts showing shoals hazardous to navigation or in monitoring changes in nearshore topography Author

N78-15663*# Wentz (Frank J) and Associates, Cambridge, Mass

RADAR BACKSCATTERING FROM A SEA HAVING AN ANISOTROPIC LARGE-SCALE SURFACE, PART 2 Final Report

Frank J Wentz Nov 1977 37 p refs

(NASA Order L-24420-A)

(NASA-CR-145278) Avail NTIS HC A03/MF A01 CSCL 08B

A two scale scattering model was derived that combines specular reflections from sea waves and Bragg scattering in a manner consistent with energy conservation The effect of the tilting of the small scale roughness by the large scale roughness was included, which accounted for the reduction of reflected power The special case of backscattering for which the transmitted polarization equaled the received polarization was considered An anisotropic large scale surface was used to specify the probability density function of the large scale surface normal In order to isolate the azimuthal variation of the normalized radar cross section produced by the anisotropic probability density function an isotropical small scale spectrum was assumed Author

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

A78-10386 **Experiments on the radar backscatter of snow.** F T Ulaby, W H Stiles, L F Dellwig, and B C Hanson (Center for Research, Inc , Lawrence, Kan.) *IEEE Transactions on Geoscience Electronics,* vol GE-15, Oct 1977, p 185-189

The 1-8-GHz microwave active spectrometer (MAS) system was used to measure the backscatter response from ground covered with a relatively thin layer of snow (up to 15 cm) in the 1975 winter Except for one dry snow data set, the results of this experiment pertain to wet snow conditions The scattering coefficient was measured for all linear polarization combinations at angles of incidence between nadir and 70 deg The ground truth data consisted of soil moisture, soil and air temperatures, snow depth, snow density, and snow water equivalent Radar sensitivity to the total snow water equivalent increases in magnitude with increasing frequency and is almost angle independent for angles of incidence higher than 30 deg, particularly at the higher frequencies In the 50-70 deg angular range in the 6-8 GHz frequency range, the sensitivity is typically around -0 4 dB per 0 1 g per sq cm of the snow water equivalent and the associated linear correlation coefficient has a magnitude of about 0 8 (Author)

A78-10524 * **Computer processing of SAR L-band imagery** M L Bryan, W D Stromberg, and T G Farr (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) *Photogrammetric Engineering and Remote Sensing,* vol 43, Oct 1977, p 1283-1294 25 refs Contract No NAS7-100

The described work in the areas of hydrology and polar ice defines possible uses of automatic picture processing of uncalibrated radar images The data used in the study were collected with the aid of an L-band synthetic aperture radar mounted in the NASA CV-990 aircraft The radar was operated at approximately 30,000 feet altitude One study area used was located in the Beaufort Sea and contained sea ice The other study area contained lakes on the Alaskan North Slope The reported investigations demonstrate that certain types of features can be efficiently studied by using simple automatic picture processing techniques applied to uncalibrated radar data G R

A78-12730 **The difference method - An approach for the objective prediction of the temperature (Die Differenzenmethode - Ein Weg zur objektiven Vorhersage der Temperatur)** A Machalek (Zentralanstalt fur Meteorologie und Geodynamik, Vienna, Austria) *Archiv fur Meteorologie, Geophysik und Bioklimatologie, Serie A Meteorologie und Geophysik,* vol 26, no 2-3, 1977, p 187-195 In German

The first step in a procedure for obtaining objective weather forecasts is related to the prediction of the daily temperature maxima and minima A description is presented of a new method which was developed in Vienna, Austria, in an attempt to improve the quality of temperature forecasts The method involves the determination of the temperature differences between the daily temperature maximum and minimum and the assignment of temperature differences, after a partition in groups of two degrees in each case, to one of a number of different types of weather The quality of the new method was studied by applying it to the meteorological data of the period from July to October 1976 It was found that the results provided by the new method for the prediction of the temperature maximum are better than the respective results obtained in the case of two other approaches G R

A78-12933 # **Snow mapping from Landsat digital data** T T Alfoldi and K P B Thomson (Canada Centre for Remote Sensing, Ottawa, Canada) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings
Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p. 73-80 7 refs

This paper reports on the applicability of Landsat digital data in operational snow cover mapping Landsat data for two test sites in Eastern Canada have been analyzed and the results of classification and enhancements of these data are compared and discussed Suggestions are made on the implementation of Landsat data into a operational snow mapping program (Author)

A78-14780 * # **The utility of short wavelength /less than 1 mm/ remote sensing techniques for the monitoring and assessment of hydrologic parameters** A Rango and V Salomonson (NASA, Goddard Space Flight Center, Greenbelt, Md) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1
Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 55-66 25 refs

The paper reviews advances made in remote sensing applications to the fields of hydrology and water resources management, with emphasis on sensing from spacecraft platforms An overview is presented of a remote sensing applications program for water resources management with attention given to water resources requirements and information content research Consideration is also given to snowcovered area mapping in the Western United States, the use of Landsat imagery in land-use mapping and in the development of hydrological watershed models employed in flood control/waterworks planning and management B J

A78-14781 # **Microwave remote sensing of hydrologic parameters** F T Ulaby (University of Kansas Center for Research, Inc , Lawrence, Kan) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 67-86 46 refs

A perspective on the implementation of microwave sensors in future airborne and spaceborne observations of hydrologic parameters is presented The rationale is based on a review of the status and future trends of active (radar) and passive (radiometer) microwave research as applied to the remote sensing of soil moisture content, snowpack water equivalent, freeze/thaw boundaries, lake ice thickness, surface water area, and the specification of watershed runoff coefficients Included are analyses and observations based on data acquired from ground based, airborne and spaceborne platforms and an evaluation of advantages and limitations of microwave sensors (Author)

A78-14782 # **Utilization of remote sensing observations in hydrologic models** R M Ragan (Maryland, University, College Park, Md) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 87-99 27 refs

Parameter definitions for hydrologic models are reviewed and model modifications for remote sensing capability are examined A number of remote-sensing-based hydrologic models are considered including the SCS model, the STORM model, and the EPA stormwater management model Time and cost comparisons among these models are presented and future directions in the development of remote sensing models are projected B J

A78-14794 # **Coastal wetlands - The present and future role of remote sensing** V Carter (U S Geological Survey, Reston, Va) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 301-323 60 refs

The organization of coastal wetland inventories as performed by the 23 coastal states is described, and the remote sensing techniques used are discussed USGS and Fish and Wildlife Service inventories are also explained Film types are recommended for the nine classes of the estuarine ecological system Problems in using satellite data are considered, and a discussion of the future use of remotely sensed data is presented M L

A78-14816 * # Automated image processing of Landsat II digital data for watershed runoff prediction R R Sasso, J R Jensen, and J E Estes (California, University, Santa Barbara, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 591-599 Grant No NsG-722

Digital image processing of Landsat data from a 230 sq km area was examined as a possible means of generating soil cover information for use in the watershed runoff prediction of Kern County, California The soil cover information included data on brush, grass, pasture lands and forests A classification accuracy of 94% for the Landsat-based soil cover survey suggested that the technique could be applied to the watershed runoff estimate However, problems involving the survey of complex mountainous environments may require further attention J M B

A78-14817 # Microwave multispectral investigations of snow. E Schanda and R Hofer (Bern, Universitat, Berne, Switzerland) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 601-607

A long-term observational program on the microwave emission and scatter behavior under controlled conditions has been started at a high-altitude alpine test site All stages of development of the snow-cover during the whole season are under investigation The purpose of this study is to achieve the required knowledge on the microwave radiative properties of snow for the optimization of the microwave payloads of air- and space-borne snow sensors and for the interpretation of large-scale snow maps obtained by these sensors Preliminary results of the first month of the investigation obtained with the radiometers at 4 9, 10 5, 21 and 36 GHz are presented (Author)

A78-14818 * # Application of Landsat data to wetland study and land use classification in West Tennessee N L Jones and F Shahrokhi (Tennessee, University, Tullahoma, Tenn) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 609-613 U S Department of Agriculture Contract No AG-47-SCS00210, Contract No NAS8-31980

Landsat data were employed in determining land use of a 32,300-hectare watershed area within the Obion-Forked Deer River Basin in northwest Tennessee Black and white transparency chips for all four wavelength bands were interpreted by use of a video-input analog/digital automatic analysis and classification facility, densitometric methods showed that wetlands, urban areas, agricultural lands and forests could be discriminated by analysis of band 6 or 7 together with band 4 or 5 Comparison with high- and low-altitude photography indicated that the Landsat data could provide sufficiently accurate resource information and determine drainage trends J M B

A78-14834 # Remote sensing-aided systems for snow quantification, evapotranspiration estimation, and their application in hydrologic models S Khorram (California, University, Berkeley, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 795-806 24 refs

A78-14835 * # Application of aerial photography to water-related programs in Michigan W R Enslin, R Hill-Rowley, and S E Tilmann (Michigan State University, East Lansing, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 807-816 Grant No NGL-23-004-083

The paper describes the use of aerial photography and information system technology in the provision of information required for the effective operation of three water-related programs in Michigan Potential mosquito breeding sites were identified from specially acquired low altitude 70 mm color photography for the City of Lansing Vector Control Area A comprehensive inventory of surface water sources and potential access sites was prepared to assist fire departments in Antrim County with fire truck water-recharge operations Remotely-sensed land cover/use data for Windsor Township, Eaton County were integrated with other resource data into a computer-based information system for regional water quality studies Eleven thematic maps specifically focussed on landscape features affecting non-point water pollution and waste disposal were generated from analyses of a four-hectare grid-based data file containing land cover/use, soils, topographic and geologic (well-log) data (Author)

A78-14836 # Remote sensing of aquatic plants K S. Long and L E Link, Jr (U S Army, Engineer Waterways Experiment Station, Vicksburg, Miss) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 817-826

To develop a means of rapidly assessing the extent and composition of aquatic plant infestations, a study including both computer simulation and field exercises was begun in 1975 to test various sensors in terms of their ability to detect and discriminate among noxious aquatic macrophytes A survey of researchers currently studying the problem and a brief summary of their work is included Results indicated that the sensor types best suited to assessment of the aquatic environment are color, color infrared, and black-and-white infrared film, which furnish consistently high contrasts between aquatic plants and their surroundings. (Author)

A78-14851 # Multidate mapping of mosquito habitat T L Woodzick and E L Maxwell (Colorado State University, Fort Collins, Colo) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 979-989 10 refs PHS-supported research

Landsat data from three overpasses in 1975 (25 June, 13 July, 9 August) formed the data base for a multidate classification of 15 ground cover categories in the margins of Lewis and Clark Lake, a fresh water impoundment between South Dakota and Nebraska When scaled to match topographic maps of the area, the ground cover classification maps were used as a general indicator of potential mosquito-breeding habitat by distinguishing productive wetlands areas from non-productive non-wetlands areas More specifically, the interpretation of the Consolidated Wetlands, Flooded and Transitional classes as permanently-flooded, frequently-flooded and intermittently-flooded, respectively, permitted a breeding potential to be assigned to each class vis-a-vis the preferred breeding habitat of Culex tarsalis, a permanent pool species and Aedes vexans, a floodwater species The 12 channel multidate classification was found to have an accuracy 23% higher than the average of the three single date 4 channel classifications By assuming that the 1 1 acre Landsat resolution reflects the dominant tendency within each pixel, the multidate classification map of ground cover categories can be considered a broadbrush indicator of potential mosquito-production and used to plan control programs (Author)

A78-14856 # Textural analysis by statistical parameters and its application to the mapping of flow-structures in wetlands /Mudflat area at the German coast of the North Sea/ U Wieczorek

(München, Universitat, Munich, West Germany) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich, Environmental Research Institute of Michigan, 1977, p 1035-1043

A78-14857 # **Production of a water quality map of Saginaw Bay by computer processing of Landsat-2 data** J B McKeon, R H Rogers (Bendix Corp, Aerospace Systems Div, Ann Arbor, Mich), and V E Smith (Cranbrook Institute of Science, Bloomfield Hills, U S Environmental Protection Agency, Grosse Ile, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich, Environmental Research Institute of Michigan, 1977, p 1045-1054 9 refs

Surface truth and Landsat measurements collected July 31, 1975 for Saginaw Bay are used to demonstrate a technique for producing a color coded water quality map On this map, color is used as a code to quantify five discrete ranges in the following water quality parameters temperature, Secchi depth, chloride, conductivity, total Kjeldahl nitrogen, total phosphorous, chlorophyll a, total solids and suspended solids The Landsat and water quality relationship is established through the use of a set of linear regression equations where the water quality parameters are the dependent variables and Landsat measurements are the independent variables (Author)

A78-14869 # **Use of thermal-infrared imagery in groundwater investigations in Montana** A J Boettcher (U S Geological Survey, Helena, Mont) and R M Haralick (Kansas, University, Lawrence, Kan) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich, Environmental Research Institute of Michigan, 1977, p 1161-1170

A78-14870 # **Satellite land use acquisition and applications to hydrologic planning models** V R Algazi and M Suk (California, University, Davis, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 2. Ann Arbor, Mich, Environmental Research Institute of Michigan, 1977, p 1171-1181 14 refs

The use of Landsat digital data to assess the flood hazards, general damage potential and environmental status of U S watersheds is discussed The hydrologic models employed in the watershed analyses discriminate among such land-use categories as forests, residential areas, highly impervious lands, grassy regions, bare land, streams and ponds Maximum likelihood classification and clustering techniques used to process the Landsat data are considered Sample analyses involving the Trail Creek watershed in Georgia and the highly urbanized Castro Valley watershed in California are presented J M B

A78-14888 # **Groundwater studies in arid areas in Egypt using Landsat satellite images** E M El Shazly (Academy of Scientific Research and Technology, Remote Sensing Centre, Cairo, Egypt), M A Abdel Hady (Atomic Energy Establishment, Cairo, Egypt), and M M El Shazly (Egyptian Desert Institute, Cairo, Egypt) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich, Environmental Research Institute of Michigan, 1977, p 1365-1372

A78-14890 # **Development of an integrated data base for land use and water quality planning** J Adams, C VanSchayk (Toledo Metropolitan Area Council of Governments, Toledo, Ohio), and L B Istvan (Michigan, Environmental Research Institute, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 1381-1386

The Land Resource Information System has been developed by the Toledo Metropolitan Area Council of Governments for the evaluation of the role played by various land resources in water quality management The system uses a computer-based data program, and has been tested in areas of Ohio and Michigan Its applications include the abatement of runoff from agricultural land, the mapping of septic tank capability based on soil data, the determination of an area's capability for underground sewage treatment facilities, land development planning, the design of resource management systems, and the functional characterization of natural regions and features S C S

A78-14893 * # **Lake water quality mapping from Landsat** J P Scherz (Wisconsin, University, Madison, Wis) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich, Environmental Research Institute of Michigan, 1977, p 1417-1425 5 refs Grant No NGL-50-002-127, Contract No NAS5-20942

In the project described remote sensing was used to check the quality of lake waters The lakes of three Landsat scenes were mapped with the Bendix MDAS multispectral analysis system From the MDAS color coded maps, the lake with the worst algae problem was easily located The lake was closely checked, and the presence of 100 cows in the springs which fed the lake could be identified as the pollution source The laboratory and field work involved in the lake classification project is described V P

A78-14906 # **Three approaches to the classification and mapping of inland wetlands** P T Gammon (U S Geological Survey, Suffolk, Va), D Malone (Tennessee Valley Authority, Chattanooga, Tenn), P D Brooks, and V Carter (U S Geological Survey, Reston, Va.) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich, April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich, Environmental Research Institute of Michigan, 1977, p 1545-1555 10 refs

Three projects representing three approaches to the classification and mapping of inland wetlands are discussed In the Dismal Swamp project, seasonal, color-infrared aerial photographs and Landsat digital data were interpreted for a detailed analysis of the vegetative communities in a large, highly altered wetland In western Tennessee, seasonal high-altitude color-infrared aerial photographs provided the hydrologic and vegetative information needed to map inland wetlands using a classification system developed for the Tennessee Valley Region In Florida, color-infrared aerial photographs were analyzed to produce wetland maps using three existing classification systems to evaluate the information content and mappability of each system The methods used in each of the three projects can be extended or modified for use in the mapping of inland wetlands in other parts of the United States (Author)

A78-15935 NOAA satellite monitoring of snow cover in the northern hemisphere during the winter of 1977 D R Wiesnet, M. Matson, and D F McGinnis (NOAA, National Environmental Satellite Service, Washington, D C) *International Astronautical Federation, International Astronautical Congress, 28th, Prague, Czechoslovakia, Sept 25-Oct 1, 1977, Paper 77-121* 19 p 5 refs

Widespread snow has the effect of raising the earth surface albedo and decreasing the net amount of long-wave radiation absorbed by the surface The snow cover also tends to cool the adjacent atmosphere, thereby inducing snow, rather than rain, in peripheral snow-free areas It has been suggested that these simple regressions might be used to forecast continental and hemispheric snow cover 30, 60, or 90 days in advance Advance estimates of snow cover, prepared to test and evaluate this antecedent snow cover technique, are tabulated Analysis shows that long-range predictions of severe global climatic change cannot be substantiated on the basis of satellite snow cover data (at least in winter 1977) Nevertheless, over the 10-year period of record, snow cover does show a tendency to increase slightly Continued satellite monitoring of this important climatic variable is clearly warranted V P

A78-16505 # **On the possibilities of using aerial photographs in the planning of the recreational use of waterways and water conservation** V Lappalainen (Tampere University of Technology, Tampere, Finland) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 55 p 41 refs

Black and white, color and infrared aerial photographs have been taken of two lakes near Helsinki, Finland The photographs were used to prepare soil maps applicable in conservation and recreational land-use planning, and to study lake catchment areas and bedrock lineaments The infrared photographs facilitate the preparation of vegetation profiles used in water vegetation studies It is noted that aerial photography may be suitable in operations such as dredging, the removal of coastal vegetation, and the draining of waters S C S

A78-16514 # **Spectral reflection measurements of water with particle suspensions for an analysis of the water quality on the basis of multispectral recordings (Spektrale Reflexionsmessungen von belastetem Wasser zur Analyse der Wasserqualitat aus multispektralen Aufnahmen).** D. Kolouch, P Lohmann (Hannover, Technische Universitat, Hanover, West Germany), M Schroeder, and R Statter (Deutsche Forschungs- und Versuchsanstalt fur Luft- und Raumfahrt, Institut fur Optoelektronik, Oberpfaffenhofen, West Germany). *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper.* 15 p In German.

An inlet at the German North Sea coast is to be used by large industrial firms for the disposal of waste water A study is to be conducted in this connection to find out whether the introduced pollutants will remain in the inlet or will be carried off into the open sea. It is planned to study water exchange processes by means of remote-sensing methods involving the use of aircraft A description is presented of experiments which were carried out to obtain information for a suitable selection of the sensing devices, taking into account the characteristics of the water in the inlet which has a yellowish color in connection with the presence of suspended clay particles It was found that three spectral ranges have to be considered for a detection of the suspended turbid materials in the sea water. The ranges lie at the wavelengths of 600 nm, 850 nm, and 1085 nm Turbid materials of the considered type are characterized by an increase in spectral reflection in the infrared. It is expected that the remote-sensing data will provide quantitative information regarding the turbid material concentration if measurements of the spectral distribution of the incident radiation are included G.R

A78-16528 # **Remote sensing of water quality in 7 lakes in northern Italy** B M Sorensen, B Sturm, and E Gatelli (EURATOM and Comitato Nazionale per L'Energia Nucleare, Centro Comune di Richerche, Ispra, Italy) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 18 p Research supported by the Danish Natural Science Research Council

Some important considerations in connection with remote sensing of water quality are presented A procedure is suggested to determine the maximum water depth where qualitative information can be obtained from aircraft altitude Density slicing and ratioing techniques applied on computer compatible tapes have been analyzed and the preliminary results are discussed A solution to compensate for discrepancies between upwelling radiance values measured by a radiometer from a lake station and from an aircraft is presented (Author)

A78-16540 # **Establishment of the hydro-morphometric characteristics for water bodies, using photogrammetric and remote-sensing recordings** M Albota and D Rosca (Rumanian Committee of Photogrammetry, Bucharest, Rumania) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 10 p

Aerial and satellite photogrammetric studies of a river bed, a water storage basin, and a river delta are reported Photographs of the Olt and Ialomita rivers in Romania were obtained at a scale of 1 25,000 Transverse profiles obtained by stereophotogrammetric techniques were used to study the flood-water discharge Photographs at scales of 1 15,000 to 1 1000 were used to study silting in the Vidraru storage basin of the Arges River while the basin was partially drained, the Bicaz lake in the Bistrita River was photographed while the basin was full Landsat data were used to investigate the impact zone between the Danube delta and the Black Sea, features studied include coast line evolution within the impact zone between the delta and the sea, the evolution of Sacalin Island, underwater bar developments along the coast line, delta development, alluvial deposition, sea stream distribution, and silting of lakes in the marine delta M L

A78-17019 # **Simulation of attenuation by rainfall at a wavelength of 5 cm** M L Weible and D Sirmans (NOAA, National Severe Storms Laboratory, Norman, Okla) In Conference on Radar Meteorology, 17th, Seattle, Wash , October 26-29, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 75-78 6 refs

Simulated rainfall rate attenuation at a radar wavelength of 5 cm has been obtained in order to quantitatively determine effects of attenuation due to rainfall Digital data collected with the 10 cm NSSL WSR-57 radar is used to compute the attenuation estimate expected with a 5 cm radar Two cases involving heavy rainfall from Oklahoma thunderstorms are examined an organized squall line which occurred on June 6, 1975 and produced radar-measured rainfall amounts in excess of 80 mm with rates exceeding 100 mm/hr, a succession of convective rainshowers which repeatedly formed and matured in the vicinity of Enid, Oklahoma on October 10, 1973 B J

A78-17074 # **Radar observed land/lake precipitation differences** J W Wilson (Center for the Environment of Man, Inc , Hartford, Conn) In Conference on Radar Meteorology, 17th, Seattle, Wash , October 26-29, 1976, Preprints
Boston, Mass , American Meteorological Society, 1977, p 422-429. 14 refs Contract No NOAA-03-5-022-17

The precipitation over Lake Ontario and its drainage basin has been measured during a one-year period by two weather radars and 338 rain gages These data were then used to evaluate the influence of Lake Ontario on precipitation distributions It was found that the lake and surrounding hills significantly affect precipitation distribution over the drainage basin During the warm season, cold lake waters may suppress shower activity over the lake, whereas during the cold season the lake may stimulate precipitation over and downwind of the lake Although the lake is estimated to influence precipitation patterns on about 50% of the yearly precipitation days, the overall effect on precipitation amount is not large. The results of this study indicate that radar may be effectively used to monitor regional climatological features in the precipitation fields generated by local topography S C S

A78-18243 **Experience with the per-point classification algorithms for the mapping of estuarine areas from Landsat** A C Armstrong (Ministry of Agriculture, Fisheries and Food, Trumpington, Cambs, England) and P Brimblecombe (East Anglia, University, Norwich, England) *British Interplanetary Society, Journal (Remote Sensing),* vol 31, Jan 1978, p 33-36 13 refs

The Bayesian algorithm, an unsupervised clustering algorithm, and a decision tree algorithm were compared in a test of estuarine mapping from Landsat data The Bayesian classification was found to perform poorly, while the decision tree algorithm provided the most accurate mapping of land, wet sand, dry sand, and shallows The unsupervised clustering algorithm yielded classifications less accurate than the decision tree results, but had the advantage of involving short computing times The usefulness of the estuarine mapping for navigation charts was also assessed J M B

A78-18247 * **Optimal spatial sampling techniques for ground truth data in microwave remote sensing of soil moisture** R

G S Rao and F T Ulaby (University of Kansas Center for Research, Inc , Laurence, Kan) *Remote Sensing of Environment*, vol 6, no 4, 1977, p 289-301 5 refs Contract No NAS9-14052

The paper examines optimal sampling techniques for obtaining accurate spatial averages of soil moisture, at various depths and for cell sizes in the range 2 5-40 acres, with a minimum number of samples Both simple random sampling and stratified sampling procedures are used to reach a set of recommended sample sizes for each depth and for each cell size Major conclusions from statistical sampling test results are that (1) the number of samples required decreases with increasing depth, (2) when the total number of samples cannot be prespecified or the moisture in only one single layer is of interest, then a simple random sample procedure should be used which is based on the observed mean and SD for data from a single field, (3) when the total number of samples can be prespecified and the objective is to measure the soil moisture profile with depth, then stratified random sampling based on optimal allocation should be used, and (4) decreasing the sensor resolution cell size leads to fairly large decreases in samples sizes with stratified sampling procedures, whereas only a moderate decrease is obtained in simple random sampling procedures S D

A78-18250 Satellite observations of snowcover in the Sierra Nevadas during the great California drought S Schneider and M Matson (NOAA, National Environmental Satellite Service, Washington, D C) *Remote Sensing of Environment*, vol 6, no 4, 1977, p 327-334

Images from the NOAA polar orbiting satellites are used to assess the extent of snowcover in the Sierra Nevada mountain range during the 1977 drought year Areal snowcover measurements derived from late April satellite imagery reveal the entire mountain range to have less than one third the snowcover that was present at a comparable date in 1975 Ratios of 1977 to 1975 snowcover for individual basins of the Sierra Nevada ranged from a low of 1 9 in low-elevation watersheds to a high of 1 2 in high-elevation water sheds Reduction of the satellite data was accomplished through the use of a density slicer, a color additive viewer, and an optical rectification device (Author)

A78-18859 Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Workshop sponsored by the Canadian Aeronautics and Space Institute Ottawa, Canadian Aeronautics and Space Institute, 1977 246 p $25

An introduction to hydrologic problems and the principles of remote sensing is presented, taking into account agriculture and soil moisture, groundwater projects in Saskatchewan and Alberta, and the application of remote sensing to watershed modeling and real-time flood forecasting Surface and near surface techniques are discussed along with airborne techniques and spaceborne methods with attention given to advances in surface geophysical techniques for groundwater and soil moisture, the surface electrical investigation of a sandy aquifer contaminated by fertilizer, the electromagnetic detection of soil water content, and the electrical properties of water in rocks and soil The integration of remote sensing techniques is applied to groundwater investigations, noting airborne thermal infrared sensing of soil moisture, methods of assessment of ground truth soil moisture, an evaluation of radar as a soil moisture sensor, microwave radiometry for soil moisture sensing, the identification of groundwater regimes in a Great Lakes basin, and the use of Landsat imagery in studies of spring icings and seasonally flooded Karst in permafrost areas G R

A78-18860 # Groundwater projects, problems, and parameters in Saskatchewan and Alberta, Canada J D Mollard (J D Mollard and Associates, Ltd , Regina, Saskatchewan, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 15-27

Data selected from over 400 groundwater projects on which remote sensing methods were used, mostly conventional airphoto interpretation, are summarized The investigations cover a 20-year period and mainly concern prospecting and exploration for municipal and industrial groundwater supplies These subsurface exploration studies were followed by water well construction and testing, and by groundwater source evaluation Characteristic types of groundwater projects, examples of problems frequently encountered, and cost and hydrogeologic parameters associated with these investigations are listed and briefly discussed (Author)

A78-18861 # The application of remote sensing to water resources planning, watershed modelling and real-time flood forecasting D W Lawson (Environment Canada, Hydrology Research Div , Calgary, Alberta, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 28-48 13 refs

It is shown that watershed modeling which is associated with real-time flood forecasting provides the greatest opportunity to demonstrate the hydrological utility of remote sensing An overview is presented of the type of water resources planning which would be required to develop an optimal hydroelectric generating scheme for a large river basin The choice of the most appropriate hydrological models is considered along with the related implications for remote sensing The classes of models generally distinguished in water resources planning include economic models, optimization (mathematical programming) models, and simulation models Attention is given to analysis techniques, the potential for remote sensing applications, project management decisions, the interrelated aspects of hydrologic model building which can be aided by remote sensing, the calibration of the gauged watersheds, and the modeling of ungauged areas G R

A78-18862 # Advances in surface geophysical techniques for groundwater and soil moisture L S Collett (Geological Survey of Canada, Resource Geophysics and Geochemistry Div , Ottawa, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 51-80 86 refs

The geophysical parameters considered for hydrogeological studies are electrical resistivity, compressional wave velocity, and, to a lesser extent, density The use of the induced polarization (IP) method constitutes an important advance with respect to the technical resistivity technique The electrical resistivity of rock is a property which depends on lithology, porosity, and fluid content Resistivity ranges of various rock types measured in situ by the galvanic resistivity method are listed in a table The seismic refraction method is used to measure the compressional wave velocity The IP method is widely used in mineral exploration for the detection of disseminated sulfides New methods in the area of electromagnetic sounding are related to the use of a new induction system operating on 14 selected frequencies in the range from 5 Hz to 45,000 Hz and to the employment of a magnetotelluric method which makes use of the natural electric currents that flow in the earth in the form of large sheets G R

A78-18863 # Electromagnetic detection of soil water content - Progress report II J L Davis, A P Annan (Geological Survey of Canada, Ottawa, Canada), and G C Topp (Agriculture Canada, Soil Research Institute, Ottawa, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8 10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 96-109 18 refs

Most of the proposed rapid, reliable, nondestructive water content measuring systems are based on the determination of the electrical properties of the soil to be studied The real dielectric constant K' appears to be highly sensitive to the amount of water in the soil A description is given of an investigation concerned with the dependence of K' on the soil water content in the frequency range

from 1 MHz to 1 GHz Laboratory measurements are being used to derive an empirical relationship between K' and soil water content Field results indicate that the time domain reflectometry techniques provide a practical method for determining soil water content profiles in the top water of the soil It is found that K' is a sensitive indicator of soil water content with a precision of better than + or - 3% overall Greater precision may result if other soil variables are considered G R

A78-18864 # **Electrical properties of water in rocks and soils** T J Katsube (Geological Survey of Canada, Resource Geophysics and Geochemistry Div , Ottawa, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 110-121 13 refs

Moisture in soils and rocks is mainly contained in pores The 'firmly bound water' consists of layers of water molecules firmly bound to the surfaces of the soil particles or rock grains, 'loosely bound water' consists of water molecule layers outside of the firmly bound water layers, and 'free water' is water which is not subject to any attraction forces towards the particle or grain surfaces The electrical properties of pore water in rocks and soils can usually be characterized by three bulk parameters The dielectric constant appears to indicate total water content in soils Resistivity and other parameters may produce further information on the bound and free water contents It is pointed out that measurements by multi-frequency techniques are necessary to extract the most useful information which can be gained by electrical or EM remote sensing methods G R

A78-18865 # **Integration of remote sensing techniques applied to groundwater investigations** J D Mollard (J D Mollard and Associates, Ltd , Regina, Saskatchewan, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 125-144

Properly integrated remote sensing methods can be a valuable aid in investigations of different types of groundwater projects It is shown that the interpretation of aerial remote sensing images, particularly medium scale panchromatic airphotos, can assist materially in about 7 out of 10 groundwater investigations in the Prairie Provinces of Western Canada However, the correct interpretation of the data requires that the photo interpreter has a sound knowledge regarding the proper integration of data developed from different aerial imaging remote sensors Especially important is the ability to recognize the groundwater indicator clues which are discernible in airphotos of the terrain, taking into account the interpretation of their significance in terms of a potentially economically developable groundwater source G R

A78-18866 # **Airborne thermal infra-red sensing of soil moisture and groundwater** J M Whiting (Saskatchewan Research Council, Saskatoon, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 145-154 23 refs

The basic element of the airborne thermal mapping system is the line scanner which is operated by means of a rotating plane mirror The intensity changes of the received radiation are converted into voltage changes by the IR detector The signal is finally recorded on magnetic tape Distortions related to the nature of the scanning techniques can be corrected with the aid of computer processing Thermal infrared methods have been successfully applied to the detection of groundwater discharge into bodies of open water Potential economic benefits of thermal IR scanning are related to the finding of new water supplies, the detection of areas of water contamination, and the discovery of new energy sources The economic potential of thermal IR for detection of soil moisture lies in its uses in agricultural research and in runoff hydrology modeling applications However, more development work is required for a realization of this potential G R

A78-18867 # **Methods of assessment of ground truth soil moisture** H H Neumann and E I Mukammal (Department of the Environment, Atmospheric Environment Service, Toronto, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 155-166 28 refs

Gravimetric sampling is the only technique for the measurement of soil moisture which provides absolute values The absolute moisture content from a sample is determined on the basis of the loss in weight of the sample in response to oven drying The principal limitations of the technique are the labor required in obtaining the samples and performing the required operations in the laboratory Details of sampling are discussed, taking into account random sampling, the independent sampling of each stratum, and systematic sampling The method most likely to be used in any relatively large scale field study of soil water contents is the neutron scattering technique The method is most suited for determining water content profiles and is less effective for the surface layer, although surface instruments are available A neutron meter consists of a radioactive source of fast or high energy neutrons and a detector of slow or thermal neutrons The major difficulty with neutron probes is obtaining a reliable calibration for the particular soil and location G R

A78-18868 # **An evaluation of radar as a soil moisture sensor** F T Ulaby (Kansas, University, Lawrence, Kan) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8 10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 169-183 13 refs

The sensitivity of radar to soil moisture variations is evaluated for bare and vegetation covered terrain The optimum microwave frequency, angle of incidence, and polarization are specified such that the combined effects of soil surface roughness and vegetation parameters (crop type, morphological state, row direction, temporal and diurnal behavior, etc) are minimized while retaining good sensitivity to soil moisture content (Author)

A78-18869 * # **Microwave radiometry for soil moisture sensing** T Schmugge (NASA, Goddard Space Flight Center, Applications Directorate, Greenbelt, Md) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 184-205 15 refs

Investigations have been conducted with truck-mounted radiometers to study the variation of microwave emissivity from a soil It was found that the longer wavelength radiometers, (21 cm), are preferable for the remote sensing of soil moisture Aircraft observations indicated a nonlinear dependence of microwave brightness temperature on soil moisture The dielectric constants of soils are considered along with the radiative transfer in soils, and soil water characteristics A description is presented of test flights conducted with a NASA aircraft, taking into account soil moisture measurements and instrumentation The obtained results show that the surface emissivity of a soil is determined by the dielectric properties of the surface soil layer a few tenths of a wavelength thick while the thermal sampling depths are much greater The capability of the 21-cm radiometer to sense soil-moisture variations through a moderate vegetation canopy, and the promising Skylab results encourage consideration of a radiometer operating at this wavelength for routine soil moisture observations G R

A78-18870 # **Soil moisture determination by thermal infrared remote sensing** J Cihlar (Canada Centre for Remote Sensing, Applications Development Section, Ottawa, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8 10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 206-215 14 refs

The determination of the soil water content by thermal infrared remote sensing includes the measurement of the surface temperature

and an evaluation procedure in which this temperature must be quantitatively related to the amount of water present in the soil The procedure used in calculating the surface temperature on the basis of the received radiation is briefly considered and approaches are discussed which can be used to establish the temperature soil moisture relationship required to evaluate the temperature data Attention is also given to various experimental studies concerning the relationship between surface temperature and soil moisture G R

A78-18871 # **Landsat-1 identification of groundwater regimes in a Great Lake basin** A G Bobba, J E Bruton, and R P Bukata (Canada Centre for Inland Waters, Remote Sensing Section, Burlington, Ontario, Canada) In Remote sensing of soil moisture and groundwater, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 216-231

A preliminary report is presented concerning the application of telemetered Landsat 1 data to the synoptic classification of a Great Lake basin in terms of its component groundwater regimes which are related to discharge, recharge, and transition areas The Big Creek and Big Otter Creek basins in southern Ontario were selected as test-sites for the satellite study Both basins drain into northeastern Lake Erie A training center for the classification procedure was selected in the Scotland area The classification determined for the training center was extended to include the entire test basins A graph is presented which displays the computer classification for all the discharge areas in the Big Otter and Big Creek basins as delineated by the Landsat 1 earth-orbiting satellite on March 20, 1974 G R

A78-18872 # **Use of Landsat imagery in studies of spring icings and seasonally flooded karst in permafrost areas** R O van Everdingen (Environment Canada, Hydrology Research Div , Calgary, Alberta, Canada) In Remote sensing of soil moisture and ground water, Proceedings of the Workshop, Toronto, Canada, November 8-10, 1976 Ottawa, Canadian Aeronautics and Space Institute, 1977, p 231 A-235

A78-20174 # **Electromagnetic detection of soil moisture Progress Report I** J L Davis and A P Annan (Geological Survey of Canada, Ottawa, Canada) *(Canadian Aeronautics and Space Institute, Aerospace Electronics Symposium, Banff, Alberta, Canada, Feb 4, 1976) Canadian Journal of Remote Sensing,* vol 3, Dec 1977, p 76-86 14 refs

The remote determination of soil moisture content requires a remotely detectable physical property of soils which is primarily dependent on moisture content One physical property which holds promise of satisfying these conditions is the complex dielectric constant of the soil in the frequency band 10 to the 7th to 10 to the 9th Hz Laboratory and field experiments employing time domain reflectometry (TDR) methods indicate the following that the dielectric constant depends strongly on soil moisture and weakly on soil type, and density, that variations of several hundred per cent in the dielectric constant occur as moisture content varies for the range of moisture content normally encountered in the field, that an empirical relationship between dielectric constant and soil moisture exists (Author)

N78-10535*# South Dakota State Univ , Brookings Remote Sensing Inst
HCMM ENERGY BUDGET DATA AS A MODEL INPUT FOR ASSESSING REGIONS OF HIGH POTENTIAL GROUNDWATER POLLUTION Interim Report, Jul. - Sep 1977
Donald G Moore, Principal Investigator J Tunheim, and J Heilman Sep 1977 14 p ref ERTS
(Contract NAS5-24206)
(E78-10010, NASA-CR-155214, QR-1) Avail NTIS HC A02/MF A01 CSCL 08H

The author has identified the following significant results The finite difference model was used to calculate the differences in surface temperature between two hypothetical sites which result from a temperature difference at 50 cm due to the presence of shallow ground water at one of the sites Although qualitative results of the model seemed consistant with experimental results, further evaluation showed a need for taking account of differences in thermal conductivity due to different moisture profiles at the two sites considered

N78-10536*# Texas A&M Univ , College Station Remote Sensing Center
LANDSAT/COASTAL PROCESSES Final Report, Jun. 1976 - Aug. 1977
Wesley P James, Principal Investigator, John M Hill, and Jon B Bright Aug 1977 105 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(NASA Order S-55812A)
(E78-10011, NASA-CR-155215, RSC-3380) Avail NTIS HC A06/MF A01 CSCL 08C

The author has identified the following significant results Correlations between the satellite radiance values water color, Secchi disk visibility, turbidity, and attenuation coefficients were generally good The residual was due to several factors including systematic errors in the remotely sensed data, errors, small time and space variations in the water quality measurements and errors caused by experimental design Satellite radiance values were closely correlated with the optical properties of the water

N78-10541*# National Aeronautics and Space Administration Lyndon B Johnson Space Center, Houston Tex
A TECHNIQUE FOR THE DETERMINATION OF LOUISIANA MARSH SALINITY ZONE FROM VEGETATION MAPPED BY MULTISPECTRAL SCANNER DATA· A COMPARISON OF SATELLITE AND AIRCRAFT DATA
M Kristine Butera Aug 1977 57 p refs
(NASA-TM-58203 JSC-12529) Avail NTIS HC A04/MF A01 CSCL 08H

Vegetation in selected study areas on the Louisiana coast was mapped using low altitude aircraft and satellite (LANDSAT) multispectral scanner data Fresh, brackish, and saline marshes were then determined from the remotely sensed presence of dominant indicator plant associations Such vegetational classifications were achieved from data processed through a standard pattern recognition computer program The marsh salinity zone maps from the aircraft and satellite data compared favorably within the broad salinity regimes The salinity zone boundaries determined by remote sensing compared favorably with those interpolated from line-transect field observations from an earlier year Author

N78-10542*# National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt Md
AOIPS WATER RESOURCES DATA MANAGEMENT SYSTEM
Peter VanWie Feb 1977 17 p Presented at Director's Sci Seminar on Earth Resources Survey Technol Transfer and System Concept Develop , Greenbelt, Md , 2 Dec 1976 Prepared in cooperation with Earth Satellite Corp , Washington, D C Original contains color illustrations
(Contract NAS5-22894)
(NASA-TM-X-71396 X-931-77-38) Avail NTIS HC A02/MF A01 CSCL 08H

The text and computer-generated displays used to demonstrate the AOIPS (Automatic and Oceanographic Information Processing System) water resources data management system are investigated The system was developed to assist hydrologists in analyzing the physical processes occurring in watersheds It was designed to alleviate some of the problems encountered while investigating the complex interrelationships of variables such as land-cover type, topography, precipitation, snow melt, surface runoff, evapotranspiration, and streamflow rates The system has an interactive image processing capability and a color video display to display results as they are obtained Author

N78-10630# Calspan Corp , Buffalo, N Y
THERMAL REMOTE SENSING CALIBRATION TECHNIQUES Final Report

John R Schott 15 Mar 1977 107 p refs Sponsored by the New York State Energy Research and Development Authority
(PB-269471/9, CALSPAN-NA-6019-M-1, NYSERDA-75/22) Avail NTIS HC A06/MF A01 CSCL 13B

A technique is described for measuring water surface temperatures from airborne platforms A number of techniques were tested and evaluated to determine which was the most suitable and with what precision surface temperatures could be measured from the air The approaches considered were wholly airborne requiring no ground truth The results indicate that the state-of-the-art has been advanced to a point where wholly airborne thermal infrared remote sensing of true water surface temperatures can be accomplished with sufficient precision to permit its use as a fully accomplished with sufficient precision to permit its use as fully operational approach GRA

N78-11447*# Bureau of Mineral Resources Geology and Geophysics, Canberra (Australia)
WATER UTILIZATION, EVAPOTRANSPIRATION AND SOIL MOISTURE MONITORING IN THE SOUTH EAST REGION OF SOUTH AUSTRALIA Final Report
K R McCloy, K J Shepherd and G F McIntosh, Principal Investigators 10 Jan 1977 7 p refs Sponsored by NASA ERTS
(E78-10001, NASA-CR-155205) Avail NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results It was established that reliable estimates of sand and coastal scrub areas can be determined from LANDSAT image classification by the Vec classifier more economically than by conventional means from a map of the coastal zone produced by photointerpretation using 1 10 000 aerial photography Current LANDSAT imagery is also suitable for monitoring for large scale storm damage to the zone, but the normal change in sand areas extent due to man s activity or other reasons is about 5 to 10 m per year, occasionally being as great as 30 m per year so that it is considered that LANDSAT D will have the resolution necessary to monitor these changes but not current imagery

N78-11455# World Meteorological Organization Geneva (Switzerland)
MODERN DEVELOPMENTS IN HYDROMETRY, VOLUME 2
Padua Intern Centre of Hydrol 1976 520 p refs Proc of the WMO Intern Seminar, Padua, 8-13 Sept 1975 co-sponsored by Intern Centre of Hydrol , UNESCO, and Intern Assoc of Hydrol Sci
(WMO-427 ISBN-92-63-10427-1) Avail NTIS HC A22/MF A01, WMO Geneva

Topics presented include instrumentation, methods and techniques of observation, measurements under difficult conditions, accuracy of hydrometric measurements inter comparison of hydrometric instruments and remote sensing and telemetering techniques

N78-11467# Department of Environment Hull (Quebec) Water Resources Branch
APPLICATION OF ELECTRONIC DISTANCE MEASURING DEVICES TO MEASUREMENT OF DISCHARGE AND SEDIMENT DEPOSITION
Percy Ian Campbell *In* WMO Mod Develop in Hydrometry Vol 2 1976 p 160-170 refs

Avail NTIS HC A22/MF A01 WMO, Geneva

How the Canadian Dept of Environment has adapted Electronic Distance Measuring Devices (EDMD s) to the measurement of both discharge and sediment changes in Canadian rivers is described The application of EDMD s was developed to reduce manpower requirements in the field, to permit automatic data handling, and to make possible measurement techniques not otherwise feasible Author (ESA)

N78-11468# World Meteorological Organization, Geneva (Switzerland)
SOME SPECIFIC PROBLEMS IN THE OPERATION OF A GAUGING STATION
James C Lambie *In* WMO Mod Develop in Hydrometry, Vol 2 1976 p 171-190
Avail NTIS HC A22/MF A01, WMO Geneva

The accuracy of the record of discharge from a gaging station is dependent on the accuracy of the record of stage and of the relation established between stage and discharge Some of the problems which arise in the operation of such a station are described and it is suggested that the quality of the stage recording instruments installed at the station should be related to the sensitivity of the station control and therefore of the stage discharge relation A method of defining sensitivity to enable a comparison of this quality to be made station to station is proposed The results of tests on different types of water level recorders both when new and after years of field use are given Details are given of velocity pulsation patterns detected on a number of rivers and the effect of these on average velocity Author (ESA)

N78-11469# Atomic Energy Research Establishment Harwell (England)
ULTRASONIC RIVER GAUGING
Ronald W Loosemore *In* WMO Mod Develop in Hydrometry Vol 2 1976 p 190-208 refs

Avail NTIS HC A22/MF A01 WMO Geneva

The principle of a non-obstructive method for determining the total volumetric flow-rate in rivers is outlined combining an ultrasonic measurement of mean water velocity at one depth with the output of a resistance water level sensor An instrument based on these principles is described which provides automatically a direct numerical display of net discharge and mean water depth together with outputs on punched tape It will operate at a mean water velocity of less than 0 01 m/sec Some details of its performance at three river sites in the U K are given A second instrument is also described, incorporating up to 8 ultrasonic measuring paths, in which the multiplexing, control and arithmetic functions are provided by a single-chip microprocessor and separate single-chip calculator It is intended for use in rivers which exhibit a wide range of stage Author (ESA)

N78-11470# Department of the Environmental Water Data Unit Reading (England)
SITE CALIBRATION OF ELECTROMAGNETIC AND ULTRASONIC RIVER GAUGING STATIONS
Michael John Green and Reginald Walter Herschy *In* WMO Mod Develop in Hydrometry Vol 2 1976 p 209-231 refs

Avail NTIS HC A22/MF A01, WMO Geneva

The output of the experimental electromagnetic river gaging system is compared to a Crump weir and it is shown that the rating equation may be expressed independent of the cross sectional area of the river A self calibrating procedure is described for the ultrasonic method of river gaging and compared to current metering and dilution gaging An accuracy of plus or minus 11 % was achieved for the standard error of estimate for the electromagnetic method The ultrasonic and current metering compared to within 6% and the dilution gaging between 3 and 14% Author (ESA)

N78-11475# Geological Survey, Anchorage Alaska
HYDROMETRY UNDER ARCTIC CONDITIONS
Joseph M Childers and James P Meckel *In* WMO Mod Develop in Hydrometry Vol 2 1976 p 298-303

Avail NTIS HC A22/MF A01 WMO Geneva

Streamflow measurement in Arctic Alaska requires special techniques and equipment in addition to those used in temperate regions Annual snowmelt contributes practically all runoff in most years in Arctic streams Variable ice and snow conditions require continuous discharge measurement to define the snowmelt hydrograph Winter flow from Sept to May produces channel ice, which hides the flow Much effort and specialized ice drilling or trenching are necessary to find and measure the flowing water, or to ascertain that no flow exists Special current meters and suspensions were designed for use through narrow drill holes

Remote sites accessible only by specialized aircraft require highly developed boating techniques where no bridges or cableways exist If a hydrometric field party is to measure not only streamflow discharge but also suspended sediment and other water-quality parameters on each trip travel is very expensive Also, this means that the hydrometrists must be versatile and trained in many skills Author (ESA)

N78-11476# Institute of Hydrology Wallingford (England)
TELEMETERING RIVER LEVEL FROM A LARGE, REMOTE, TROPICAL AREA
Ian Strangeways *In* WMO Mod Develop in Hydrometry Vol 2 1976 p 304-310 refs

Avail NTIS HC A22/MF A01 WMO Geneva

The problems of designing a radio telemetry system for river forecasting in a remote area of Brazil are discussed The area concerned is of about 490 000 sq km lacks more than rudimentary road or rail transport or a telephone network and is virtually unpopulated and undeveloped The sophisticated back-up required by complex instruments is in the distant modern cities on the coast The equipment used and the results achieved are described The importance of the part people play in instrument networks is discussed and a plea is made for instrument systems designed to fit the circumstances Author (ESA)

N78-11480# State Hydrological Inst (USSR)
AERIAL METHODS OF MEASURING WATER DISCHARGES
Vsevolod V Kuprianov *In* WMO Mod Develop in Hydrometry, Vol 2 1976 p 343-350 refs

Avail NTIS HC A22/MF A01, WMO Geneva

Methods of measuring water discharges with the help of an airplane have been under development in the U S S R since 1965 By now no less than 4 000 measurements have been carried out at the rivers in hard-to-access areas where the usage of routine methods is difficult There were methods of stream surface velocities determination by means of floats and velocity integration along the vertical The accuracy of aerial water discharge measurements if carefully carried out is not inferior to the accuracy of ground methods This method is particularly advantageous in the case of a submerged flood plain, when ground measurements are practically impossible The use of aerial methods affords the possibility of reducing or even eliminating ground measurements Author (ESA)

N78-11489# Geological Survey, Reston, Va
USE OF EARTH SATELLITE TECHNOLOGY FOR TELEMETERING HYDROMETEOROLOGICAL STATION DATA
Richard W Paulson *In* WMO Mod Develop in Hydrometry, Vol 2 1976 p 476-489 refs

Avail NTIS HC A22/MF A01 WMO Geneva

Recent developments in communications and earth satellite technologies are presenting new and powerful tools for the collection of hydrometeorological station data It is now possible, using existing technologies to deploy an earth satellite system to collect hydrometeorological data from a large network of stations distributed over continental or global areas Experiments for the last 3 years with the LANDSAT series of polar orbiting satellites have demonstrated that data can be collected via inexpensive battery operated radios several times daily from 1,000 to 2 000 stations distributed over North America The Geostationary Operational Environmental Satellites, two of which are in orbit are designed to collect data from 10,000 stations Existing technology can permit the collection of data from 100 000 stations deployed globally Earth satellites can become powerful tools for collecting data related to changes in the environment and for monitoring the status and performance of data gathering networks The hydrometeorological communities are faced with the challenge to develop water resources management and forecasting techniques to fully realize the benefits earth satellites can provide Author (ESA)

N78-11490# Inland Waters Directorate Ottawa (Ontario) Water Resources Branch
DATA RETRANSMISSION BY SATELLITE FOR OPERATIONAL PURPOSES
R A Halliday *In* WMO Mod Develop in Hydrometry Vol 2 1976 p 490-501 refs
Avail NTIS HC A22/MF A01 WMO Geneva

It is not economically possible to telemeter water resources data from many parts of Canada using conventional telephone or radio systems Because of this experimental use of the LANDSAT data retransmission system was initiated in 1972 Since that time both the LANDSAT and GOES spacecraft have been used to retransmit water level and other related data for operational purposes The retransmitted data have been used for flow and flood forecasting and for hydrometric operations The satellite data collection systems have operated so well and the costs of using the system have been so favorable that a considerable expansion of the network seems likely There is also a good possibility that a data retransmission system using Canadian UHF satellites will be implemented Author (ESA)

N78-11647# Maryland Univ College Park Meteorology Program
AN INTERCOMPARISON OF SATELLITE IMAGES AND RADAR RAINFALL RATES Final Report
Nancy Cheng and David Rodenhuis Apr 1977 69 p refs (Grant NOAA-04-4-158-48)
(PB-270299/1 NOAA-77062709) Avail NTIS HC A04/MF A01 CSCL 04B

Digitized NOAA-2 visible and infrared data were compared with the observations of WSR-57 10 cm radar for 1041 AM June 28, 1973 in the Miami area The linear correlation coefficients between satellite and radar data ranged from 0 23 to 0 34 for visible 0 17 to 0 27 for infrared The correlation could not be improved by considering only a fraction of the satellite image data above a threshold value That is the overlapping area ratios between satellite images and radar echoes ranged from 44% to 73% for the visible and slightly smaller (41% to 63%) for the infrared When only the area of the radar echo is considered the area ratios could be increased to an average of 75% (visible) and 71% (infrared) GRA

N78-12490 Old Dominion Univ , Norfolk, Va
FUNDAMENTAL ANALYSIS OF THE LINEAR MULTIPLE REGRESSION TECHNIQUE FOR QUANTIFICATION OF WATER QUALITY PARAMETERS FROM REMOTE SENSING DATA Ph D Thesis
Charles Henry Whitlock III 1977 184 p
Avail Univ Microfilms Order No 77-16940

Optical physics and environmental conditions under which multiple regression analysis is applicable were defined An investigation of signal response equations was conducted and concepts were tested by application to both analytical test cases and actual remote sensing data Least squares and statistical concepts for performing the analysis were examined and a test for evaluating the applicability of least squares techniques to a particular set of data was defined It was concluded that constituents with linear radiance gradients may be quantified from signals which contain nonlinear atmospheric and surface reflection effects for both homogeneous and nonhomogeneous water bodies provided accurate data can be obtained and nonlinearities are constant with wavelength Dissert Abstr

N78-12506*# Tennessee Univ Space Inst , Tullahoma Remote Sensing Div
APPLICATION OF LANDSAT IMAGES TO WETLAND STUDY AND LAND USE CLASSIFICATION IN WEST TENNESSEE, PART 1 Final Report
F Shahrokhi, Principal Investigator and Nancy L Jones [1977] 70 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(Contract NAS8-31980)
(E78-10031, NASA-CR-150422) Avail NTIS HC A04/MF A01 CSCL 08B

The author has identified the following significant results Densiometric analysis was performed on LANDSAT data to permit numerical classification of objects observed in the imagery on the basis of measurements of optical density Relative light transmission measurements were taken on four types of scene elements in each of three LANDSAT black and white bands in order to determine which classification could be distinguished The analysis of band 6 determined forest and agricultural classifications, but not the urban and wetlands Both bands 4 and 5 showed a significant difference existed between the confirmed classification of wetlands-agriculture, and urban areas Therefore, the combination of band 6 with either 4 or 5 would permit the separation of the urban from the wetland classification To enhance the urban and wetland boundaries, the LANDSAT black and white bands were combined in a multispectral additive color viewer Several combinations of filters and light intensities were used to obtain maximum discrimination between points of interest The best results for enhancing wetland boundaries and urban areas were achieved by using a color composite (a blue, green, and red filter on bands 4, 5 and 6 respectively)

N78-12607*# Calspan Corp, Buffalo, N Y
APPLICATIONS OF NCMM SATELLITE DATA Quarterly Report, 23 Aug. - 23 Nov. 1977
23 Nov 1977 2 p ERTS
(Contract NAS5-24263)
(E78-10033, NASA-CR-155257, QR-1) Avail NTIS HC A02/MF A01 CSCL 05B

N78-12618# Army Armament Research and Development Command, Aberdeen Proving Ground, Md Chemical Systems Lab
INFRARED ABSORPTION SPECTRA ATTRIBUTED TO ION-NUCLEATED WATER CLUSTERS Technical Report, Aug. 1976 - Jun. 1977
Hugh R Carlon Sep 1977 22 p refs
(AD-A044661, ARCSL-TR-77-59) Avail NTIS HC A02/MF A01 CSCL 04/1

Until recently it was assumed that atmospheric water was found in one of three phases vapor (monomer), liquid droplets or ice crystals Now it is known that an ion-nucleated, polymolecular cluster phase of water exists in the vapor phase, as well These water clusters consist of numbers of water molecules gathered about small ionic nuclei, where the number of molecules per cluster is dependent upon relative humidity and other meteorological parameters In real atmospheres, mean cluster sizes range from about 11 to about 14 molecules per cluster Their infrared absorption is due to intermolecular hydrogen bonding, and the 'continuum'-like absorption spectrum which they produce is shifted in wavelength by changes in mean cluster size Water clusters are always present in the atmosphere and in the cleanest of laboratory experimental equipment Except under supersaturations of about 420% relative humidity, clusters are not able, because of equilibrium considerations, to attain 'critical' size and to grow to droplets Water cluster theory and equations give excellent agreement with observed data for infrared 'continuum' absorption Author (GRA)

N78-13503*# Bendix Corp, Ann Arbor Mich Aerospace Systems Div
APPLICATION OF LANDSAT TO THE SURVEILLANCE OF LAKE EUTROPHICATION IN THE GREAT LAKES BASIN Final Report, Mar. 1975 - Sep. 1977
Robert H Rogers, Vann E Smith (Cranbrook Inst of Science, Bloomfield Hills, Mich), James P Scherz (Wisconsin Univ, Madison), William J Woelkerling (Wisconsin Univ, Madison), Michael S Adams (Wisconsin Univ, Madison), and John E Gannon, Principal Investigators (Michigan Univ, Pellston) Sep 1977 193 p refs Original contains color imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(Contract NAS5-20942)
(E78-10023, NASA-CR-154951, BSR-4291) Avail NTIS HC A09/MF A01 CSCL 08H

The author has identified the following significant results A step-by-step procedure for establishing and monitoring the trophic status of inland lakes with the use of LANDSAT data, surface sampling, laboratory analysis, and aerial observations were demonstrated The biomass was related to chlorophyll-a concentrations, water clarity, and trophic state A procedure was developed for using surface sampling, LANDSAT data, and linear regression equations to produce a color-coded image of large lakes showing the distribution and concentrations of water quality parameters, causing eutrophication as well as parameters which indicate its effects Cover categories readily derived from LANDSAT were those for which loading rates were available and were known to have major effects on the quality and quantity of runoff and lake eutrophication Urban, barren land, cropland, grassland, forest, wetlands, and water were included

N78-13504*# Wisconsin Univ, Madison Inst for Environmental Studies
ON MULTIDISCIPLINARY RESEARCH ON THE APPLICATION OF REMOTE SENSING TO WATER RESOURCES PROBLEMS Progress Report, 1976 - 1977
James L Clapp 1977 384 p refs Original contains color imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(Grant NGL-50-002-127)
(E78-10028, NASA-CR-155253) Avail NTIS HC A17/MF A01 CSCL 08H

N78-13505*# Norwegian Water Resources and Electricity Board, Oslo
APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY Final Report
Helger Odegaard Principal Investigator and Gunnar Ostrem 1 Feb 1977 64 p refs Sponsored by NASA Original contains color imagery Original photography may be purchased from the EROS Data Center Sioux Falls, S D ERTS
(E78-10029, NASA-CR-155254) Avail NTIS HC A04/MF A01 CSCL 08L

The author has identified the following significant results It was shown that if the snow cover extent was determined from all four LANDSAT bands, there were significant differences in results The MSS 4 gave the largest snow cover, but only slightly more than MSS 5, whereas MSS 6 and 7 gave the smallest snow area A study was made to show that there was a relationship between the last date of snow fall and the area covered with snow as determined from different bands Imagery obtained shortly after a snow fall showed no significant difference in the snow-covered area when the four bans were compared, whereas, pronounced differences in the snow-covered area were found in images taken after a long period without precipitation

N78-13509*# Ecosystems International, Inc, Gambrills, Md
APPLICATIONS OF REMOTE SENSING TO WATER RESOURCES Technical Report, 15 Mar - 30 Apr. 1977
Dec 1977 52 p
(Contract NAS8-32408)
(NASA-CR-150467) Avail NTIS HC A04/MF A01 CSCL 08H

Analyses were made of selected long-term (1985 and beyond) objectives, with the intent of determining if significant data-related problems would be encountered and to develop alternative solutions to any potential problems One long-term objective selected for analysis was Water Availability Forecasting A brief overview was scheduled in FY-77 of the objective -- primarily a fact-finding study to allow Data Management personnel to gain adequate background information to perform subsequent data system analyses This report, includes discussions on some of the larger problems currently encountered in water measurement, the potential users of water availability forecasts, projected demands of users, current sensing accuracies, required parameter monitoring status of forecasting modeling and some measurement accuracies likely to be achievable by 1980 and 1990 Author

N78-13513# Army Cold Regions Research and Engineering Lab, Hanover N H
AERIAL PHOTOINTERPRETATION OF A SMALL ICE JAM

Stephen L. Denhartog Oct 1977 21 p
(AD-A045870, CRREL-SR-77-32) Avail NTIS HC A02/MF A01 CSCL 08/12

Aerial photos of a small ice jam on the Pemigewasett River near Plymouth, New Hampshire, were taken three days after the jam and compared with photos taken after the ice went out. The winter photos show a marked and sudden decrease in floe size apparently indicative of faster and longer movement of the ice. The spring photos show a number of shallows and obstructions that apparently had no effect on the ice movement. It is concluded that this jam was caused by a change in slope and subsequent reduction in velocity. Author (GRA)

N78-13522# Idaho Univ., Moscow. Water Resources Research Inst.
EFFECT OF ANTECEDENT ON FROZEN GROUND FLOODS
Ralph Pedersen, Myron Molnau, and En Sheng Yen (Ping Tung Inst. of Agriculture). Jan 1977 32 p refs Sponsored by Dept. of the Interior
(PB-270632/3 W77-10175, OWRT-A-045-IDA(3)) Avail NTIS HC A03/MF A01 CSCL 08H

Discriminant analysis is used to study frozen and unfrozen ground runoff events for four watersheds in the Pacific Northwest. Part of the discriminant procedure was used to choose a set of meteorological factors for each area that can distinguish between frozen and unfrozen ground runoff events. These variables were then used to define a system to classify other past or future runoff events. The occurrence of a frozen ground runoff event is dependent on the combination of several meteorological factors interacting together rather than on the influence of one single variable such as the average minimum air temperature. This methodology proved successful for two of the watersheds studied. GRA

N78-13628*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
QUANTITATIVE ANALYSIS OF AIRCRAFT MULTISPECTRAL-SCANNER DATA AND MAPPING OF WATER-QUALITY PARAMETERS IN THE JAMES RIVER IN VIRGINIA
Robert W. Johnson and Gilbert S. Bahn (Vought Corp., Hampton Va.). Dec 1977 33 p refs
(NASA-TP-1021, L-10968) Avail NTIS HC A03/MF A01 CSCL 13B

Statistical analysis techniques were applied to develop quantitative relationships between in situ river measurements and the remotely sensed data that were obtained over the James River in Virginia on 28 May 1974. The remotely sensed data were collected with a multispectral scanner and with photographs taken from an aircraft platform. Concentration differences among water quality parameters such as suspended sediment, chlorophyll a, and nutrients indicated significant spectral variations. Calibrated equations from the multiple regression analysis were used to develop maps that indicated the quantitative distributions of water quality parameters and the dispersion characteristics of a pollutant plume entering the turbid river system. Results from further analyses that use only three preselected multispectral scanner bands of data indicatead that regression coefficients and standard errors of estimate were not appreciably degraded compared with results from the 10-band analysis. Author

N78-14458*# Norwegian Water Resources and Electricity Board, Oslo.
APPLICATION OF LANDSAT IMAGERY FOR SNOW MAPPING IN NORWAY. Final Report, 16 May 1975 - 27 Aug. 1976
Helge Odegaard and Johnny E. Skorve. Principal Investigators. 25 May 1977 29 p refs Sponsored by NASA. Original contains imagery. Original photography may be purchased from the EROS Data Center, Sioux Falls, S. D. ERTS
(E78-10041, NASA-CR-155341) Avail NTIS HC A03/MF A01 CSCL 08L

The author has identified the following significant results. During the summer seasons of 1975 and 1976, the snow cover was successfully monitored and measured in the four basins. By using elevation distributions for these basins combined with the measured snow cover percentages, the equivalent snow line altitude was calculated. Equivalent snow line altitude was used in accordance with Mark Meier's definition. Cumulative runoff data were collected for the basins. Tables showing percentage snow cover versus cumulative runoff were worked out for 1975.

N78-14467*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE UTILITY OF SHORT WAVELENGTH (>1mm) REMOTE SENSING TECHNIQUES FOR THE MONITORING AND ASSESSMENT OF HYDROLOGIC PARAMETERS
A. Rango and V. Salomonson. *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 55-66 refs
Avail NTIS HC A99/MF A01 CSCL 08H

Remote sensing programs that respond to the requirements of the water resources management and hydrologic communities are reviewed. The major areas where the needs of water resources management are being met involve the mapping and monitoring of snowcovered areas, hydrologic landuse and surface water area. In the case of snowcovered area mapping the transfer of technology process is now being accomplished in the Western United States in a cooperative effort involving 6 federal agencies and 3 state agencies along with NASA. A new collaborative effort of the U.S. Army Corps of Engineers and NASA involves the mapping of landuse by Landsat and its use in hydrologic engineering watershed models employed in flood control/waterworks planning, design, and management. Improved systems planned for implementation in the 1978-1981 time frame can be expected to result in increased utilization of visible and near infrared remote sensing observations. Author

N78-14468*# Kansas Univ. Center for Research, Inc., Lawrence. Remote Sensing Lab.
MICROWAVE REMOTE SENSING OF HYDROLOGIC PARAMETERS
Fawwaz T. Ulaby. *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 67-86 refs

Avail NTIS HC A99/MF A01 CSCL 08H

A perspective on the implementation of microwave sensors in future airborne and spaceborne observations of hydrologic parameters is presented. The rationale is based on a review of the status and future trends of active (radar) and passive (radiometer) microwave research as applied to the remote sensing of soil moisture content, snowpack water equivalent, freeze/thaw boundaries, lake ice thickness, surface water area and the specification of watershed runoff coefficients. Analyses and observations based on data acquired from ground based, airborne and spaceborne platforms and an evaluation of advantages and limitations of microwave sensors are included. Author

N78-14469*# Maryland Univ., College Park. Dept. of Civil Engineering.
UTILIZATION OF REMOTE SENSING OBSERVATIONS IN HYDROLOGIC MODELS
Robert M. Ragan. *In* ERIM Proc. of the 11th Intern. Symp. on Remote Sensing of Environment, Vol. 1 1977 p 87-99 refs

Avail NTIS HC A99/MF A01 CSCL 08H

Most of the remote sensing related work in hydrologic modeling has centered on modifying existing models to take advantage of the capabilities of new sensor techniques. There has been enough success with this approach to insure that remote sensing is a powerful tool in modeling the watershed processes. Unfortunately, many of the models in use were designed without recognizing the growth of remote sensing technology. Thus their parameters were selected to be map or field crew definable. It is believed that the real benefits will come through the evolution of new models having new parameters that are developed specifically to take advantage of our capabilities in remote sensing. The ability to define hydrologically active areas could have a significant impact. The ability to define soil moisture and the evolution of new techniques to estimate evoportransportation

could significantly modify our approach to hydrologic modeling Still without a major educational effort to develop an understanding of the techniques used to extract parameter estimates from remote sensing data, the potential offered by this new technology will not be achieved Author

N78-14485*# Geological Survey Reston, Va
COASTAL WETLANDS THE PRESENT AND FUTURE ROLE OF REMOTE SENSING
Virginia Carter *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 301-323 refs
Avail NTIS HC A99/MF A01 CSCL 08C

During the past decade, there has been a rapid expansion of remote sensing research and technology development related to coastal wetlands As a result of this research all of the 23 coastal states have ongoing or completed wetland inventories, most utilizing aerial photographs as the data source for producing a variety of map products with varying scales formats, classification systems and intended uses The U S Geological Survey is increasing emphasis on map production and revision for the coastal zone The new U S Fish and Wildlife Service National Wetland Inventory is intended to provide a standardized method for comparison of wetlands on a national basis - it too will use available aerial photographs as a basic data source At present, satellite data is not used for operational mapping of coastal wetlands because of resolution and geometric constraints In the future, however satellite data may provide an accurate reliable and economical source to update wetland inventories and to monitor or evaluate coastal wetlands The technological improvements accompanying the development and launch of Landsat C and D and the space shuttle promise to make satellite digital data a more powerful tool to supply information for future management decisions for coastal wetlands Author

N78-14492*# Tennessee Valley Authority, Chattanooga Mapping Services Branch
REMOTE MONITORING AND TENNESSEE VALLEY AUTHORITY PROGRAMS
Alan R Stevens and Alan W Voss *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 385-392
Avail NTIS HC A99/MF A01 CSCL 05A

The Tennessee Valley Authority was created in 1933 as a resource development agency and was charged with the basic mission of improving the economy of a depressed region through power production flood control and navigation Those programs which availed themselves of remotely monitored data, either directly or indirectly supporting this mission were examined Author

N78-14499*# Universidad Nacional Autonoma de Mexico, Villa Obregon Interdisciplinario Lab
A STUDY OF SUSPENDED SOLIDS IN THE REQUENA DAM BY REMOTE SENSING
P Ruiz Azuara and L Lemus Hidalgo *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 495-504 refs
Avail NTIS HC A99/MF A01 CSCL 08H

Remote sensing was applied to a preliminary study of suspended solids in the Requena Dam Aerial and terrestrial photographs were analyzed by photointerpretation and microdensitometry Field measurements and sampling were also made A relationship between ground data for the concentration of suspended solids and the transmissibility of the aerial infrared film was suggested Author

N78-14501*# EROS Data Center Sioux Falls S Dak
MONITORING IRRIGATED LAND ACREAGE USING LANDSAT IMAGERY AN APPLICATION EXAMPLE
William C Draeger *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 515-524 ref
Avail NTIS HC A99/MF A01 CSCL 08B

A demonstration of the utility of LANDSAT imagery for quickly and cheaply estimating irrigated land area was conducted in the Klamath River basin of Oregon LANDSAT color composite images at 1 250 000 scale and acquired on two dates during the 1975 growing season, were interpreted Irrigated lands were delineated manually and the irrigated area was estimated, based on dot-grid sampling of the manually delineated lands The image interpretation estimate of irrigated area was then adjusted by a comparison of interpretation results with ground data on 45 sample plots each 2 6 square kilometers in size Two interpreters independently estimated the irrigated area Their adjusted estimates were 115 000 hectares and 108 000 hectares respectively with corresponding 95 percent confidence intervals of + or - 7 880 hectares and + or - 14,000 hectares Author

N78-14508*# California Univ Santa Barbara Geography Remote Sensing Unit
AUTOMATED IMAGE PROCESSING OF LANDSAT 2 DIGITAL DATA FOR WATERSHED RUNOFF PREDICTION
Robert R Sasso, John R Jensen and John E Estes *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 591-599 refs

(Grant NGR-05-025-001)
Avail NTIS HC A99/MF A01 CSCL 08H

The U S Soil Conservation Service (SCS) model for watershed runoff prediction uses soil and land cover information as its major drivers Kern County Water Agency is implementing the SCS model to predict runoff for 10,400 sq cm of mountainous watershed in Kern County California The Remote Sensing Unit University of California Santa Barbara was commissioned by KCWA to conduct a 230 sq cm feasibility study in the Lake Isabella, California region to evaluate remote sensing methodologies which could be ultimately extrapolated to the entire 10,400 sq cm Kern County watershed Digital results indicate that digital image processing of Landsat 2 data will provide usable land cover required by KCWA for input to the SCS runoff model Author

N78-14509*# Bern Univ (Switzerland) Inst of Applied Physics
MICROWAVE MULTISPECTRAL INVESTIGATIONS OF SNOW
E Schanda and R Hofer *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 601-607 refs
Avail NTIS HC A99/MF A01 CSCL 08L

A long term observational program on microwave emission and scatter behavior under controlled conditions, was started at a high altitude alpine test site All stages of development of snow cover during the whole season are under investigation The study was done to achieve required knowledge on microwave radiative properties of snow for optimization of the microwave payloads of air and spaceborne snow sensors and for the interpretation of large scale snow maps obtained by these sensors Preliminary results of the first month obtained with radiometers at 4 9, 10 5 21 and 36 GHz are presented Author

N78-14510*# Tennessee Univ Space Inst , Tullahoma Remote Sensing Div
APPLICATION OF LANDSAT DATA TO WETLAND STUDY AND LAND USE CLASSIFICATION IN WEST TENNESSEE
N L Jones and F Shahrokhi *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 609-613
(Contract NAS8-31980)
Avail NTIS HC A99/MF A01 CSCL 08C

The Obion-Forked Deer River Basin in northwest Tennessee is confronted with several acute land use problems which result in excessive erosion sedimentation, pollution, and hydrologic runoff LANDSAT data was applied to determine land use of selected watershed areas within the basin with special emphasis on determining wetland boundaries Densitometric analysis was performed to allow numerical classification of objects observed in the imagery on the basis of measurements of optical densities Multispectral analysis of the LANDSAT imagery provided the capability of altering the color of the image presentation in order to enhance desired relationships Manual mapping and

classification techniques were performed in order to indicate a level of accuracy of the LANDSAT data as compared with high and low altitude photography for land use classification Author

N78-14527*# California Univ Berkeley Space Sciences Lab
REMOTE SENSING-AIDED SYSTEMS FOR SNOW QUALIFICATION, EVAPOTRANSPIRATION ESTIMATION, AND THEIR APPLICATION IN HYDROLOGIC MODELS
Siamak Korram *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 795-806 refs
Avail NTIS HC A99/MF A01 CSCL 08L

The design of general remote sensing-aided methodologies was studied to provide the estimates of several important inputs to water yield forecast models These input parameters are snow area extent snow water content, and evapotranspiration The study area is Feather River Watershed (780 000 hectares), Northern California The general approach involved a stepwise sequence of identification of the required information, sample design measurement/estimation and evaluation of results All the relevent and available information types needed in the estimation process are being defined These include Landsat meteorological satellite and aircraft imagery, topographic and geologic data ground truth data, and climatic data from ground stations A cost-effective multistage sampling approach was employed in quantification of all the required parameters The physical and statistical models for both snow quantification and evapotranspiration estimation was developed These models use the information obtained by aerial and ground data through appropriate statistical sampling design Author

N78-14528*# Michigan State Univ East Lansing
APPLICATION OF AERIAL PHOTOGRAPHY TO WATER-RELATED PROGRAMS IN MICHIGAN
W R Enslin, R Hill-Rowley, and S E Tilmann *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 807-816
(Grant NGL-23-004-083)
Avail NTIS HC A99/MF A01 CSCL 08H

Aerial photography and information system technology were used to generate information required for the effective operation of three water-related programs in Michigan Potential mosquito breeding sites were identified from specially acquired low altitude 70 mm color photography for the city of Lansing the inventory identified 35% more surface water areas than indicated on existing field maps A comprehensive inventory of surface water sources and potential access sites was prepared to assist fire departments in Antrim County with fire truck water-recharge operations Remotely-sensed land cover/use data for Windsor Township, Eaton County, were integrated with other resource data into a computer-based information system for regional water quality studies Eleven thematic maps focusing on landscape features affecting non-point water pollution and waste disposal were generated from analyses of a four-hectare grid-based data file containing land cover/use, soils topographic and geologic (well-log) data Author

N78-14536*# Consiglio Nazionale delle Richerche, Venice (Italy) Laboratorio per lo Studio della Dinamica delle Grandi Masse
QUANTITATIVE EVALUATION OF WATER BODIES DYNAMIC BY MEANS OF THERMAL INFRARED AND MULTISPECTRAL SURVEYS ON THE VENETIAN LAGOON
L Alberotanza and G M Lechi (CNR, Milano, Italy) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 893-902
Avail NTIS HC A99/MF A01 CSCL 08H

Surveys employing a two channel Daedalus infrared scanner and multispectral photography were performed The spring waning tide, the velocity of the water mass, and the types of suspended matter were among the topics studied Temperature salinity sediment transport and ebb stream velocity were recorded The bottom topography was correlated with the dynamic characteristics of the sea surface Author

N78-14545*# Colorado State Univ Fort Collins Dept of Earth Resources
MULTIDATE MAPPING OF MOSQUITO HABITAT
Thomas L Woodzick and Eugene L Maxwell *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 979-989 refs Sponsored by PHS

Avail NTIS HC A99/MF A01 CSCL 06C

LANDSAT data from three overpasses formed the data base for a multidate classification of 15 ground cover categories in the margins of Lewis and Clark Lake a fresh water impoundment between South Dakota and Nebraska When scaled to match topographic maps of the area the ground cover classification maps were used as a general indicator of potential mosquito-breeding habitat by distinguishing productive wetlands areas from nonproductive nonwetlands areas The 12 channel multidate classification was found to have an accuracy 23% higher than the average of the three single date 4 channel classifications Author

N78-14550*# Ludwig-Maximilians-Universitat Munich (West Germany) Institut fur Geographie
TEXTURAL ANALYSIS BY STATISTICAL PARAMETERS AND ITS APPLICATION TO THE MAPPING OF FLOW-STRUCTURES IN WETLANDS
U Wieczorek *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1035-1043 refs
Avail NTIS HC A99/MF A01 CSCL 08B

From 1974 to 1977, the application of remote sensing methods in coastal areas and tidal bays and estuaries was investigated on the German coast of the North Sea Aerial photographs were taken using different films, (1) color (2) color infrared, and (3) black and white films Scanner recordings were taken by an 11 channel scanner Ground truth measurements of radiation and measurements of meteorological elements were carried out For mapping the morphology in mudflat areas a digital texture analysis was developed by which measurement of the change of image structures cased by distributing factors, such as changing illumination is possible Author

N78-14551*# Bendix Corp Ann Arbor Mich Aerospace Systems Div
PRODUCTION OF A WATER QUALITY MAP OF SAGINAW BAY BY COMPUTER PROCESSING OF LANDSAT-2 DATA
John B Mckeon Robert H Rogers and V Elliott Smith (Cranbrook Inst of Sci, Bloomfield Hills Mich) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1045-1054 refs Sponsored by EPA

Avail NTIS HC A99/MF A01 CSCL 08H

Surface truth and LANDSAT measurements collected July 31, 1975, for Saginaw Bay were used to demonstrate a technique for producing a color coded water quality map On this map color was used as a code to quantify five discrete ranges in the following water quality parameters (1) temperature (2) Secchi depth (3) chloride (4) conductivity (5) total Kjeldahl nitrogen (6) total phosphorous (7)chlorophyll a, (8) total solids and (9) suspended solids The LANDSAT and water quality relationship was established through the use of a set of linear regression equations where the water quality parameters are the dependent variables and LANDSAT measurements are the independent variables Although the procedure is scene and surface truth dependent, it provides both a basis for extrapolating water quality parameters from point samples to unsampled areas and a synoptic view of water mass boundaries over the 3000 sq km bay area made from one day s ship data that is superior, in many ways, to the traditional machine contoured maps made from three day's ship data Author

N78-14563*# Geological Survey Helena Mont
USE OF THERMAL-INFRARED IMAGERY IN GROUND-WATER INVESTIGATIONS IN MONTANA
A J Boettcher and R M Haralick (Kansas Univ Lawrence) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing

of Environment, Vol 2 1977 p 1161-1170 refs

Avail NTIS HC A99/MF A01 CSCL 08H

Thermal infrared imagery was used to locate ground-water inflow along three streams and one lake in Montana The thermal scanner used in May 1972, March 1973 and November 1975 was mounted in a twin-engined aircraft On the 1973 and 1975 flights, the data were recorded in an analog format on magnetic tape in flight, later were converted to digital format and were computer processed using an assignment of patterns to indicate differences in water temperature Output from the image processing program was converted to a temperature map having an isotherm spacing of 0 5 C Computerization was found to be the most efficient method to manipulate data from lakes, large rivers, and narrow sinuous streams Author

N78-14564*# California Univ Davis Dept of Electrical Engineering

SATELLITE LAND USE ACQUISITION AND APPLICATIONS TO HYDROLOGIC PLANNING MODELS

V R Algazi and Minsoo Suk *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1171-1181 refs

Avail NTIS HC A99/MF A01 CSCL 08H

A developing operational procedure for use by the Corps of Engineers in the acquisition of land use information for hydrologic planning purposes was described The operational conditions preclude the use of dedicated interactive image processing facilities Given the constraints, an approach to land use classification based on clustering seems promising and was explored in detail The procedure is outlined and examples of application to two watersheds given Author

N78-14582*# Atomic Energy Establishment Cairo (Egypt) Remote Sensing Center

GROUNDWATER STUDIES IN ARID AREAS IN EGYPT USING LANDSAT SATELLITE IMAGES

E M ElShazly, M A AbdelHady and M M ElShazly *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1365-1372 refs

Avail NTIS HC A99/MF A01 CSCL 08H

Various features are interpreted which have strong bearing on groundwater in the arid environment These include the nature of geological and lithologic units, structural lineaments, present and old drainage systems, distribution and form of water pools geomorphologic units, weathering surfaces and other weathering phenomena, desert soils sand dunes and dune sand accumulations growths of natural vegetation and agriculture, and salt crusts and other expressions of salinization There are many impressive examples which illustrate the significance of satellite image interpretation on the regional conditions of groundwater which could be traced and interconnected over several tens or even several hundreds of kilometers This is especially true in the northern Western Desert of Egypt where ground water issuing from deep strata comes to the surface along ENE-WSW and ESE-WNW fault lines and fracture systems Another striking example is illustrated by the occurrence of fresh to brackish groundwater on the Mediterranean Sea Coastal Zone of the Western Desert where the groundwater is found in the form of lenses floating on the saline sea water Author

N78-14600*# Geological Survey Suffolk Va

THREE APPROACHES TO THE CLASSIFICATION OF INLAND WETLANDS

Patricia T Gammon, Donald Malone (Tenn Valley Authority, Chattanooga), Paul D Brooks, and Virginia Carter *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1545-1555 refs

Avail NTIS HC A99/MF A01 CSCL 08B

In the Dismal Swamp project, seasonal, color-infrared aerial photographs and LANDSAT digital data were interpreted for a detailed analysis of the vegetative communities in a large highly altered wetland In Western Tennessee seasonal high altitude color-infrared aerial photographs provided the hydrologic and vegetative information needed to map inland wetlands, using a classification system developed for the Tennessee Valley Region In Florida, color-infrared aerial photographs were analyzed to produce wetland maps using three existing classification systems to evaluate the information content and mappability of each system The methods used in each of the three projects can be extended or modified for use in the mapping of inland wetlands in other parts of the United States Author

N78-14609*# Leningrad (A A Zhdanov) State Univ (USSR) Dept of Atmospheric Physics

PASSIVE MICROWAVE REMOTE SENSING OF SOIL MOISTURE

K Ya Kondratyev, V V Melentyev, Yu I Rabinovich and E M Shulgina *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1637-1661 refs

Avail NTIS HC A99/MF A01 CSCL 08M

The theory and calculations of microwave emission from the medium with the depth-dependent physical properties are discussed, the possibility of determining the vertical profiles of temperature and humidity is considered Laboratory and aircraft measurements of the soil moisture are described, the technique for determining the productive-moisture content in soil, and the results of aircraft measurements are given Author

N78-14616# California Univ , Berkeley Lawrence Berkeley Lab.

RECENT DEVELOPMENTS IN MODELING GROUNDWATER SYSTEMS

T N Narasimhan and P A Witherspoon 20 May 1977 34 p refs

(Contract W-7405-eng-48)

(LBL-5209) Avail NTIS HC A03/MF A01

Developments in the mathematical modeling of groundwater systems over the past decade are reviewed The physics of the different types of problems that are of interest in hydrogeology and a statement of the related initial-boundary value problems are described The various numerical techniques that have been employed to solve the governing equations are discussed and a few typical case histories are presented to illustrate the trend of progress that has occurred in the application of mathematical modeling to actual field problems ERA

N78-14624# Wyoming Univ Laramie Water Resources Research Inst

RELATIONSHIP OF TECTONIC STRUCTURE TO AQUIFER MECHANICS IN THE WESTERN GRAND CANYON DISTRICT, ARIZONA

Peter W Huntoon Apr 1977 91 p refs

(Contract DI-14-34-0001-6134, OWRT Proj B-031-WYO(1)) (PB-272308/8, W77-11867, Ser-66) Avail NTIS HC A05/MF A01 CSCL 08H

The Rampart Cave Member of the Muay Limestone, the major aquifer in the western Grand Canyon district was studied It was found that prospects for developing large ground water supplies in the district are dim because total recharge and permeabilities are small, and there are no extensive permeable zones under the plate in which large quantities of water are stored Selected fault zones that supply water to large springs offer the most promising areas for drilling GRA

N78-15529 Texas A&M Univ , College Station

MICROWAVE REMOTE SENSING AND ITS APPLICATION TO SOIL MOISTURE DETECTION, VOLUMES 1 AND 2 Ph D Thesis

Richard Wayne Newton 1977 768 p

Avail Univ Microfilms Order No 77-20398

Theoretical and experimental studies of the thermal microwave emission from moist soil were performed The theoretical study was undertaken to provide a physical understanding of the emission from soil and its relationship to soil mositure It is shown that the soil permittivity is dependent on the soil water metric potential independent of soil texture Relationships describing the effects of the soil permittivity profile, surface

roughness and vegetation cover on the microwave emission from soil are developed Emission from the soil volume is described using a radiative transfer approach, the effect of surface roughness is modeled using the Kirchhoff approximation and vegetation cover is modeled as a dielectric slab Dissert Abstr

N78-15531 Indiana Univ, Bloomington
TRICHLOROFLUOROMETHANE, A NEW HYDROLOGIC TOOL FOR TRACING AND DATING GROUND WATER Ph.D Thesis
Glenn Michael Thompson 1976 103 p
Avail Univ Microfilms Order No 77-22639

Preliminary investigations were conducted in three areas where the hydrology was well understood and where tritium measurements had been made in the past They were the Wharton tract of southern New Jersey Hot Springs National Park, Arkansas, and the Edwards aquifer of south central Texas Good agreement was observed between the CCl3F data and the known hydrology The Texas study revealed a series of anomalous CCl3F concentrations that were too high to be of atmospheric origin The anomalous points occurred in a line extending from the northwest corner of San Antonio 46 miles along the Balcones fault zone The location of the plume indicates direction of ground-water movement in the area and demonstrates the likely utility of CCl3F as a ground-water tracer All CCl3F measurements were made in the field with a portable gas chromatograph
Dissert Abstr

N78-15541*# Geological Survey, Reston, Va Water Resources Div
APPLICATION OF REMOTELY SENSED LAND-USE INFORMATION TO IMPROVE ESTIMATES OF STREAMFLOW CHARACTERISTICS, VOLUME 8 Final Report
Edward J Pluhowski, Principal Investigator Aug 1977 93 p refs ERTS
(NASA Order S-70243-AG)
(E78-10052, NASA-CR-155365) Avail NTIS HC A05/MF A01 CSCL 08H

The author has identified the following significant results Land use data derived from high altitude photography and satellite imagery were studied for 49 basins in Delaware and eastern Maryland and Virginia Applying multiple regression techniques to a network of gaging stations monitoring runoff from 39 of the basins, demonstrated that land use data from high altitude photography provided an effective means of significantly improving estimates of stream flow Forty stream flow characteristic equations for incorporating remotely sensed land use information, were compared with a control set of equations using map derived land cover Significant improvement was detected in six equations where level 1 data was added and in five equations where level 2 information was utilized Only four equations were improved significantly using land use data derived from LANDSAT imagery Significant losses in accuracy due to the use of remotely sensed land use information were detected only in estimates of flood peaks Losses in accuracy for flood peaks were probably due to land cover changes associated with temporal differences among the primary land use data sources

N78-15630# Army Cold Regions Research and Engineering Lab, Hanover, N H
OBSERVATIONS OF THE ULTRAVIOLET SPECTRAL REFLECTANCE OF SNOW
Harold W OBrien Jan 1977 25 p
(DA Proj 1T1-61102-B-52A)
(AD-A046349, CRREL-77-27) Avail NTIS HC A02/MF A01 CSCL 08/12

The spectral reflectance of natural snow in the range of 0 20- to about 0 40-micrometers wavelengths was studied in the laboratory using both continuous spectral scanning and fixed bandpass measurements White barium sulfate pressed powder was used as a standard for comparison The reflectance of fresh snow was found to be very high (usually nearly 100%) and only weakly wavelength dependent from 0 24 micrometers to the visible range In the 0 20- to 0 24-micrometers portion of the spectrum, the reflectance was found to be quite erratic Possible reasons for the irregularities in reflectance measurements are discussed GRA

N78-15660# Center for the Environment and Man, Inc, Hartford, Conn
PRECIPITATION (RADAR) PROJECT OF THE IFYGL LAKE METEOROLOGY PROGRAM
James W Wilson and David M Pollock (Atmospheric Environment Serv, Downsview Ontario) Jul 1977 53 p refs
(Grant NOAA-03-5-022-17)
(PB-272152/0 NOAA-77082507, IFYGL-Special-Bull-20) Avail NTIS HC A04/MF A01 CSCL 04B

Precipitation measurements for Lake Ontario and its watershed were derived for the period from April 1972 to March 1973 of the International Field Year for the Great Lakes The precipitation observation systems and measurement techniques are described, and measurements are compared The lake had a discernable effect on the precipitation approximately one half of the precipitation days While the lake frequently influences precipitation patterns, its effect on total season precipitation is less apparent GRA

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07
DATA PROCESSING AND DISTRIBUTION SYSTEMS

Includes film processing computer technology satellite and aircraft hardware and imagery

A78-10075 **A modern tool for land design** G E Clark *Waste Age,* vol 8, Sept 1977, p 10 12

Precision aerial photography and aerial photogrammetry of areas used for or projected for landfills are described Weather obstacles to aerial surveys, and ground control measures required, are described, and mapping and stereoplotting techniques are outlined briefly Information obtainable from comparison of panchromatic film records and IR or other special film records is noted, contrasts between the vivid IR false-color images of healthy and lush vegetation and the IR false-color of sickly vegetation affected by pollutants is described and also illustrated by the front cover color photo of the periodical R D V

A78-10325 **Side-looking airborne radar** H Jensen (Litton Industries, Beverly Hills, Calif), L C Graham (Goodyear Aerospace Corp , Litchfield Park, Ariz), L J Porcello (Science Applications, Inc , Tucson, Ariz), and E N Leith (Willow Run Laboratories, Mich) *Scientific American,* vol 237, Oct 1977, p 84-95

The article discusses airborne radar systems that form microwave images of adjacent terrain in fine detail, regardless of weather or time of day or night, by looking to the side of an aircraft The question of why the radar antenna should be pointed to the side is considered along with the resolution of a side-looking airborne radar system, unique properties of the microwave images recorded by such a system, the reflection characteristic of various surfaces, and image geometry Aperture synthesis with side-looking airborne radar is described, and it is shown that synthetic-aperture radar makes it possible to obtain high-resolution images of terrain many miles away from the aircraft flight path Holographic imaging with synthetic-aperture radar is examined, practical problems in recording a holographic radar image are noted, and simple solutions to these problems are outlined Several applications of side-looking airborne radar are reviewed, including terrain-mapping surveys in South America, identification of faults and other tectonic features, site selection for nuclear power plants, and surface imaging of the moon and Venus F G M

A78-10519 **Height measurements from satellite images** R Welch and C P Lo (Georgia, University, Athens, Ga) *(American Society of Photogrammetry, Annual Meeting, 42nd, Washington, D C , Feb 1976) Photogrammetric Engineering and Remote Sensing,* vol 43, Oct 1977, p 1233-1241 22 refs

A description is presented of the development of an instrument, the Zoom Height Finder, for the economical derivation of heights from small-scale images with the aid of instrumentation and techniques comparable to those employed with aerial photographs An investigation is conducted of the interrelationships between various factors, including the base-height ratio, image quality, viewing magnification, and the precision and accuracy of height measurements obtained from Skylab and Landsat models Attention is given to height difference measurements, height measurements, and Skylab and Landsat model characteristics G R

A78-10543 # **Stationary waves in the Southern Hemisphere mid-latitude zone revealed from average brightness charts** T Yasunari (Kyoto University, Kyoto, Japan) *Meteorological Society of Japan, Journal,* vol 55, June 1977, p 274-285 16 refs

Zonal stationary waves in the Southern Hemisphere mid-latitude belt (20S to 60S) were analyzed using 90-day-average brightness charts for summer and winter and one intermediate season in 1969 based on daily satellite records of cloud cover Stationary waves of wavenumber 1-4 were found (by harmonic analysis of average brightness) along the four latitude circles, with a general NW-SE tilt The waves are correlated with geographic location and local features, maximum brightness (wavenumber 1) corresponds to the pressure wave trough and stays in the eastern Atlantic through the Indian Ocean at 40S-50S, but in the central Pacific at subtropical latitudes (20S-40S) R D V

A78-12927 # **The Italian ground receiving and processing facility for earth resources survey data** G Bressanin (Telespazio S p A , Rome, Italy) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings.
Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 23-32.

An Italian ground facility for processing earth resources data from Landsat satellites and from weather satellites is described The facility, which employs all-digital hardware components, monitors the European and North African areas The acquisition, monitoring and processing systems are considered, radiometric and geometric corrections, off-loaded to two high-speed processors operating in conjunction with a minicomputer, are also discussed Products available from the facility include 70-mm black and white transparencies, 240-mm black and white or color transparencies, paper prints, computer-compatible tapes, digitally enlarged images and contrast-processed images J M B

A78-12928 # **Earth Resources Management system for analyzing remotely sensed data** E J Albuquerque (IBM Public Sector Industry Center, Brussels, Belgium) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 33-40 5 refs

Earth Resources Management, a software system for the analysis of remote sensing data from Landsat satellites, is described The executive routine of the software system, which uses a menu-oriented method, is examined, image loading, image manipulation and display, and image creation applications are discussed The registration application of the system, which allows the user to remove image distortions, correlate data from different sensor types, and conduct multi-temporal analyses of the same scene, is considered In addition, the pattern recognition application of the system, a set of programs which performs multivariate analysis of imagery data, is mentioned J M B

A78-12929 # **The practical application of remote sensing for the purposes of resource assessment and resource management** M O'Hagan (Centre for Industrial Development, Brussels, Belgium) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 41-49

Assembling a multi-disciplinary team to interpret Landsat data is discussed, and the problems of obtaining useful interpretations of Landsat imagery for such underdeveloped areas as Africa are described It is suggested that the resolution provided by Landsat imagery, while suited to agricultural monitoring where cropland is homogeneous, may need to be supplemented by airborne radar data when mixed croplands are analyzed Narrow-band sensing and ground-truth assessments are also considered The possible use of Landsat data for the detection of disease-prone areas, or for the location of subterranean water in arid regions, is mentioned J M B

A78-12935 # **An application of numerical filtering and data compression to the elaboration of earth resources imagery (Applicazione del filtraggio numerico e della compressione dei dati alla elaborazione di immagini per risorse terrestri)** V Cappellini and M Fondelli (Firenze, Università, Florence, Italy) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale

Elettronica Nucleare ed Aerospaziale, 1977, p 91-99 5 refs In Italian

The general characteristics of images from aircraft and from satellites for earth resource investigation are considered The importance of two digital image processing techniques - digital filtering and data compression - for this purpose is outlined It is shown how through digital filtering efficient processing of the considered images can be obtained, performing correction operations, noise reduction, enhancement, edge extraction, while through data compression the amount of data representing the images can be appreciably reduced with negligible information reduction for useful main earth-resource characterization and data bank implementation The particular interest for agriculture resource investigation is shown Some examples of processing images from aircraft and satellites by means of digital filtering and data compression are given (Author)

A78-12942 # **Data acquisition in the specification of 'behavior models' (L'acquisizione dati nella individuazione dei 'modelli di comportamento')** L Benetazzo (Lecce, Università, Lecce, Padova, Università, Padua, Italy) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 191-196 In Italian

The paper analyses the specifications of a computer-based acquisition system intended to provide a 'behavioural model' for an ecologic environment The purpose of a behavioural model is to achieve a better knowledge, use and conservation of the earth's resources in order to supply a fairly reliable long-term forecast The automatic data acquisition system must be able to modify its operating structure as a consequence of changes in the measured environment and according to results obtained from previous measurements A few remarks are included about the best policy to be adopted in designing and implementing such a system As an example a project is described which is presently in progress and whose aim is to study shore processes in the Adriatic sea by means of an off-shore data acquisition system (Author)

A78-12944 # **Earth remote sensing using microwave /radar/ techniques** R W Okkes (ESA, European Space Research and Technology Centre, Noordwijk, Netherlands) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 259-267

The paper focus on the application of active microwave (radar) techniques for remote sensing of the earth by low-orbiting satellites After a broad overview of the microwave sensing characteristics and user requirements, an outline is given of the radar system concept as presently envisaged by ESA (European Space Agency) to form part of the payload of European earth resources satellite The resulting space-borne radar system is shown to require synthetic-aperture techniques, i e , the coherent summation of radar returns to yield the required high range-independent azimuth resolution Due to the very high data rates involved, the associated signal processing requirement, basically consisting of the transformation of the received radar signal on-board (target reflections) into a two-dimensional image, is an important aspect of the mission definition studies, their problem areas are further outlined A promising system concept using CCD (charge couple devices) is presented as a possible solution (Author)

A78-13113 **Landsat, computers, and development projects.** P-M Adrien (Inter-American Development Bank, Washington, D C) and M F Baumgardner (Purdue University, West Lafayette, Ind) *Science,* vol 198, Nov 4, 1977, p 466-470 29 refs

The U S satellites Landsat 1 and Landsat 2 scan the same area on the earth's surface once every 18 days The data acquisition system can provide information at frequent intervals about the location, availability, and changing conditions of the natural resources of specific project areas Attention is given to the development of remote sensing techniques, the use of Landsat data, the relevancy of Landsat data to development projects, Landsat improvements, and a broad range of technical modifications which are being planned to bring about significant changes in both the data and distribution systems G R

A78-13493 **Composite sampling for digital terrain models** B Makarovic (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) *ITC Journal,* no. 3, 1977, p 406-433

Composite techniques for Digital Terrain Model (DTM) data acquisition, involving both selective sampling of rough terrain and progressive sampling of more regular regions, are discussed The decision logic of data analysis for progressive sampling is considered, two means of applying supplementary data (procured selectively) to the composite sample are examined One alternative relies on the selective sampling of distinctive morphological features prior to progressive sampling The other option involves the interruption of progressive sampling and the addition of selectively-acquired data, procured either before or after the progressive sampling Digital computer applications to the high-speed data acquisition problems are also mentioned J M B

A78-13496 **Primer for the production of Landsat colour-composites** M A Romijn (International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) *ITC Journal,* no. 3, 1977, p 545-556

Basic technical information for the production of Landsat color-composites is presented, together with comments on the selection of materials and equipment for the production process Techniques for registration of the film positives and for determination of step-wedge density on the negatives are considered, the choice between use of the sixth or the seventh multispectral scanning band of the Landsat imagery is discussed. Production of positive paper prints from the false-color negatives is also reviewed J M B

A78-13686 # **Predictions on future use of active microwave systems for all weather sensing of the earth** J W Rouse, Jr (Texas A & M University, College Station, Tex) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers Conference sponsored by AIAA, AMS, AGU, IEEE, MTS, and SEG New York, American Institute of Aeronautics and Astronautics, Inc , 1977 6 p 5 refs (AIAA 77-1584)

Recent developments in microwave remote sensing have clearly established the utility of these techniques for global survey applications for a wide range of disciplines Because of these encouraging research findings and several recent studies of the potential, NASA has accelerated its program in this area Microwave systems have been approved for Seasat and early Shuttle flights and long range plans are being formulated to incorporate microwave sensing with the present visible/IR capabilities The basis for these activities and a summary of the plans are presented in this paper along with a prediction of the technological and system developments expected during the next ten years (Author)

A78-14314 **The microstructure of California coastal fog and stratus** J Goodman (San Jose State University, San Jose, Calif) *Journal of Applied Meteorology,* vol 16, Oct 1977, p 1056-1067 24 refs NSF Grant No GA-42464

A78-14784 * # **Remote sensing data processing - Two years ago, today, and two years from today** Q A Holmes (Michigan Environmental Research Institute, Ann Arbor, Mich), D Good enough (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and J D Erickson (NASA, Johnson Space Center, Houston, Tex) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 125-135 15 refs

Certain technical problems arising in the recent past (1975) in the field of the processing of remote sensing data are reviewed including approaches to the analysis of Landsat MSS data and

technical difficulties which must be overcome to achieve operational data processing The current status of remote sensing data processing is then examined with emphasis on such current technical issues as training selection and labeling, sampling schemes and classification and mensuration Hardware projections are made for the near future (1979) relative to the development of remote sensing data processing B J

A78-14786 # **A perspective on the state of the art of photographic interpretation** J E Estes (California, University, Santa Barbara, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 161-177 19 refs

The field of aerial photointerpretation is reviewed with attention given to such activities as identification, measurement and problem solving and to such elements of photointerpretation as tone or color, size, shape, shadow, texture, pattern, and resolution Techniques of photointerpretation are surveyed including the use of collateral material, stereoscopic viewing, methods of search, the use of multiple images, and the convergence of evidence B J

A78-14789 # **Operational data processing - The first ten years are the hardest** J A. Leese (NOAA, National Environmental Satellite Service, Washington, D C) and C L Bristor In. International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 201-219 18 refs

The processing of meteorological satellite data is reviewed Attention is given to the exploratory years (Tiros 1), experimental operations involving ATS, TOS and ITOS, and initial quantitative operations with the NOAA satellites and GOES The current and projected future status of the operational processing of meteorological satellite data (1975-1980) is then surveyed B.J.

A78-14803 # **Space radar system specifications** F T Ulaby, T F Bush, and W H Stiles (University of Kansas Center for Research, Inc , Lawrence, Kan) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 407-425 10 refs

Specifications are developed for a spaceborne imaging radar whose primary objective is to provide surveys of hydrology, agriculture and geology In particular, experimental measurements of soil moisture and snowpack wetness are reported, applications of radar to crop inventories are also mentioned In addition, the advantages of using radar surveys for cartographic applications are considered It is proposed that both a C-band and an X-band system be employed to create a versatile spaceborne radar sensor J M B

A78-14806 * # **Landsat-D thematic mapper simulation using aircraft multispectral scanner data** J Clark and N A Bryant (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 483-491 Contract No NAS7-100

A simulation of imagery from the upcoming Landsat-D Thematic Mapper was accomplished by using selected channels of aircraft 24-channel multispectral scanner data The purpose was to simulate Thematic Mapper 30-meter resolution imagery, to compare its spectral quality with the original aircraft MSS data, and to determine changes in thematic classification accuracy for the simulated imagery The original resolution of approximately 7 5 meters IFOV and simulated resolution of 15, 30, and 60 meters were used to indicate the trend of spectral quality and classification accuracy The study was based in a 6 5 square kilometer area of urban Los Angeles having a diversity of land use The original imagery was reduced in resolution by two related methods pixel matrix averaging, and matrix smoothing with a unity box filter, followed by matrix averaging Thematic land use classification using training sites and a Bayesian maximum-likelihood algorithm was performed at three levels of standard deviation - 1 0, 2 0, and 3 0 sigma Plots of relative standard deviation showed that for larger training sites with a normal distribution of data, as the resolution decreased, the distribution range of density values decreased Also, the classification accuracies for three levels of standard deviation increased as resolution decreased However, the indication is that a point of diminishing returns had been reached, and 30 meters IFOV should be the best for multispectral classification of urban scenes (Author)

A78-14807 # **A study of suspended solids in the Requena Dam by remote sensing** P Ruiz Azuara and L Lemus Hidalgo (Universidad Nacional Autónoma de México, Villa Obregón, Mexico) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 495-504 20 refs

Remote sensing was applied to a preliminary study of suspended solids in the Requena Dam Aerial and terrestrial photographs were analyzed by photointerpretation and microdensitometry Field measurements and sampling were also made A relationship between ground data for the concentration of suspended solids and the transmissibility of the aerial infrared film was suggested (Author)

A78-14814 # **On the photographic processing and digital texture for remote sensing of Kujukuri coast of Chiba in Japan** H Genda, H Okayama, T Ishiyama (Chiba University, Chiba, Japan), and K Takeda (Science and Technology Agency, National Institute of Resources, Tokyo, Japan) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 571-578 5 refs

Remote sensing of various coastal phenomena on the Kujukuri Coast and Kashimanada Coast has been done by use of aircraft for the purpose of investigating the characteristics of shore reefs and floating sand, and the depth of the sea A multispectral camera and a video ITV camera have been used as sensor The first flight was over the Kashimanada and Kujukuri Coasts and the next flight was over the Katsuura Bay The shape of shore reefs, the state of floating sand, the depth of the sea, etc , are represented by equidensitographs The digital graphs are analyzed by a hybrid system and correlations between the textures represented by equidensitographs, digital graphs and analog display are estimated (Author)

A78-14819 # **Testing the accuracy of remote sensing land use maps** J L Van Genderen, P A Vass (Fairey Surveys, Ltd., Maidenhead, Berks., England), and B F Lock (Salisbury College of Advanced Education, Adelaide, Australia) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich., April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 615-623 12 refs

A sampling and statistical testing procedure for analyzing the accuracy of remote sensing data is presented The procedure is distinguished from other studies of interpretation errors in that it assesses the probability of incorrect categorization for a particular ground truth sample size, instead of expressing interpretation errors as a percentage of a subjectively determined number of sample sites Because it relies on a minimum number of sample points, the technique may save time and money, especially when high accuracy levels need to be guaranteed J M B

A78-14830 # **Use of clear lakes as standard reflectors for atmospheric measurements** F J Ahern, D G Goodenough, S C Jain, V R Rao (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada), and G Rochon (Université Laval, Quebec, Canada) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich., April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 731-755 20 refs

A method is proposed using clear lakes as dark backgrounds against which the atmospheric path radiance can be determined from satellite observations If the path radiance can be determined to sufficient accuracy, the atmospheric extinction can be inferred with suitable radiative transfer models An extensive program of observation has been made to determine the magnitude and variability of the various contributors to the total radiance observed by a satellite It is shown that the volume and surface reflectance contributions (in the absence of sunglint) are small, constant, and can be modeled accurately enough to make these an insignificant source of error The sunglint radiance observed in this investigation may be a significant source of error The individual sources of error in the path radiance and extinction coefficient estimates are determined, and the total error in these estimates is calculated, with and without sunglint (Author)

A78-14831 # **A low-cost system for reception and processing of line-scan data from Landsat and other sources.** D S Sloan, B C Isherwood, and J S MacDonald (MacDonald, Dettwiler and Associates, Ltd., Richmond, British Columbia, Canada) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich., April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 757-773

A low-cost receiving station for real-time processing of photographic and digital satellite data is described The station is capable of processing line-scan image data from the Landsat and NOAA (Very High Resolution Radiometer) satellite series, as well as aircraft scanner data, and data from planned remote sensing and meteorological satellites such as Meteosat, Nimbus-G and Tiros-N The system, which houses all the needed electronic and photographic equipment in a 3 by 12 m trailer, provides black and white images and computer-compatible tapes of the data The possibility of upgrading the capabilities of the facility through the addition of equipment is also mentioned J M B

A78-14832 # **The use of Landsat imagery to locate uncharted coastal features on the Labrador Coast** E A Fleming (Department of Energy, Mines and Resources, Topographical Survey Directorate, Ottawa, Canada) and D D Lelievre (Department of the Environment, Canadian Hydrographic Service, Dartmouth, Nova Scotia, Canada) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich., April 25-29, 1977, Proceedings. Volume 1 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 775-781

A78-14838 # **The application of IR- and MSS-data in the Ruhr district, Germany.** P Stock (Siedlungsverband Ruhrkohlenbezirk, Essen, West Germany) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich., April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 837-847 23 refs

The paper presents a brief review of the land-use applications of IR and multispectral scanner remote sensing data by the Ruhr Planning Authority Survey techniques are described and special attention is given to the monitoring of surface temperature behavior (homogeneous surfaces and urban surfaces) and to the existence of an urban heat island in the Ruhr area B J

A78-14839 # **Potential applications of digital, visible, and infrared data from geostationary environmental satellites.** D. B. Miller, M P Waters, III, J D Tarpley, R N Green, and D C. Dismachek (NOAA, National Environmental Satellite Service, Washington, D C) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich., April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 849-858

The National Environmental Satellite Service (NESS) is experimenting with an hourly, digital data base from the Visible/Infrared Spin-Scan Radiometer (VISSR) instrument on the GOES-1 and SMS-2 geostationary satellites The general characteristics of this experimental VISSR data base (VDB) are described Several examples of developmental applications of these quantitative digital data are presented These include a review of recent attempts to develop products that are of use to meteorologists who provide services to aviation, agriculture, forestry, hydrology, oceanography, and climatology The sample products include high resolution thermal gradients of land and ocean surfaces, thermal change analyses, fruit frost/freeze application, cloud-top altitude analysis, analysis of hurricane characteristics, and analyses of solar insolation (Author)

A78-14848 * # **View angle effect in Landsat imagery** T Kaneko (IBM Corp., Federal Systems Div., Houston, Tex.) and J. L Engvall (NASA, Johnson Space Center, Houston, Tex.) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich., April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 945-951 6 refs Contract No NAS9-14350

The paper investigates the view angle effect in Landsat II imagery, using consecutive-day acquisition data collected over the same geographical location, acquired 24 h apart, with view angle changes of 7-8 deg at a latitude of 35-45 deg It is shown that there is approximately a 5% reduction in the average sensor response on the second-day acquisitions as compared with the first-day acquisitions, and that the view angle effect differs field to field and crop to crop On false infrared pictures, the view angle effect causes changes primarily in brightness and to a lesser degree in color (hue and saturation) B J

A78-14854 # **Processing of satellite imagery at the National Environmental Satellite Service.** M Crowe (NOAA, National Environmental Satellite Service, Washington, D C) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich., April 25-29, 1977, Proceedings Volume 2

Ann Arbor, Mich., Environmental Research Institute of Michigan, 1977, p 1015-1020 5 refs

Processing of scanning radiometer (SR), very high resolution radiometer (VHRR) and visible infrared spin scan radiometer (VISSR) data, obtained from polar orbiter and geostationary satellites, is described The processing, conducted by the National Environmental Satellite Service, includes creation of polar-stereographic mapped mosaics, mercator-mapped mosaics, time-composites of mapped data, pass-by-pass gridded images, as well as hydrologic charts (from VHRR data) and animated sequences of successive VISSR picture frames Meteorological analyses based on SR, VHRR and VISSR data are also mentioned J M B

A78-14865 # **Digital processing system for developing countries** C Nanayakkara (Office of the Surveyor General of Sri Lanka, Colombo, Sri Lanka) and H Wagner (Michigan, Environmental Research Institute, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1123-1126

The application of an experimental software package to the digital processing of Landsat computer-compatible tapes is described The software package, capable of performing such basic processing tasks as level slicing, gray mapping and ratio processing, is used in small-scale general-purpose digital computers The digital processing system will be employed for crop and irrigation network surveys in Sri Lanka J M B

A78-14866 * # **Remote sensing and geographically based information systems** R C Cicone (Michigan, Environmental Research Institute, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977 p 1127-1136 18 refs Contract No NAS9-14988

A structure is proposed for a geographically-oriented computer-based information system applicable to the analysis of remote sensing digital data The structure, intended to answer a wide variety of user needs, would permit multiple views of the data, provide independent management of data security, quality and integrity, and rely on automatic data filing Problems in geographically-oriented data systems, including those related to line encoding and cell encoding, are considered J M B

A78-14881 # **Reducing Landsat data to parameters with physical significance and signature extension - A view of Landsat capabilities** B C Salmon-Drexler (GeoSpectra Corp , Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p. 1289-1299 7 refs Research supported by the U S Bureau of Land Management, Contract No AT(05-1)-1635

Determination of color hue and color value (i e , lightness) from Landsat multispectral scanning (MSS) data is discussed, and the limitations in using Landsat data for crop identification and mineral detection are considered. Color value, which is obtained by taking the ratio of MSS channel 5 to MSS channel 4, is employed in conjunction with MSS channel 7 data in an illustrative example involving the detection of limonite (hydrous ferric oxide) Ambiguities in Landsat analyses of ephemeral rangeland or desertification trends are also cited J M B

A78-14882 # **Aerial albedos of natural vegetation in southeastern Australia** J A. Howard (United Nations, Food and Agriculture Organization, Rome, Italy) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings. Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1301-1307 6 refs Research supported by the Reserve Bank of Australia

70 mm black-and-white low-level photography was used to record the track of the aircraft, which was then plotted on conventional 1 80,000 23 cm photogrammetric photographs and referenced against simultaneous measurements of the beam albedos of vegetation Using stereoscopic pairs of the 70 mm photographs, the vegetation was classified into subformations. Marked differences in the subformation albedos were observed A two-way table using stand height and crown cover of the subformations clearly showed a very distinctive trend of albedos This finding may be important in other vegetal studies (Author)

A78-14883 * # **Blob - An unsupervised clustering approach to spatial preprocessing of MSS imagery** R J Kauth, A P. Pentland, and G S Thomas (Michigan, Environmental Research Institute, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1309-1317 5 refs Contract No NAS9-14988

A basic concept of MSS data processing has been developed for use in agricultural inventories, namely, to introduce spatial coordinates of each pixel into the vector description of the pixel and to use this information along with the spectral channel values in a conventional unsupervised clustering of the scene The result is to isolate spectrally homogeneous field-like patches (called 'blobs') The spectral mean vector of a blob can be regarded as a defined feature and used in a conventional pattern recognition procedure The benefits of use are ease in locating training units in imagery, data compression of from 10 to 30 depending on the application, reduction of scanner noise and consequently potential improvements in classification/proportion estimation performances (Author)

A78-14884 * # **Multispectral system analysis through modeling and simulation** W A Malila, J M Gleason, and R C Cicone (Michigan, Environmental Research Institute, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1319-1328 18 refs Contract No NAS9-14988

The design and development of multispectral remote sensor systems and associated information extraction techniques should be optimized under the physical and economic constraints encountered and yet be effective over a wide range of scene and environmental conditions Direct measurement of the full range of conditions to be encountered can be difficult, time consuming, and costly Simulation of multispectral data by modeling scene, atmosphere, sensor, and data classifier characteristics is set forth as a viable alternative, particularly when coupled with limited sets of empirical measurements A multispectral system modeling capability is described Use of the model is illustrated for several applications - interpretation of remotely sensed data from agricultural and forest scenes, evaluating atmospheric effects in Landsat data, examining system design and operational configuration, and development of information extraction techniques (Author)

A78-14885 # **A 'digital' technique for manual extraction of data from aerial photography** L B Istvan and M T Bondy (Michigan, Environmental Research Institute, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1329-1336

The Environmental Research Institute of Michigan has developed a digital system for the manual interpretation of aerial photography data The procedure uses a cell/point grid established on a base map, and identical grids matching the scale of the photographic frames The technique corrects for photography distortions The procedure is applicable to land use and land cover data used for local and regional planning and resource management S C S

A78-14886 # **Application of conventional and advanced techniques for the interpretation of Landsat 2 images for the study of linears in the Friuli earthquake area.** P Cardamone, G M Lechi (CNR, Istituto per la Geofisica della Litosfera, Milan, Italy), A Cavallin, C M Marino (Milano, Universita, Milan, Italy), and A Zanferrari (Padova, Università, Padua, Italy) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich., April 25-29, 1977, Proceedings Volume 2

Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1337-1353 7 refs

A78-14898 # **Digital color analysis of color-ratio composite Landsat scenes** G L Raines (U S Geological Survey, Denver, Colo.)

In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1463-1472

A method is presented that can be used to calculate approximate Munsell coordinates of the colors produced by making a color composite from three registered images Applied to the Landsat MSS data of the Goldfield, Nevada, area, this method permits precise and quantitative definition of the limonitic areas originally observed in a Landsat color ratio composite In addition, areas of transported limonite can be discriminated from the limonite in the hydrothermally altered areas of the Goldfield mining district From the analysis, the numerical distinction between limonitic and non-limonitic ground is generally less than 3% using the Landsat bands and as much as 8% in ratios of Landsat MSS bands (Author)

A78-14905 # **Interpretation of multispectral and infrared thermal surveys of the Suez Canal Zone, Egypt** E M El Shazly, M A Abdel Hady, M A. Abdel Hafez, A B Salman, M A Morsy, M M El Rakaiby, I E E Al Aassy, and A F Kamel (Academy of Scientific Research and Technology, Remote Sensing Centre, Atomic Energy Establishment, Cairo, Egypt) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1533-1542

Remote sensing airborne IR thermal and multispectral surveys of the Suez Canal Zone were used in combination with ground investigations to construct new geological, structural lineation, and drainage maps on a 1 20,000 scale A number of structural, lithological, drainage, and environmental features detected from the survey maps are discussed V P

A78-14908 * # **Quantification of soil mapping by digital analysis of Landsat data** F R Kirschner (U S Department of Agriculture, Soil Conservation Service, Washington, D C), S A Kaminsky, E J Hinzel, R A Weismiller (Purdue University, West Lafayette, Ind), and H R Sinclair (U S Department of Agriculture, Soil Conservation Service, Indianapolis, Ind) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1567-1573 6 refs Grant No NGL-15-005-186

A78-14978 * # **Cold climate mapping using satellite high resolution thermal imagery** J F Bartholic and R A Sutherland (Florida, University, Gainesville, Fla) In Conference on Aerospace and Aeronautical Meteorology, 7th, and Symposium on Remote Sensing from Satellites, Melbourne, Fla , November 16-19, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 137-140 NASA-supported research

In an attempt to improve cold climate mapping and freeze forecasting techniques, thermal imagery from the NOAA-2 and -3 satellites and the Synchronous Meteorological Satellite (SMS) were obtained and analyzed Enhanced image transparencies showed detailed temperature patterns over the peninsula of Florida The analysis was superior to hand-drawn isotherms drawn from the 300 to 500 thermograph stations presently in use Satellite data on several cold nights with similar synoptic conditions showed that similar cold patterns existed Thus, cold climate mapping is possible P T H

A78-15004 * # **Interactive image processing for meteorological applications at NASA/Goddard Space Flight Center** J B Billingsley (NASA, Goddard Space Flight Center, Greenbelt, Md) In Conference on Aerospace and Aeronautical Meteorology, 7th, and Symposium on Remote Sensing from Satellites, Melbourne, Fla , November 16-19, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 268-275

The paper reviews the development of the AOIPS (Atmospheric and Oceanographic Information Processing System) system for the interactive manipulation of meteorological satellite images A block diagram of the system is presented, both software and hardware considerations are examined, and attention is given to the Image 100 processing system and to the interactive terminal As a example the paper examines the functions of Metpak (the software package) which involve cloud tracking and wind vector generation B J

A78-15010 * # **Thunderstorm monitoring from a geosynchronous satellite** R F Adler (NASA, Goddard Space Flight Center, Greenbelt, Md) and D D Fenn (General Electric Co , Beltsville, Md) In Conference on Aerospace and Aeronautical Meteorology, 7th, and Symposium on Remote Sensing from Satellites, Melbourne, Fla , November 16-19, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 307-311 6 refs

It has been shown that SMS digital IR data can be used to calculate parameters which appear to be related to cloud or thunderstorm growth rates and variations in cloud top structure The data appear to be useful in examining both clearly defined single clouds and cold areas within mature cirrus anvils The data used for this study were blackbody temperatures derived from digital IR data from SMS-2 for a series of storms over the midwest United States on May 6, 1975 B J

A78-15012 # **Pulsed coherent lidar systems for airborne and satellite based wind field measurement** R M Huffaker, D W Beran, and C G Little (NOAA, Wave Propagation Laboratory, Boulder, Colo) In Conference on Aerospace and Aeronautical Meteorology, 7th, and Symposium on Remote Sensing from Satellites, Melbourne, Fla , November 16-19, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 318-324 16 refs

A system description of a basic CO2 coherent infrared lidar system is given and some feasibility considerations in using this type of lidar for satellite global wind monitoring are discussed, taking account of such parameters as signal to noise, aerosol density, eye safety, and pointing accuracy Potential problems associated with scanning modes for airborne and satellite applications are examined and some potential applications (e g , airport wind shear measurements) of the lidar are considered B J

A78-15330 **Digital image processing** G Kang (TRW Defense and Space Systems Group, Redondo Beach, Calif) *Quest*, vol 1, Autumn 1977, p 2-20 7 refs

The technology of image processing is concerned with a manipulation of the elements of a picture to enhance its information content Digital image processing involves the use of a digital computer for the required operations In the case of images transmitted from spacecraft, the images are received at ground stations in the form of a stream of binary-coded data bits which are recorded on magnetic tape The data can be converted to pictures by means of a straightforward process involving a film recorder However, the results are often unsatisfactory in connection with geometric, photometric, and other types of distortion The elimination of distortion by means of data manipulations conducted with the aid of computers is discussed, taking into account photometric manipulation, geometric correction, precision registration, and image enhancement G R

A78-15455 **Waves and turbulence in the vicinity of a chinook arch cloud** P F Lester (Calgary, University, Calgary, Alberta, Canada) and J I MacPherson (National Research Council, Flight Research Laboratory, Ottawa, Canada) *Monthly Weather Review*, vol 105, Nov 1977, p 1447-1457 11 refs Research supported by Environment Canada

Instrumental aircraft flights were made near a chinook arch cloud in the lee of the Rocky Mountains in Alberta, Canada The aircraft data combined with satellite imagery have shown that the arch cloud, based near 5500 m MSL, extended about 50 km in the alongwind direction and more than 900 km in the crosswind direction and was embedded in the crest of a gravity wave 95 km in length The wave displacement amplitude in the temperature field was about 800 m with estimated vertical motions of 1 6 m/s The

wave persisted more than 10 h, moving eastward at a mean speed of about 6 m/s, somewhat slower than the wind speed at the same height Light turbulence was found in the wave crests and troughs The possibility that the wave was partially trapped is discussed with respect to the simultaneous observation of more than one long lee wave cycle in some of the temperature data (Author)

A78-16364 # **Role of cumulonimbus in the evolution of cyclonic disturbances in Mediterranean regions (Rôle des cumulonimbus dans l'evolution des perturbations cycloniques des regions mediterraneennes)** R M Thepenier and D Cruette (Paris VI, Universite, Paris, France) *La Météorologie,* June 1977, p 165-171 In French

Photographs transmitted by ESSA 8 and NOAA-2 were used to study cloud formations associated with above-average rain in the Mediterranean area The photographs show in such circumstances the presence of essentially convective low pressure cloud systems with a typical form quite different from that of classical extratropical disturbances The observed cloud system has in horizontal projection an approximately circular contour and is composed of a mass of stormy clouds arranged in an anarchic manner A cyclonic eddy, characterized by an approximate coincidence of isohypses and horizontal isotherms, is associated with the cloud system The observations suggest that the birth and maintenance of certain cyclonic eddies is a consequence of the intense convection associated with the advection of cold air on relatively warmer water or land masses This hypothesis is discussed M L

A78-16501 # **The complex of optical-photographical transformation methods of aerial and space images used for study of natural resources** Z G Efimova, V B Komarov, V F Nomokanova, and U V Uglev (National Committee of Photogrammetrists, Moscow, USSR) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 25 p

A variety of optical-photographic methods of processing and analyzing aerial and space photographic images for extracting desired information is characterized. A functional model of an elementary photographic filtering system realizing the transformation of images is given The procedures of constructing graphical schemes of physical parameters in isolines is described A method of obtaining and analyzing spatial spectra of photographic images with a coherent optical system is briefly described. P T H

A78-16507 # **The significance of an arc shaped dark patch on the Nimbus III /HRIR/ imagery of India** V M D Kulkarni (K J Somaiya College of Science, Bombay, India) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 7 p 13 refs Research supported by K J Somaiya College of Science, Indian Space Research Organization, and Ministry of Education and Social Welfare of India

Night-time infrared imagery obtained from the U S weather satellite Nimbus-III was employed to study a geothermal field in western India An arc-shaped dark area in the satellite imagery appeared to be the surface expression of a fault lying at some depth, along the curve of this fault line is found a series of hot springs. Results of the study suggested that a combination of thermal, photographic and gamma radiation surveys of the fault region may provide criteria for predicting crustal movements and volcanic disturbances J M B

A78-16509 # **A multiseries digital mapping system for positioning MSS and photographic remotely sensed data** M Nasu and J M Anderson (California, University, Berkeley, Calif) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper.* 31 p 8 refs

The multiseries remote sensing - which consists of multispectral, multiband, multistage, multidate remote sensing data - provides various kinds of spectral or radiometric information in different kinds of recording and image characteristics Results are presented for a study designed to develop and investigate the feasibility of a method for positioning multiseries remotely sensed data by means of geometric multistage sampling The designed multiseries positioning system consists of point identification and measurement of images, geometric adjustment for determination of exterior orientation of data, and analytical image restitution The key concept in this procedure is the capability of performing sequential or simultaneous adjustments with all photographic and scan data while using parametric constraints for specified orientation parameters It is shown that positioning of multiseries data is feasible and yields improved results using sequential or simultaneous parametric adjustment of multistage imagery S D

A78-16518 # **Automated earth resources surveys using satellite and aircraft scanner data - A Finnish approach** E Kilpela (Helsinki University of Technology, Helsinki, Finland), S Jaakkola, R Kuittinen (Technical Research Centre of Finland, Helsinki, Finland), and J Talvitie (Oulu, University, Oulu, Finland) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 19 p

In the beginning of 1974, a three-year Earth Resources Remote Sensing Project was initiated at the Laboratory of Land Use, Technical Research Center of Finland The ultimate objective of the project is to develop automated environment monitoring and resource inventory methods capable to meet Finnish needs and conditions The fields of study involved in the multidisciplinary R & D effort are forestry, geology and hydrology In addition to digital LANDSAT data, the prject also operates with digital aircraft scanner data from the altitude of 300-5000 m Preliminary results are presented in the paper (Author)

A78-16520 # **Practical experience in the rectification of MSS-images** G Otepka (Wild Heerbrugg AG, Vienna, Austria) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 13 p 8 refs

A procedure is described for determining the distortions of multispectral scan (MSS) images at all image points The basic principle of this procedure involves defining a square reference grid in the desired image (i e , the rectified MSS image) and determining the corresponding grid points in the original MSS image, the latter data are used together with the original image to produce a rectified image in an orthophoto system Necessary measurements are discussed along with a computer program for interpolating distortions of the reference grid, some examples of rectified MSS imagery, orthophotos as optimum rectification masters, coordinate measurement, and differential rectification The procedure is shown to be a completely operational and very economical method for rectifying MSS images F G M

A78-16526 # **A compensation procedure in a block of simply overlapping photograms, for the case of flat terrain (Un procédé de compensation en bloc des photogrammes à recouvrement simple, pour le cas des terrains plans).** L Turdeanu (Rumanian Committee of Photogrammetry, Bucharest, Rumania) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 7 p In French

When flat terrain is studied, and stereoplotting is not required, the use of a compensation procedure for blocks of aerial photograms with about 20 percent horizontal and vertical overlap is proposed The procedure is based on the in situ determination of a limited number of preparation points on both sides of the blocks so that the connection of photograms can be achieved by means of two connection points An analysis of the procedure is provided, and the advantages and limitations are considered M L

A78-16527 # **Test on the mapping application of Landsat imagery.** J C Trinder and S U Nasca (New South Wales, University, Sydney, Australia) *International Society for Photogrammetry, Inter-*

national Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper 14 p 9 refs Research supported by the Australian Research Grants Committee

Tests have been made on the application of Landsat images to 1 250,000 mapping within Australia, using identifiable points on existing maps as control Polynomial and affine formulae have been used to test the accuracy of transformation of image coordinates onto ground coordinates derived from available maps at scales of 1 250,000 and 1 100,000 The accuracies of the coordinates after both transformations approach the local map accuracy standards Based on the parameters derived from affine transformations of each quadrant of an image, rectified enlargements have been prepared at a scale of 1 250,000 It appears that the accuracy of such enlargements may satisfy the map accuracy standards for 1 250,000 maps (Author)

A78-16531 # **Directional reflectances of terrain objects from B&W-aerial photos.** J Sievers (Karlsruhe, Universitat, Karlsruhe, West Germany) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 16 p. Research supported by the Deutsche Forschungsgemeinschaft

A procedure for determining directionally dependent reflection features of horizontal flat-terrain objects, especially agricultural areas, from densities in black-and-white aerial photos is described Some factors, such as atmospheric haze, transfer characteristics of the camera lens, light fall off, photographic emulsion, photographic processing, and density measurement, are analyzed Directional reflectances are determined by photographing a uniform horizontal area from above so that the area covers the whole image plane An image with a variable density distribution is compared with the reflection properties of two reference areas M.L.

A78-16532 # **Digital rectification of multispectral imagery** W Schuhr (Hannover, Technische Universitat, Hanover, West Germany) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper.* 7 p. 6 refs Research sponsored by the Deutsche Forschungsgemeinschaft and Bundesministerium fur Forschung und Technologie

Procedures for the computerized digital rectification of Landsat data and modular multispectral scanner data are described and compared. A direct method, which provides comparatively low accuracy, involves the calculation of the output position for every image coordinate of the unrectified two-dimensional image. In the indirect method, image coordinates and the corresponding grey values are computed for every three-dimensional output position Collinearity equations are introduced, and the use of first- and second-order polynomials as well as spline functions for expressing changes in exterior orientation is described M L.

A78-16533 # **Analytical aerial triangulation - Its obtention through a simple algorithm.** A Pérez Salas (Instituto Geografico Militar, Buenos Aires, Argentina) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 32 p

The paper discusses a method to derive analytical aerial triangulations It employs the orthogonal projections of the homologous perspective rays on two reference instrumental coordinated planes An iterative process changes the orientation of the pair's left beam while moving the right beam without changing its orientation These iterations can thus form any number of independent models An analytical assembly method, which spatially links the models, results in analytical aerial triangulation S C S

A78-16538 # **Modulation transfer analysis of aerial imagery** E L Gliatti (USAF, Avionics Laboratory, Wright-Patterson AFB, Ohio) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 24 p 5 refs

The edge gradient analysis (EGA) method of modulation transfer analysis was applied in the evaluation of aerial imagery of a rural area A brief outline of the procedure is given, consisting in ensemble averaging, Fourier transforming, and using the D-log E curve for converting density values to exposure Selected edges were raster-scanned with a Mann data microanalyzer Cascading effects of micro-D MTF, film MTF, and the frequency response of the smoothing filter had to be removed The processed aerial MTFs were then compared with laboratory-measured lens MTFs The plots for 23 different target edges scanned showed good correspondence with the expected MTFs P T H

A78-16541 # **Aerial triangulation with Skylab photography** M E O Ali (Université Laval, Quebec, Canada) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 18 p. 6 refs Research supported by the National Research Council and Department of Energy, Mines and Resources of Canada

A research program has been carried out in the Department of Photogrammetry, Laval University, Canada, to utilize the Skylab photography for aerial triangulation purposes The appropriate applications for such photography are areas where there are no ground control as such except the coordinates of points obtained from small scale maps An efficient algorithm has been developed and has been tested to adjust simultaneously the photogrammetric measurements and the coordinates of the ground control points As an example, using one Skylab model (covering an area of 165 x 100 km) and seven ground control points whose coordinates are known to the nearest 500 m, it was possible to obtain RMS errors of 67 m and 136 m in planimetry and height respectively (Author)

A78-16542 * # **Digital preprocessing and classification of multispectral earth observation data** P E Anuta (Purdue University, West Lafayette, Ind) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper.* 31 p 17 refs Grant No NGL-15-005-112, Contract No NAS9-14016

The development of airborne and satellite multispectral image scanning sensors has generated wide-spread interest in application of these sensors to earth resource mapping These point scanning sensors permit scenes to be imaged in a large number of electromagnetic energy bands between 3 and 15 micrometers The energy sensed in each band can be used as a feature in a computer based multi-dimensional pattern recognition process to aid in interpreting the nature of elements in the scene Images from each band can also be interpreted visually Visual interpretation of five or ten multispectral images simultaneously becomes impractical especially as area studied increases, hence, great emphasis has been placed on machine (computer) techniques for aiding in the interpretation process This paper describes a computer software system concept called LARSYS for analysis of multivariate image data and presents some examples of its application (Author)

A78-16545 # **Geometrical models for satellite scanner imagery** H P Bahr (Hannover, Technische Universitat, Hanover, West Germany) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 12 p 10 refs

The best model (Model 213) for describing the geometry of satellite scanner imagery collinearity equations, while the adjustment parameters (in the form of polynomials) are kept variable along the flight path, is considered This results in residual errors of about plus or minus 0 85 pixel, which improves by 46% the values of the constant adjustment parameters The geometric conditions in a Landsat-1 image ('bulk', 234 points) are adequately described by simple second-order polynomials (plus or minus 0 54/0 83 pixel) Least-squares filtering does not improve the result significantly Because of the absolute random pointing accuracy and the relative determination accuracy of ground control points, 0 5 pixel appear to be the limiting accuracy for all geometrical models (Author)

A78-16547 # **Analysis of MSS digital imagery with the aid of principal component transform** N H W Donker and N J Mulder

(International Institute for Aerial Survey and Earth Sciences, Enschede, Netherlands) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 35 p 6 refs

The principal component transform, a data compression technique, is applied to Landsat multispectral scanning (MSS) digital data in order to produce imagery best suited to visual interpretation Histogram equalization and level by level display for various radiation values of the MSS data are employed to select the most important spectral classes for image production The spectrally significant classes are then subjected to treatment by the principal component transform, and a color-coded picture is developed Sample color imagery for an area having a wide variety of topographical features and land use classes is analyzed. J M B

A78-16548 # **A block adjustment for SLAR-imagery.** G Dowideit (Hannover, Technische Universitat, Hanover, West Germany). *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 11 p. 15 refs

A computer program for the block adjustment of side-looking airborne radar imagery is described The block adjustment program relies on a linear least squares technique with a simple inversion process By formulating the image coordinates as functions of parameters valid for real sensors, aircraft and navigation systems, the dynamic problems of flight path and imaging process are taken into account Results of the block adjustment process are found to be adequate for mapping in three coordinates if opposite side flight configurations with more than 60% overlap are analyzed. J M B

A78-16549 # **A mathematical model for digital rectification of remote sensing data** H Ebner (Stuttgart, Universitat, Stuttgart, West Germany) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper.* 10 p 7 refs

Digital rectification of remote sensing imagery is intended for the generation of an image that represents an orthogonal projection of the scanned terrain A mathematical model based on collinearity equations is proposed, which describes the variation of the exterior orientation parameters with time by stochastic processes This allows for a rather general description of the time-variable deformations of linewise generated remote sensing imagery. The proposed model is then used for digital rectification, where a least-squares adjustment is formulated for estimation of the time-dependent orientation parameters from the available control points The feasibility of the approach is demonstrated by simulated examples S D

A78-16554 # **Landsat-radar synergism.** G. Harris, Jr (U.S Geological Survey, Sioux Falls, S Dak) and L C Graham (Goodyear Aerospace Corp , Akron, Ohio) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper.* 27 p

U S Geological Survery EROS Data Center and Goodyear Aerospace Corporation engineers, working independently at first and then in cooperation, have synergistically combined Landsat multispectral scanner data and airborne synthetic aperture radar imagery This paper presents the techniques and procedures used in the experiments Examples of Landsat and radar images of the same terrain, separate and combined, are presented to show that providing the two types of data in a single image retains all the information available from each sensor system and additional detailed data resulting from the simultaneous viewing of the two in superposition (Author)

A78-16730 * # **Vertical lifting of ionization during geomagnetic storms from satellite measurements of ion composition** M K Goel, B C N Rao (National Physical Laboratory of India, New Delhi, India), S Chandra, and E J Maier (NASA, Goddard Space Flight Center, Greenbelt, Md) *Journal of Geomagnetism and Geoelectricity,* vol 29, no 3, 1977, p 143 151 21 refs

Magnetic-storm phenomena at low latitudes are discussed based on ion-composition /O(+), H(+), He(+)/ and electron- and ion-temperature measurements from the OGO 4 and Isis-2 satellites For the moderately severe storms considered, the effects of changes in the neutral composition and in the neutral and plasma temperatures are discussed, and it is shown that these changes would not produce the observed O(+) increase during storms at low latitudes It is suggested that the observed increase in O(+) in the topside region is a manifestation of the vertical lifting of ionization of the F layer The argument in favor of vertical lifting is further substantiated by the observed changes in the F-region critical frequency and the height parameters (Author)

A78-17068 # **Analysis of GATE radar data for a tropical cloud cluster in an easterly wave** C A Leary and R A Houze, Jr (Washington, University, Seattle, Wash) In Conference on Radar Meteorology, 17th, Seattle, Wash , October 26-29, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 376-383 9 refs NSF-supported research, Grant No NOAA-OCD-14830

A78-17543 **Clustering of ERTS data using various orthogonal transforms** G W Zobrist (Toledo, University, Toledo, Ohio) In Imaginative engineering thru education and experience, Proceedings of the Southeast Region 3 Conference, Williamsburg, Va , April 4-6, 1977 New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 205-207 6 refs

A78-18071 * **Some aspects of adaptive transform coding of multispectral data** N Ahmed (Kansas State University of Agriculture and Applied Science, Manhattan, Kan) and T Natarajan (Texas Instruments, Inc , Dallas, Tex) In Annual Asilomar Conference on Circuits, Systems, and Computers, 10th, Pacific Grove, Calif , November 22-24, 1976, Conference Record North Hollywood, Calif , Western Periodicals Co , 1977, p 583-597 6 refs Grant No NCA2-OR363-601

This paper concerns a data compression study pertaining to multi-spectral scanner (MSS) data The motivation for this undertaking is the need for securing data compression of images obtained in connection with the Landsat Follow-On Mission, where a compression of at least 6 1 is required The MSS data used in this study consisted of four scenes Tristate, consisting of 256 pels per row and a total of 512 rows - i e , (256x512), (2) Sacramento (256x512), (3) Portland (256x512), and (4) Bald Knob (200x256) All these scenes were on digital tape at 6 bits/pel The corresponding reconstructed scenes of 1 bit/pel (i e , a 6 1 compression) are included (Author)

A78-18103 **Applications of remotely sensed data to wetland studies** V Carter (U S Geological Survey, Reston, Va) In Space research XVII, Proceedings of the Open Meetings of Working Groups on Physical Sciences, June 8-19, 1976 and Symposium on Minor Constituents and Excited Species, Philadelphia, Pa , June 9, 10, 1976 Oxford and New York, Pergamon Press, 1977, p 19-23 11 refs

Remotely sensed data from both aircraft and satellite platforms have been used for a variety of wetland studies For example, identification of major vegetative associations with Landsat digital data made it possible to estimate primary productivity in a Virginia salt marsh Both seasonal color infrared photographs and Landsat digital data are being used for inland wetland investigations In co-operation with the Tennessee Valley Authority, wetlands in western Tennessee are being classified and mapped at 1 24,000 scale using color infrared photographs which show both boundary dynamics and vegetation The US Geological Survey and the US Fish and Wildlife Service are using color infrared photographs to aid in a hydrologic study and to map vegetation at 1 24,000 and 1 100,000 scales in the Great Dismal Swamp of Virginia and North Carolina In each case the base maps are being used to evaluate the accuracy of Landsat analyses with the objective of using Landsat data for monitoring vegetative change and for updating maps (Author)

A78-18104 * Application of aircraft multispectral scanners to quantitative analysis and mapping of water quality parameters in the James River, Virginia R W Johnson (NASA, Langley Research Center, Hampton, Va) In Space research XVII, Proceedings of the Open Meetings of Working Groups on Physical Sciences, June 8-19, 1976 and Symposium on Minor Constituents and Excited Species, Philadelphia, Pa , June 9, 10, 1976 Oxford and New York, Pergamon Press, 1977, p 25-31 9 refs

A78-18241 Computer elaboration and visualization of remote-sensing data D J David (Paris I, Universite, Paris, France), G Joly (CNRS, Laboratoire d'Information et de Documentation en Géographie, Paris, France), and F Verger (Ecole Nationale Supérieure, Montrouge, Hauts-de-Seine, France) *British Interplanetary Society, Journal (Remote Sensing),* vol 31, Jan 1978, p 16-20 7 refs

A set of computer programs designed to produce fully automatic cartography from Landsat data is described The data elaboration and image processing capacities of the programs are linked to a graph plotter, which produces master maps suitable for publication, these full-color master's unlike line printer maps, take into account deviation angle due to the earth's rotation Diachronic mapping (i e , mapping that distinguishes features on the basis of their time-varying spectral signatures), smoothing of distortions in the raw data, and acceleration of the drawing process are also included in the automatic cartography programs Furthermore, drawing problems and data elaboration problems are completely distinct in the automatic cartography system, permitting introduction of other data analysis, pattern recognition and automatic classification schemes as desired J M B

A78-18244 The use of Landsat imagery for terrain analysis B J Chandler and E S Owen-Jones (Bedford College, London, England) *British Interplanetary Society, Journal (Remote Sensing),* vol 31, Jan 1978, p 37-40 Research supported by the Department of Industry

A terrain mapping system which uses Landsat computer compatible tapes to produce lineprinter images, microfilm gray level images (and thence color composites), or microfilm symbolic shading images is described The level slicing technique employed by the mapping system is a modified equal interval slice, rather than an equal population slice, which causes excessive contrast in color composites Pixel classification programs, which may produce useful classifications after about three iterations of the processing, are also mentioned Sample gray level imagery and symbolic shading imagery for a region of Queensland, Australia are given J M B

A78-18271 # Photo interpretative procedures in assessing river recreation potential S M Nor and R Hill Rowley (Michigan State University, East Lansing, Mich) *Scenic Rivers Symposium, Louisiana State University, Baton Rouge, La , June 1977, Paper* 8 p

The photo interpretative procedures were employed in connection with two types of imagery, including black and white modified infrared prints (BWIR) at 1 15,840 dated September 1974 from the U S Forest Service, and color infrared transparencies (CIR) at 1 36,000 dated March 1973 from the Michigan Department of State Highways and Transportation The classification system used in the interpretation can be divided into three basic categories related to a description of nature of river and landscape, the numerical count of features, and subjective evaluations The BWIR imagery had some inherent characteristics which made interpretation more difficult than with the CIR Water and shadows both appeared dark, and tree shadows obscured details of the river, river banks, and other water bodies Use of CIR imagery seemed to allow better shadow penetration Identification of waterways, sandy beaches, and roads was much easier G R

A78-18440 Remote sensing experiment for magnetospheric electric fields parallel to the magnetic field K Wilhelm (Max-Planck-Institut fur Aeronomie, Katlenburg, West Germany) *Journal of Geophysics - Zeitschrift fur Geophysik,* vol 43, no 5-6, 1977, p 731-750 37 refs Bundesministerium fur Forschung und Technologie Contracts No WRT-1074, No WRK-274/3

A procedure for studying the magnetospheric electric fields parallel to the magnetic field is proposed In this procedure, test particles would be injected into the magnetosphere and detected as fast echoes Means of observing these echoes are discussed with particular emphasis on the determination of transit times as functions of the magnetic moment and energy It is shown that the transit time function, obtained by integrating the equation of motion of the guiding center of a test particle, is distinctly different for different electric field configurations The use of Abel's integral equation permits the approximate determination of the electric field along the magnetic field line M L

A78-18649 * Data handling for the geometric correction of large images H K Ramapriyan (Computer Sciences Corp , Silver Spring, Md) *IEEE Transactions on Computers,* vol C-26, Nov 1977, p 1163-1167 6 refs Contract No NAS8-21805

Several geometric distortions are present in remotely sensed images depending on the type of sensors and the object being observed It is often desirable to compensate for these distortions and store the images in reference to a standard coordinate system Digital techniques for correction are versatile and introduce a minimum of radiometric errors The main problems to be considered in this area are the determination of the corrective transformation, resampling, and the management of the large quantities of data It is shown that, by a judicious rearrangement of the input data, considerable reductions in the required memory capacity can be achieved The rearrangement can be accomplished in several stages The method presented here is amenable to pipeline implementation for processing a continuous stream of images (Author)

A78-18730 * Dependence of substorm occurrence probability on the interplanetary magnetic field and on the size of the auroral oval Y Kamide (Cooperative Institute for Research in Environmental Sciences, Boulder, Colo , Kyoto Industrial University, Kyoto, Japan), P D Perreault (Stanford Research Institute, Menlo Park, Calif), S-I Akasofu (Alaska, University, Fairbanks, Alaska), and J D Winningham (Texas, University, Richardson, Tex) *Journal of Geophysical Research,* vol 82, Dec 1, 1977, p 5521-5528 45 refs NSF Grant No ATM-74-23832, Contracts No F19628-76-C-074, No F19628-76-C-005, Grants No NGL-44-004-130, No NGR-44-004-150

A78-18749 Aerial photography and remote sensing for soil survey L P White Oxford and New York, Clarendon Press, 1977 118 p 43 refs $13 95

The present work outlines the use of aerial photography for soil mapping Attention is directed at the working principles of cameras and other devices that obtain images within and beyond the visible spectrum, the ways in which the images are produced and processed, and how they are used in soil survey A detailed discussion is presented of linescanners, the side looking radar, imagery from space platforms such as Landsat and Skylab, and image enhancement and automatic image analysis Several black-and-white and color aerial photographic plates are provided S D

A78-18910 A numerical algorithm for remote sensing of density profiles of a simple ocean model by acoustic pulses Y M Chen and D S Tsien (New York, State University, Stony Brook, N Y) *Journal of Computational Physics,* vol 25, Dec 1977, p 366-385 30 refs Contract No N00017-76-C-0804

An iterative algorithm is developed for solving nonlinear inverse problems in the remote sensing of density profiles of a simple ocean model by means of acoustic impulses The adiabatic sound velocity is assumed to be proportional to the inverse square root of the density The original pulse problem in the time domain is reduced to a continuous wave problem in the frequency domain after which the nonlinear inverse problem in the frequency domain is solved by a hybrid of a Newton-like iterative method, Backus and Gilbert linear inversion technique, and the finite difference method Algorithm

validity is confirmed by numerical simulations The effects of data frequency range and background noise are investigated, low-frequency data are found to be preferable to high-frequency data Error estimates are provided M L

A78-19114 # **Influence of temperature on the emissivity of moist soil in the microwave range (Vliianie temperatury na izluchatel'nuiu sposobnost' vlazhnoi pochvy v SVCh diapazone)** L M Mitnik and I A Aframeeva (Leningradskii Gidrometeorologicheskii Institut, Leningrad, USSR) *Meteorologiia i Gidrologiia,* Aug 1977, p 16-22 21 refs In Russian

In the study described, the influence of temperature on the emissivity of moist soils (clay, silt) was assessed on the basis of the temperature dependence of the real and imaginary parts of the permittivity of the soils at wavelengths between 1 15 and 150 cm To determine their permittivity, the soil samples were frozen to -20 C and reheated to +24 C The permittivity values were used to calculate, on the basis of Fresnel formulas, the emissivity of the soils in horizontal and vertical polarization, the degree of polarization, and the penetration depth of electromagnetic waves The results are presented in the form of graphs V P

A78-19241 # **Methods of analytic processing of various aerocosmic photoimages (Metody analiticheskoi obrabotki razlichnykh aerokosmicheskikh fotoizobrazhenii)** B A Novakovskii (Moskovskii Institut Inzhenerov Geodezii, Aerofotos'emki i Kartografii, Moscow, USSR) *Geodeziia i Aerofotos'emka,* no 4, 1977, p 87-90 In Russian

A78-20168 # **Four metre antenna system for Landsat and NOAA reception** R L Irwin (Canada Centre for Remote Sensing, Prince Albert Satellite Station, Canada) *(Canadian Remote Sensing Society, Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb 21-23, 1977) Canadian Journal of Remote Sensing,* vol 3, Dec 1977, p 21-27

The paper discusses the design of an antenna that can be used for reception from both Landsat (1690-1700 MHz) and NOAA-Very High Resolution Radiometer (2200-2300 MHz) systems A 4-meter parabolic antenna with a feed providing 50% efficiency is described The block diagram is portrayed, system performance specification and margin calculations are presented, and real time MSS and VHRR downlink margin calculations are considered The small antenna is needed to supplement the large 26-meter antenna which sometimes must be used to monitor Landsat at times when desired NOAA data are also available The antenna can receive high-azimuth data from Landsat which the large antenna, as a result of its slow slewing, can not receive M L

A78-20171 # **HRPT ground station** R J Welsh (Department of the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada) *(Canadian Remote Sensing Society, Remote Sensing Science and Technology Symposium, Ottawa, Canada, Feb 21-23, 1977) Canadian Journal of Remote Sensing,* vol 3, Dec 1977, p 46-52

The paper describes the high resolution picture transmission (HRPT) direct readout station which is operated by the Aerospace Meteorology Division of Canada The data for HRPT are obtained from the very high resolution radiometer (VHRR) on the NOAA series of polar orbiting meteorological satellites The station uses an auto-tracking ten-foot diameter solid parabolic dish antenna system Information on station components is provided, and the computer system, both in its present form and in a possible expanded form, is discussed M L

A78 20173 # **Homomorphic processing of Landsat data** S Carrol and J E Robinson (Union Oil Company of Canada, Canada) *Canadian Journal of Remote Sensing,* vol 3, Dec 1977, p 66-75 25 refs

Homomorphic transforms that permit realistic linear enhancement of Landsat images are described Usually the product is a false color picture with the information content of all four bands compressed into three corrected and enhanced images that are combined for full color display The advantages of this technique include scene to scene continuity, one disadvantage is that homomorphic processing requires multi-processing of each band of each scene Image processing, homomorphic principles, and applications to Landsat data are discussed, and, as an example, the generalized geology of the Sudbury Basin in northern Ontario is illustrated M L

N78-10341*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md

MONTE CARLO SIMULATION OF WAVE SENSING WITH A SHORT PULSE RADAR

D M LeVine, L D Davisson (Maryland Univ , College Pk), and R L Kutz Oct 1977 23 p refs

(NASA-TM-X-71412, X-953-77-239) Avail NTIS HC A02/MF A01 CSCL 17I

A Monte Carlo simulation is used to study the ocean wave sensing potential of a radar which scatters short pulses at small off-nadir angles In the simulation, realizations of a random surface are created commensurate with an assigned probability density and power spectrum Then the signal scattered back to the radar is computed for each realization using a physical optics analysis which takes wavefront curvature and finite radar-to-surface distance into account In the case of a Pierson-Moskowitz spectrum and a normally distributed surface, reasonable assumptions for a fully developed sea, it has been found that the cumulative distribution of time intervals between peaks in the scattered power provides a measure of surface roughness This observation is supported by experiments Author

N78-10528 Pennsylvania State Univ , University Park

FLOODPLAIN DELINEATION USING MULTISPECTRAL SCANNER DATA Ph.D. Thesis

Donald Lee Henninger 1976 110 p

Avail Univ Microfilms Order No 77-9769

Computer analysis techniques were applied to aircraft- and satellite-collected digital multispectral scanner (MSS) data to determine if floodplain boundaries could be accurately and quickly delineated in Pennsylvania The criteria used to distinguish floodplain areas were natural indicators such as differences in vegetation and soils Aircraft MSS data in the visible, the near infrared, and the intermediate infrared regions of the electromagnetic spectrum were analyzed for detection of natural features which could be associated with a floodplain boundary Satellite (LANDSAT 1) MSS data in four spectral regions of the electromagnetic spectrum were also analyzed Results indicate that computer analysis of remotely sensed digital MSS data has the potential of playing a prominent role in the identification and mapping of floodplain boundaries Dissert Abstr

N78-10530*# Department of the Northern Territory, Darwin (Australia)

ERTS B IMAGERY TO MONITOR LARGE SCALE CLEARING AND DEVELOPMENT PROGRAMMES IN THE DALY BASIN, NORTHERN TERRITORY

Blair G Wood, Principal Investigator 26 Oct 1977 2 p Sponsored by NASA ERTS

(E78-10002 NASA-CR-155206) Avail NTIS HC A02/MF A01 CSCL 02C

N78-11451*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md

AIRCRAFT SENSOR ANALYSIS PACKAGE SYSTEM DESCRIPTION

M L Forman Sep 1977 28 p refs Submitted for publication

(NASA-TM-78038 X-933-77-236) Avail NTIS HC A03/MF A01 CSCL 14B

An overview of the capabilities of the Aircraft Sensor Analysis Package (ASAP) is presented The approach is non-technical and several output products are illustrated The major features of the system are described in more detail than is found in the User's Guide to a potential user, or to a user looking for a specific capability to be incorporated in another system Author

N78-11561# Lockheed Missiles and Space Co , Palo Alto Calif Research Lab
IONOSPHERIC IRREGULARITIES OPTICAL SUPPORT OF HAES SCINTILLATION EXPERIMENTS Final Report, 15 Dec 1975 - 31 Jan 1977
Robert D Sears 31 Jan 1977 89 p refs
(Contract DNA001-76-C-0182)
(AD-A043666 DNA-4240F) Avail NTIS HC A05/MF A01 CSCL 04/1

Photometric measurements of auroral spectral emission features and of the horizontal phase velocity of auroral motions were conducted at Chatanika Alaska during several observing periods in 1976 These experiments provided ground-based optical support for the DNA HAES (High Altitude Effects Simulation) rocket experiments launched from Poker Flat Multispectral data on the auroral emission intensities at 4278A and 6300A and the intensity ratio was analyzed in terms of the mean energy parameter for an assumed Maxwellian flux of precipitating electrons Comparison between photometric determination of the mean energy parameter and that derived from incoherent scatter radar data provided a useful cross calibration of the two measurement techniques This agreement also tends to confirm the theoretical predictions for the intensity ratio R sub 64 1(6300)/1(4278) as a function of the mean energy parameter Additional analytical work was conducted to improve the three beam analysis code which allows inference of auroral E-fields and associated quantities from the auroral motion and intensity data Results of the improved code are presented for the WIDEBAND rocket support experiment GRA

N78-12486 Catholic Univ of America, Washington, D C
APPLICATION OF DIGITAL FILTERING TO SATELLITE GEODESY Ph.D. Thesis
Clyde Clarenton Goad 1977 85 p
Avail Univ Microfilms Order No 77-16801

Accurate measurements of satellite orbits were used to deduce the value of the lunar semi-diurnal (M2) ocean tide Since the ocean tides cause periodic perturbations with periods greater than a week in the evolution of the Keplerian elements of a satellite, the mean Keplerian elements (osculating Keplerian elements less all short period oscillations) are studied Approximate analytical transformations were applied which account for large first-order effects Elimination of very high frequency effects was accomplished with the aid of an ideal low-pass filter Two terms in the harmonic expansion of the M2 global tide height can be observed These estimates are somewhat smaller than recent publicized coefficients obtained from numerical solutions of Laplace tidal equations Using this value of M2 to calculate the deceleration of the lunar mean longitude yields an estimate in close agreement with recent analyses of ancient eclipses and modern transit data Dissert Abstr

N78-12487 Ohio State Univ , Columbus
ANALYSIS OF PHOTOGRAMMETRIC AERIAL CAMERA CALIBRATIONS Ph.D Thesis
Wicha Jiwalai 1977 213 p
Avail Univ Microfilms Order No 77-17103

A pair of reseau type aerial cameras were calibrated by using goniometer collimator bank and stellar calibration methods This information was applied to unconstrained exterior orientation positional constraints rotational constraints, and fully constrained exterior orientation The calibration data provided significantly different results in all cases except single photo resection with no constraint on the exterior orientation The results of block adjustment indicated the presence of some types of systematic errors Moreover, they yielded such different results that it was not possible to group them together Out of six calibrations, in block triangulations, only one provided satisfactory results on both planimetry and height while another one provided a satisfactory result only in planimetry Dissert Abstr

N78-12489 California Univ Berkeley
GEOMETRIC PROCESSING FOR DIGITAL MAPPING WITH MULTISERIES REMOTE SENSING DATA Ph D Thesis
Mitsuru Nasu 1976 198 p
Avail Univ Microfilms Order No 77-15799

Digital geometric procedures for positioning multiseries remote sensing data have been studied for digital cartographic mapping purposes Tests with simulated and real data show that the digital approach is feasible Improvement of sensor exterior orientation by multistage geometric sampling and improved point identification by digital image matching result in higher positioning accuracy Dissert Abstr

N78-12491 Purdue Univ , Lafayette, Ind
IMAGE MODELING WITH APPLICATION TO MEASUREMENT Ph.D Thesis
James William Burnett 1976 89 p
Avail Univ Microfilms Order No 77-15386

A fast and efficient algorithm was developed for pulse width estimation from blurred and nonlinear observation in the presence of signal dependent noise The problem is approached by modeling the signal (reflected light intensity) as a discrete position finite state Markov process Sample functions of such a process are graphically represented by a path through a trellis By assigning a cost or length to each branch of the trellis a MAP sequence estimate of the signal is computed by finding the minimum cost or minimum length path through the trellis The Viterbi algorithm is introduced as an efficient means of finding the minimum cost path through the trellis When the possible states are known a-priori, the algorithm is shown to produce asymptotically unbiased, minimum variance discrete width estimates Computer simulation results show the variance of discrete estimates is close to the Cramer-Rao bound Dissert Abstr

N78-12493*# Geological Survey Iowa City, Iowa Research Div
LAND CLASSIFICATION OF SOUTH-CENTRAL IOWA FROM COMPUTER ENHANCED IMAGES Progress Report, 3 Feb. - 3 Apr 1976
James R Lucas Principal Investigator (Technicolor Graphic Services, Inc Sioux Falls South Dakota), James V Taranik (EROS Data Center, Sioux Falls South Dakota), and Frederic C Billingsley (JPL) 3 May 1976 90 p refs Original contains color imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(Contract NAS5-20832)
(E78-10005, NASA-CR-155209, PR-5) Avail NTIS HC A05/MF A01 CSCL 08B

The author has identified the following significant results The Iowa Geological Survey developed its own capability for producing color products from digitally enhanced LANDSAT data Research showed that efficient production of enhanced images required full utilization of both computer and photographic enhancement procedures The 29 August 1972 photo-optically enhanced color composite was more easily interpreted for land classification purposes than standard color composites

N78-12495*# International Business Machines Corp , Gaithersburg, Md
RESAMPLING STUDY Final Report
D G Ferneyhough, Principal Investigator and C W Niblack Mar 1977 175 p Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls S D ERTS
(Contract NAS5-21865)
(E78-10014 NASA-CR-156643, FSD-7700-01) Avail NTIS HC A08/MF A01 CSCL 05B

The author has identified the following significant results The nearest neighbor and cubic convolution resampling algorithms were applied to a variety of images extracted from LANDSAT MSS data A comparison of the results demonstrated that (1) cubic convolution can cause spreading of small features and can introduce noticeable overshoot (ringing) into the data (2) cubic convolution attenuates the high spatial frequencies compared to the original and nearest neighbor resampled data, and (3) cubic convolution generally produces photographic products of superior visual quality The effects of the resampling algorithms on multispectral classification were not conclusively determined due to the small number of images tested

N78-12497*# Purdue Univ , Lafayette, Ind Lab for Applications of Remote Sensing

COMPUTER-AIDED ANALYSIS OF LANDSAT DATA FOR SURVEYING TEXAS COASTAL ZONE ENVIRONMENTS
Stevan J Kristof, Principal Investigator and Richard A Weismiller 6 Sep 1977 33 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D EREP
(Contracts NAS9-14016, NAS9-14970)
(E78-10018, NASA-CR-151536, LARS-TR-090677) Avail NTIS HC A03/MF A01 CSCL 08J

The author has identified the following significant results The study areas were Pass Cavallo and Port O'Connor The following terrestrial and aquatic environments were discriminated alternating beach ridges, swales, sand dunes, beach birms, deflation surfaces, land-water interface, urban, spoil areas, fresh and salt water marshes grass and woodland, recently burned or grazed areas, submerged vegetation, and waterways

N78-12498*# Environmental Research Inst of Michigan, Ann Arbor Infrared and Optics Div
EVALUATION OF SIGNATURE EXTENSION ALGORITHMS Interim Technical Report, 15 May 1976 - 31 Aug 1977
R F Nalepka, Principal Investigator and Alex P Pentland Sep 1977 76 p refs EREP
(Contract NAS9-14988)
(E78-10021, NASA-CR-151537, ERIM-122700-29-T) Avail NTIS HC A05/MF A01 CSCL 05B

The author has identified the following significant results One of the major findings was that nearly all of the bias in the proportion estimates of the multisegment training and classification procedure resulted from the particular configuration of the signature set used for classification rather than from peculiarities of the recognition sample segments This meant that the proportion estimation bias could be accurately corrected simply by estimating the bias on the original six training segments The bias corrected proportion estimates of the multisegment training and classification procedure were extremely accurate and had a low variance when compared to local training and classification This finding may have important ramifications for reducing the cost and increasing the accuracy of bias correction procedures

N78-12499*# Control Data Corp , Minneapolis Minn
DIGITAL IMAGE CORRELATION TECHNIQUES APPLIED TO LANDSAT MULTISPECTRAL IMAGERY
L O Bonrud, Principal Investigator and W J Miller Jan 1976 118 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D ERTS
(Contract NAS5-20570)
(E78-10022, NASA-CR-156647) Avail NTIS HC A06/MF A01 CSCL 05B

The author has identified the following significant results Automatic image registration and resampling techniques applied to LANDSAT data achieved accuracies, resulting in mean radial displacement errors of less than 0 2 pixel The process method utilized recursive computational techniques and line-by-line updating on the basis of feedback error signals Goodness of local feature matching was evaluated through the implementation of a correlation algorithm An automatic restart allowed the system to derive control point coordinates over a portion of the image and to restart the process, utilizing this new control point information as initial estimates

N78-12502*# Atomic Energy Commission, Dacca (Bangladesh)
INVESTIGATIONS USING DATA FROM LANDSAT-2 Quarterly Report, Jul. - Sep 1977
Anwar Hossain, Principal Investigator Nov 1977 4 p refs Sponsored by NASA ERTS
(E78-10026, NASA-CR-155251) Avail NTIS HC A02/MF A01 CSCL 05B

The author has identified the following significant results A land use map was prepared of Dacca-Narayanganj-Demra area on a scale of 1 50,000 LANDSAT imageries of Dinajpur and Rangpur districts were studied The difference between the exposed Pleistocene red clay this clay under alluvial cover and recent alluvium was noted Different types of soils, crops, etc were delineated on the ERTS imagery

N78-12504*# Purdue Univ , Lafayette Ind Lab for Applications of Remote Sensing
A CASE STUDY USING ECHO(EXTRACTION AND CLASSIFICATION OF HOMOGENEOUS OBJECTS) FOR ANALYSIS OF MULTISPECTRAL SCANNER DATA
Donna Scholz, Principal Investigator, James Russell John Lindenlaub, and Philip Swain 1 Sep 1977 94 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D EREP
(Contract NAS9-14970)
(E78-10030, NASA-CR-151532, LARS-Publ-090177) Avail NTIS HC A05/MF A01 CSCL 05B

N78-12511*# Wolf Research and Development Corp , Pocomoke City, Md
SEAHT A COMPUTER PROGRAM FOR THE USE OF INTERSECTING ARCS OF ALTIMETER DATA FOR SEA SURFACE HEIGHT REFINEMENT
C P Allen and C F Martin Nov 1977 119 p refs
(Contract NAS6-2639)
(NASA-CR-141432) Avail NTIS HC A06/MF A01 CSCL 13B

The SEAHT program is designed to process multiple passes of altimeter data with intersecting ground tracks with the estimation of corrections for orbital errors to each pass such that the data has the best overall agreement at the crossover points Orbit error for each pass is modeled as a polynomial in time, with optional orders of 0, 1, or 2 One or more passes may be constrained in the adjustment process, thus allowing passes with the best orbits to provide the overall level and orientation of the estimated sea surface heights Intersections which disagree by more than an input edit level are not used in the error parameter estimation In the program implementation, passes are grouped into South-North passes and North-South passes with the North-South passes partitioned out for the estimation of orbit error parameters Computer core utilization is thus dependent on the number of parameters estimated for the set of South-North arcs, but is independent on the number of North-South passes Estimated corrections for each pass are applied to the data at its input data rate and an output tape is written which contains the corrected data Author

N78-12515# Environmental Research Inst of Michigan, Ann Arbor
BASIC REMOTE SENSING INVESTIGATION FOR BEACH RECONNAISSANCE Interim Report, 1 Jan. - 31 Dec. 1976
David Lyzenga, Robert Shuchman, Fred Thomson Carl F Davis, and Gwynn H Suits Sep 1977 77 p refs
(Contract N00014-74-C-0273)
(AD-A044836, ERIM-108900-9-P) Avail NTIS HC A05/MF A01 CSCL 14/5

Progress is reported on two tasks designed to develop remote sensing beach reconnaissance techniques applicable to benthic and beach intertidal zones In Task1--whose goal is to develop remote sensing algorithms for important beach composition and physical parameters--results of radiative transfer model development and application are reported The model calculates the radiance of a beach, given physical and compositional information In Task 2--whose goal is to develop remote sensing algorithms for mapping of bottom features in the benthic zone--results of radiative transfer model calculations and an evaluation of the modified ratio algorithm (MRA) performance in scattering waters are presented Author (GRA)

N78-12516# Systems Research Labs , Inc , Dayton, Ohio
RESEARCH AND SIMULATION IN SUPPORT OF NEAR REAL TIME/REAL TIME RECONNAISSANCE RPV SYSTEMS Progress Report, Dec 1975 - Jun. 1976
Gilbert Kuperman, William N Kama, Joseph Fraggiotti, and John Kettlewell Jun 1977 262 p refs
(Contract F33615-75-C-0127, AF Proj 7184)
(AD-A044598, AMRL-TR-77-33) Avail NTIS HC A12/MF A01 CSCL 15/4

A facility was developed for assessing operator performance in target recognition and interpretation tasks using real time and near real time electrooptical sensor imagery A programmable image scanner was upgraded to generate simulated sensor imagery

under operational flight profiles A study was performed to compare operator performance against three candidate sensors The study utilized two V/H levels, the operationally preferred and the minimum commensurate with RPV survivability Significant findings were developed for the dependent measures of percent of targets detected, time on display until detection, ground range at detection, slant range at detection, and displayed image scale at detection Accuracy of interpretation and interpreter confidence did not yield significant results These results were combined with analytically based performance measures to produce a sensor comparison table in which twelve criteria, weighted by their respective operational impact, were used A slewable television camera, equipped with zoom optics, and supported by a near real time playback capability achieved the highest performance score Additionally, seventeen areas were identified in which future investigations could provide operationally important findings to the RPV Special Project Office Author (GRA)

N78-12586*# National Aeronautics and Space Administration, Washington, D C
INVERSION METHODS IN ATMOSPHERIC REMOTE SOUNDING
Adarsh Deepak, ed 1977 609 p refs Workshop held at Hampton, Va 15-17 Dec 1976 Sponsored in part by Old Dominion Univ
(NASA-CP-004) Avail NTIS HC A99/MF A01 CSCL 04A
The mathematical theory of inversion methods is applied to the remote sounding of atmospheric temperature, humidity, and aerosol constituents

N78-12587*# Leiden Univ (Netherlands)
HYBRID METHODS ARE HELPFUL
H C VanDeHulst *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 1-19 ref

Avail NTIS HC A99/MF A01 CSCL 04A
Multiple scattering problems in a plane layer often permit the convenient use of different methods joined together Sample numerical results to illustrate this point refer to X- and Y-functions, asymptotic fitting, the small-loss approximations, polarization in high orders, and photon path distribution Author

N78-12588*# Universite des Sciences et Techniques de Lille (France)
REVIEW OF RADIATIVE TRANSFER METHODS IN SCATTERING ATMOSPHERES
Jacqueline Lenoble *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 21-40 refs
Avail NTIS HC A99/MF A01 CSCL 04A
The radiative transfer in a scattering plane-parallel atmosphere is discussed, considering the exact analytical, the computational and the approximate methods Some results of numerical comparisons are given Finally, the difficulties of realistic atmospheric models are emphasized Author

N78-12589*# Arizona Univ , Tucson
SOME ASPECTS OF THE INVERSION PROBLEM IN REMOTE SENSING
S Twomey *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 41-65 refs

Avail NTIS HC A99/MF A01 CSCL 04A
Several commonly used methods for inversion--constrained linear inversion, synthesis (Backus-Gilbert) methods and nonlinear iterative techniques for the Chahine type--are discussed It is demonstrated that a very close connection exists between Backus-Gilbert solutions and those given by constrained linear inversion A number of examples of the application of such methods are presented, showing that resolution is not greatly different for quite different algorithms, a result quite in accord with general theoretical considerations more resolution can be achieved at the expense of introducing greater a priori bias in the procedure Author

N78-12590*# Jet Propulsion Lab , Calif Inst of Tech , Pasadena
GENERALIZATION OF THE RELAXATION METHOD FOR THE INVERSE SOLUTION OF NONLINEAR AND LINEAR TRANSFER EQUATIONS
Moustafa T Chahine *In its* Inversion Methods in Atmospheric Remote Sounding 1977 p 67-116 refs

(Contract NAS7-100)
Avail NTIS HC A99/MF A01 CSCL 04A
A mapping transformation is derived for the inverse solution of nonlinear and linear integral equations of the types encountered in remote sounding studies The method is applied to the solution of specific problems for the determination of the thermal and composition structure of planetary atmospheres from a knowledge of their upwelling radiance Author

N78-12591*# Oxford Univ (England) Clarendon Lab
STATISTICAL PRINCIPLES OF INVERSION THEORY
C D Rodgers *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 117-138 refs

Avail NTIS HC A99/MF A01 CSCL 04A
Statistical methods are used to deal with the inverse problem of radiative transfer All the available information about an unknown profile can be expressed in the form of values of functions of that profile and error estimates of these values Estimation theory shows how these values are combined to give an estimate of the unknown profile and its error covariance Many inversion methods are expressed in this form although the error estimate is not usually carried out Practical applications are described, both for inversion of individual profiles, and the global analysis of satellite data Author

N78-12592*# Air Force Geophysics Lab , Hanscom AFB, Mass
INVERSE SOLUTION OF THE PSEUDOSCALAR TRANSFER EQUATION THROUGH NONLINEAR MATRIX INVERSION
Jean I F King *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 139-153 refs
Avail NTIS HC A99/MF A01 CSCL 04A
Nonlinear matrix inversion operators have been developed which, applied to observed radiances, infer maximal information regarding atmospheric scattering parameters and vertical distribution of radiant sources and sinks The algorithm has the attractive feature of noise discrimination, attributing instrumental errors to extra-atmospheric sources Author

N78-12593*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
BACKUS-GILBERT THEORY AND ITS APPLICATION TO RETRIEVAL OF OZONE AND TEMPERATURE PROFILES
Barney J Conrath *In its* Inversion Methods in Atmospheric Remote Sounding 1977 p 155-193 refs

Avail NTIS HC A99/MF A01 CSCL 04A
The inversion method provides a quantitative evaluation of the trade-off between vertical resolution of a retrieved profile and formal root-mean-square (rms) error due to measurement noise propagation The problem of retrieving the top-side ozone profile from backscattered ultraviolet (BUV) measurements is considered For measurements of the type currently being obtained with the Nimbus 4 and AE-E BUV experiments, it is found that a vertical resolution of approximately 0 75 scale height can be achieved for a formal volume mixing ratio profile error of 10%. Other examples include treatments of the retrieval of temperature profiles from measurements in the 15 micron CO2 absorption band for both the terrestrial and Martian atmospheres Finally, the method is applied to the problem of retrieving temperature profiles of the Jovian planets from measurements in the far infrared pressure induced H2 lines to be obtained from the Mariner Jupiter/Saturn fly-by missions Author

N78-12594*# National Center for Atmospheric Research, Boulder, Colo
INVERSION OF INFRARED LIMB EMISSION MEASUREMENTS FOR TEMPERATURE AND TRACE GAS CONCENTRATIONS
John C Gille and Paul L Bailey *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977

p 195-216 refs Sponsored by NSF

Avail NTIS HC A99/MF A01 CSCL 04A

Limb emission measurements are characterized by sharp weighting functions at high altitudes, and for temperature determinations, strongly nonlinear dependence of the weighting function on the temperature Several methods for inverting this type of measurement have been described and used, including iterative, statistical, nonlinear and approximate direct approaches These approaches are described and advantages and disadvantages of each are outlined Author

N78-12595*# Draper (Charles Stark) Lab, Inc, Cambridge, Mass

INVERSION OF SCATTERED RADIANCE HORIZON PROFILES FOR GASEOUS CONCENTRATIONS AND AEROSOL PARAMETERS

Harvey L Malchow and Cynthia K Whitney *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 217-263 refs

(Contract NAS1-14150)

Avail NTIS HC A99/MF A01 CSCL 04A

Techniques have been developed and used to invert limb scan measurements for vertical profiles of atmospheric state parameters The parameters which can be found are concentrations of Rayleigh scatters, ozone, NO2, and aerosols, and aerosol physical properties including a Junge-size distribution parameter and real and imaginary parts of the index of refraction Author

N78-12596*# Old Dominion Univ, Norfolk, Va

INVERSION OF SOLAR AUREOLE MEASUREMENTS FOR DETERMINING AEROSOL CHARACTERISTICS

Adarsh Deepak *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 265-295 refs Prepared in cooperation with Inst for Atmospheric Optics and Remote Sensing, Hampton Va

(Grant NsG-1252)

Avail NTIS HC A99/MF A01 CSCL 04A

Solar aureole radiance is very sensitively dependent on the aerosol size distributions The photographic solar aureole isophote (PSAI) measurement technique for determining the aerosol size distribution and other characteristics takes advantage of this sensitivity Single scattering theory of the solar aureole is given The assumptions and conditions imposed on the single scattering theory to make it tractable to inversion are discussed The important role of the almucantar measurements is also discussed Author

N78-12598*# National Environmental Satellite Service, Washington, D C

COMPARISON OF LINEAR INVERSION METHODS BY EXAMINATION OF THE DUALITY BETWEEN ITERATIVE AND INVERSE MATRIX METHODS

Henry E Fleming *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 325-360 refs

Avail NTIS HC A99/MF A01 CSCL 04A

Linear numerical inversion methods applied to atmospheric remote sounding generally can be categorized in two ways (1) iterative, and (2) inverse matrix methods However, these two categories are not unrelated a duality exists between them In other words, given an iterative scheme, a corresponding inverse matrix method exists, and conversely This duality concept is developed for the more familiar linear methods The iterative duals are compared with the classical linear iterative approaches and their differences analyzed The importance of the initial profile in all methods is stressed Calculations using simulated data are made to compare accuracies and to examine the dependence of the solution on the initial profile Author

N78-12599*# Massachusetts Inst of Tech Cambridge

INVERSION OF PASSIVE MICROWAVE REMOTE SENSING DATA FROM SATELLITES

David H Staelin *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 361-394 refs

(Contracts NAS5-21980 F19628-75-C-0122)

Avail NTIS HC A99/MF A01 CSCL 04A

Global passive microwave observations from earth-orbiting satellites have mapped humidity and liquid water over ocean, temperature profiles, ice and snow, and other geophysical parameters In most applications, the inversion problem is adequately approximated as linear with jointly Gaussian statistics and thus, a linear retrieval performs well In some cases, the problem is typically factored into a decision process followed by appropriate linear or quasilinear processes Certain problems, however, require more powerful nonlinear or nonstationary procedures, such as Kalman filtering Author

N78-12600*# National Oceanic and Atmospheric Administration, Boulder, Colo Wave Propagation Lab

APPLICATION OF STATISTICAL INVERSION TO GROUND-BASED MICROWAVE REMOTE SENSING OF TEMPERATURE AND WATER VAPOR PROFILES

E R Westwater and M T Decker *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 395-427 refs

Avail NTIS HC A99/MF A01 CSCL 04A

Surface-based observations of downwelling microwave thermal emission are related to temperature and humidity profiles via a standard integral equation of radiative transfer Both in clear and in cloudy atmospheres, statistical inversion techniques are used to retrieve profiles from a data vector of brightness observations and surface meteorological constraints For the clear case, accuracy predictions and profile retrievals are illustrated for (1) single frequency angular scanned data (2) multi-frequency angular scanned data, and (3) multi-frequency zenith data For the last case predicted and achieved accuracies were compared in a recently conducted radiometric experiment Retrievals of cloud contaminated radiometric data are elaborated Author

N78-12601*# Jet Propulsion Lab Calif Inst of Tech, Pasadena

INVERSION METHODS IN TEMPERATURE AND AEROSOL REMOTE SOUNDING. THEIR COMMONALITY AND DIFFERENCES, AND SOME UNEXPLORED APPROACHES

Alain L Fymat *In its* Inversion Methods in Atmospheric Remote Sounding 1977 p 429-467 refs

(Contract NAS7-100)

Avail NTIS HC A99/MF A01 CSCL 04A

The two remote sensing problems of temperature profiling and aerosol characterization (complex refractive index size distribution) are considered These problems differ only in the explicit form of the source function which for aerosols, includes contributions from both single and multiple scattering processes When the observables are the spectral extinction or the single scattering of the source radiation, the associated problem is completely analogous to the linearized temperature inversion problem Methods for obtaining the solution of the linear problem are classified following three main categories (1) derivation of properties that all solutions satisfy, which must then be properties of the actual solution, (2) regularization of the ill-posed problem, and (3) data changes within their domain of uncertainty in order to avoid the basic instability A number of unexplored methods are indicated Author

N78-12602*# Arizona Univ, Tucson

APPLICATION OF MODIFIED TWOMEY TECHNIQUES TO INVERT LIDAR ANGULAR SCATTER AND SOLAR EXTINCTION DATA FOR DETERMINING AEROSOL SIZE DISTRIBUTIONS

S M Herman *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 469-503 refs

Avail NTIS HC A99/MF A01 CSCL 04A

Polarization properties of the angularly scattered laser light from a volume of air are used to determine the size distribution of the aerosol particles within the volume by the use of appropriate inversion techniques Similar techniques are employed to determine a mean size distribution of the particulates within a vertical column through the atmosphere from determinations of the aerosol optical depth as a function of wavelength In both of these examples, a modification of an inversion technique originally described by Twomey has been employed Details of

this method are presented as well as results from actual measurements employing bistatic lidar and solar radiometer
Author

N78-12603*# Old Dominion Univ Norfolk, Va
THE INVERSION OF STRATOSPHERIC AEROSOL AND OZONE VERTICAL PROFILES FROM SPACECRAFT SOLAR EXTINCTION MEASUREMENTS
William P Chu *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 505-527 refs
Avail NTIS HC A99/MF A01 CSCL 04A

The inversions of multi-channel solar extinction measurements have been analyzed for the 0 35-1 0 micron wavelength region to retrieve stratospheric aerosol and ozone vertical profiles using both the constrained linear inversion scheme and the iterative scheme The inversions of the multi-wavelength solar extinction data obtained from spacecraft have been analyzed based on the inversion of computer simulated data using various atmospheric models with differing amounts of aerosol and ozone in the stratosphere The sensitivities of the inversion schemes to different experimental errors are discussed in terms of accuracy and resolution of the retrieved profiles Author

N78-12604*# Wyoming Univ , Laramie
INVERSION OF SOLAR EXTINCTION DATA FROM THE APOLLO-SOYUZ TEST PROJECT STRATOSPHERIC AEROSOL MEASUREMENT (ASTP/SAM) EXPERIMENT
Theodore J Pepin *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 529-554 refs
(Contract NAS1-3213)
Avail NTIS HC A03/MF A01 CSCL 04A

The inversion methods are reported that have been used to determine the vertical profile of the extinction coefficient due to the stratospheric aerosols from data measured during the ASTP/SAM solar occultation experiment Inversion methods include the onion skin peel technique and methods of solving the Fredholm equation for the problem subject to smoothing constraints The latter of these approaches involves a double inversion scheme Comparisons are made between the inverted results from the SAM experiment and near simultaneous measurements made by lidar and balloon born dustsonde The results are used to demonstrate the assumptions required to perform the inversions for aerosols Author

N78-12605*# California Univ Berkeley
EFFECTIVE AEROSOL OPTICAL PARAMETERS FROM POLARIMETER MEASUREMENTS
Jacob G Kuriyan *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 555-575 refs
(Grants NGR-05-007-328, NsG-1270)
Avail NTIS HC A99/MF A01 CSCL 04A

The theory underlying the interpretation of polarimeter measurements is described The assumptions of the model are carefully stated so that the results obtained from the ground-based experiment can be understood without ambiguity The meteorological significance of the parameters is also deduced With a satellite-borne polarimeter that monitors the upwelling radiation field, the effect of the ground must be taken into account in order to obtain the aerosol parameters Two methods that hold promise are described Author

N78-12606*# Atmospheric Environment Service, Ottawa (Ontario)
EXPERIENCE WITH THE INVERSION OF NIMBUS 4 BUV MEASUREMENTS TO RETRIEVE THE OZONE PROFILE
Carleton L Mateer *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 577-597 refs
Avail NTIS HC A99/MF A01 CSCL 04A

The relative merits of pressure increment and partial derivative formulations of the ozone inversion problem are discussed briefly The height range of validity of the retrieved ozone profile and the effects of adding wavelengths to or of dropping wavelengths from the inversion system are indicated Illustrative results are presented for profiles retrieved from BUV data using Backus-Gilbert, minimum information (Twomey) and quasi-optimum procedures Author

N78-12607*# Chicago Univ , Ill
TEMPERATURE SENSING. THE DIRECT ROAD TO INFORMATION
Lewis D Kaplan *In* NASA Langley Res Center Inversion Methods in Atmospheric Remote Sounding 1977 p 599-615 ref
(Grant NSF ATM-72-01381)
Avail NTIS HC A99/MF A01 CSCL 04A

The retrievability of detailed temperature soundings from remote measurements of emission spectra depends not so much on how the data are treated as on what the data are It is shown that the shape of the weighting functions depends on the nature of the pressure and temperature dependence of the transmittance, which differ from one part of the spectrum to another as well as with spectral resolution It is shown that careful selection of channels results in much narrower weighting functions than those corresponding to channels that have actually been used Author

N78-12608*# College of William and Mary, Williamsburg Va
ATLAS OF INFRARED ABSORPTION LINES Final Report
Jae H Park Nov 1977 71 p refs Supersedes NASA-CR-144976, N76-22719
(Grant NsG-1203)
(NASA-CR-2925 NASA-CR-144976) Avail NTIS HC A04/MF A01 CSCL 04A

Infrared absorption line parameters (line strength vs wavenumber) are presented from 500 to 7000 cm/1 for 15 gases H2O, CO2, O3 N2O CO CH4, O2, SO2 NO, NO2, NH3, HCl HF HNO3 and CH3Cl Author

N78-13412# State Univ of New York, Binghamton
TEXTURE TONE FEATURE EXTRACTION AND ANALYSIS Final Technical Report, Apr 1976 - May 1977
Shin-yi Hsu and Eugene Klimko Aug 1977 50 p refs
(Contract F30602-76-C-0211)
(AD-A045542, RADC-TR-77-279) Avail NTIS HC A03/MF A01 CSCL 14/5

A new texture measurement and the Mahalanobis classifier with a generalized inverse scheme were developed to generate decision maps of terrain features with digitized B/W photographs on a pixel by pixel basis Eight scenes within the Northeast test area, four low altitude and four high altitude, were analyzed yielding a hit-rate of about 90% with properly digitized image data To determine the degree of non-normal behavior of the texture variables, the stable distribution models were utilized Methods of estimating the stable parameters of the texture variables were developed It is found that fifty % of the texture variables are not normally distributed Since the stable distribution models are capable of incorporating the skewness parameters into the classification process, it is recommended as a new classifier for image data analysis GRA

N78-13497 Pennsylvania State Univ , University Park
A REMOTE DISPLAY SYSTEM UTILIZING COMPRESSED DATA TRANSMISSION Ph.D Thesis
Edsel Glen Crenshaw 1977 163 p
Avail Univ Microfilms Order No 77-17681

The design, implementation and evaluation of a color display system for use in image analysis is described The system design is compatible with the satellite and aircraft image processing requirements of the Office for Remote Sensing of Earth Resources Potential system configurations were defined and evaluated The selected configuration consisted of a minicomputer, a modem, color television display hardware and an operator terminal A telephone connection to an IBM 370/168 computer was used to receive images which conformed to standard remote job entry data formats Because of the relatively slow transmission speeds possible and the large data content of the images, data compression was necessary Dissert Abstr

N78-13498 Cornell Univ , Ithaca, N Y
ANALYTICAL AERIAL TRIANGULATION WITH CORRECTIONS FOR SYSTEMATIC ERRORS Ph D Thesis

Bahattin Coskun 1976 172 p
Avail Univ Microfilms Order No 77-19993

It was shown that a portion of systematic image deformations can successfully be compensated for by the introduction of unknown additional parameters into the colinearity equations A model consisting of 29 additional parameters was incorporated into the bundle adjustment The additional parameters were treated as observations to avoid the ill conditioning of the normal equations arising from the fact that some of the parameters are correlated with one another and/or with orientation unknowns It was not generally necessary to justify the physical meaning of each parameter, though the terms should be effective and significant in compensating for the systematic errors The correction model incorporated a combination of the sources of systematic errors as well as some empirical terms to account for persistent sources of systematic errors Dissert Abstr

N78-13951# Battelle Pacific Northwest Labs, Richland, Wash
COMPREHENSIVE INFORMATION RETRIEVAL AND MODEL INPUT SEQUENCE (CIRMIS)
D R Friedrichs Apr 1977 82 p ref
(Contract EY-76-C-06-1830)
(BNWL-2235) Avail NTIS HC A05/MF A01

A computer system developed to increase data storage and retrieval capabilities and ground-water model control is described The overall configuration, however, can be used in other areas to provide the user with three major functions retrieval of well-based data, special application for manipulating surface data or background maps, and the manipulation and control of ground-water models These programs comprise only a portion of the entire comprehensive information retrieval and model input sequence system ERA

N78-14457*# Environmental Research Inst of Michigan, Ann Arbor Infrared and Optics Div
SIGNATURE EXTENSION PREPROCESSING FOR LANDSAT MSS DATA Final Report, 15 May 1976 - 14 Nov. 1977
Richard F Nalepka, Principal Investigator and Peter F Lambeck Nov 1977 69 p refs Original contains imagery Original photography may be purchased from the EROS Data Center, Sioux Falls, S D EREP
(Contract NAS9-14988)
(E78-10040, NASA-CR-151563, ERIM-122700-32-F) Avail NTIS HC A04/MF A01 CSCL 05B

N78-14460*# Purdue Univ, Lafayette Ind Lab for Applications of Remote Sensing
TEST OF SPECTRAL/SPATIAL CLASSIFIER Final Report
D A Landgrebe Principal Investigator J L Kast, and B J Davis Nov 1977 168 p refs EREP
(Contract NAS9-14970)
(E78-10044 NASA-CR-155344, LARS-112877 T-1314/4 MA-129TA) Avail NTIS HC A08/MF A01 CSCL 05B

The author has identified the following significant results The supervised ECHO processor (which utilizes class statistics for object identification) successfully exploits the redundancy of states characteristic of sampled imagery of ground scenes to achieve better classification accuracy, reduce the number of classifications required, and reduce the variability of classification results The nonsupervised ECHO processor (which identifies objects without the benefit of class statistics) successfully reduces the number of classifications required and the variability of the classification results

N78-14461*# Purdue Univ, Lafayette, Ind Lab for Applications of Remote Sensing
PROCESSING TECHNIQUES DEVELOPMENT Final Report
D A Landgrebe, Principal Investigator B J Davis T L Phillips C R Sand, and P E Anuta Nov 1977 57 p refs EREP
(Contract NAS9-14970)
(E78-10045, NASA-CR-155345, LARS-112777, T-1314/4, MA-129TA) Avail NTIS HC A04/MF A01 CSCL 05B

N78-14466*# Jet Propulsion Lab, Calif Inst of Tech, Pasadena
TECHNOLOGY ADVANCES IN ACTIVE AND PASSIVE MICROWAVE SENSING THROUGH 1985
Frank T Barath *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 51-54 refs
(Contract NAS7-100)
Avail NTIS HC A99/MF A01 CSCL 17E

The capabilities of passive and active microwave sensors are discussed The Nimbus-G and Seasat-A scanning multichannel microwave spectrometer, the Seasat-A radar altimeter, scatterometer and synthetic aperture radar represent the first systematic attempt at exploring a wide variety of applications utilizing microwave sensing techniques and are indicators of the directions in which the pertinent technology is likely to evolve The trend is toward high resolution multi-frequency imagers spanning wide frequency ranges and wide swaths requiring sophisticated receivers, real-time data processors and most importantly, complex antennas Author

N78-14471*# Environmental Research Inst of Michigan, Ann Arbor
REMOTE SENSING DATA PROCESSING TWO YEARS AGO, TODAY, AND TWO YEARS FROM TODAY
Quentin A Holmes David Goodenough (Canada Centre for Remote Sensing, Ottawa), and Jon D Erickson (NASA Johnson Space Center) *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 125-135 refs

Avail NTIS HC A99/MF A01 CSCL 08F

Beginning with a survey of the state-of-the-art of processing remotely sensed data in early 1975, significant developments between that time and the present are chronicled, and technologies for early 1979 are projected Current technical issues discussed include training selection and labeling, classification and mensuration, use of satellite indicators to supplement predictions, small scale field structures physical factors, ancillary data, geometric quality, and the cost of processing Author

N78-14472*# Environmental Research Inst of Michigan, Ann Arbor
A SURVEY OF SAR IMAGE-FORMATION PROCESSING FOR EARTH RESOURCES APPLICATIONS
Robert W Bayma, Rolando L Jordan (JPL), and Bob N Manning (Goodyear Aerospace Corp, Litchfield Park, Ariz) *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 137-159 refs

Avail NTIS HC A99/MF A01 CSCL 17I

Currently there is considerable interest in active microwave sensors for earth resources applications, such as the SEASAT-A radar However, to obtain spatial resolutions comparable to optical sensors at radar frequencies, sophisticated image formation processing techniques must be applied to the raw data Processing requirements for non-coherent optical and coherent radar imaging systems are compared The image formation processing requirements for synthetic aperture radar (SAR) systems are discussed Both optical and digital techniques are addressed, and examples of hardware and imagery for each processing technique are presented Author

N78-14473*# California Univ, Santa Barbara Dept of Geography
A PERSPECTIVE ON THE STATE OF THE ART OF PHOTOGRAPHIC INTERPRETATION
John E Estes *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 161-177 refs
Avail NTIS HC A99/MF A01 CSCL 14E

Aerial photography and photographic interpretation are the cornerstone of remote sensing Many interpretative techniques used on data from these more advanced or unconventional imaging systems are essentially extensions of techniques originally developed for the analysis of aerial photographic data As research on the analysis and application of data from other than photographic imaging systems progresses, the role of the interpretation of aerial photography becomes more important Any individual who wishes to practice the art of remote sensing data analysis must gain a thorough knowledge of the activities elements and techniques of manual photographic/image interpretation While the activities and elements of photo interpretation have remained essentially the same, technique development

has continued to progress Additional studies are proposed dealing with the basics of interactive processes Author

N78-14475*# National Environmental Satellite Service, Washington, D C
METEOROLOGICAL SENSORS AND RELATED TECHNOLOGY FOR THE EIGHTIES
E L Heacock *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 189-199

Avail NTIS HC A99/MF A01 CSCL 04B
The sensors currently projected for the new generation of meteorological satellites which will be in operation during the First Global Atmospheric Research Program [GARP] Global Experiment (FGGE) are described The closely related subject of on-board data processing is treated briefly as well as efforts by the countries/agencies responsible for these satellites to make useful products available to developing countries at low cost Author

N78-14476*# National Environmental Satellite Service Washington, D C
OPERATIONAL DATA PROCESSING THE FIRST TEN YEARS ARE THE HARDEST
John A Leese and Charles L Bristor *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 201-219 refs
Avail NTIS HC A99/MF A01 CSCL 05B
A historical perspective of operational data processing and its development in the National Environmental Satellite Service is presented The types of sensor data to be used in operational data processing are specified through the time period of the 1980's Features that are essential for the design and implementation of a good data base system are outlined Realistic standards for optimal data productions are discussed Author

N78-14494*# Massachusetts Inst of Tech , Cambridge Dept of Electrical Engineering and Computer Science
ATMOSPHERIC SOUNDING WITH PASSIVE MICROWAVES· REVIEW AND PROGNOSIS
David H Staelin *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 401-406 refs
(Contracts NAS5-21980, NAS5-23677)
Avail NTIS HC A99/MF A01 CSCL 04A
Global maps of temperature profiles from 0 to 20 km altitude and of total water vapor and liquid water over the ocean were obtained from satellite-borne microwave spectrometers Future satellites will extend the altitude range above 100 km and permit monitoring of H2O, O3, CO, N2O, and other trace constituents Operational microwave temperature sounding spectrometers are scheduled for launch on both military and civilian U S satellites, and future improvements can be expected Author

N78-14498*# Jet Propulsion Lab , Calif Inst of Tech , Pasadena
LANDSAT-D THEMATIC MAPPER SIMULATION USING AIRCRAFT MULTISPECTRAL SCANNER DATA
Jerry Clark and Nevin A Bryant *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 339-351
(Contract NAS7-100)
Avail NTIS HC A99/MF A01 CSCL 08B
A simulation of imagery from the upcoming LANDSAT-D thematic mapper was accomplished by using selected channels of 24-channels aircraft multispectral scanner data The purpose was to simulate thematic mapper 30-meter resolution imagery and compare its spectral quality with the original aircraft MSS data and determine changes in thematic classification accuracy for the simulated imagery The original resolution of approximately 7 5 meters IFOV and simulated resolution of 15, 30, and 60 meters were used to indicate the trend of spectral quality and classification accuracy The study was based in a 6 5 square kilometer area of urban Los Angeles having a diversity of land use Author

N78-14505*# Environmental Research Inst of Michigan, Ann Arbor
DIGITAL EXPLOITATION OF SYNTHETIC APERTURE RADAR
H L Wagner and R A Shuchman *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 563-570 refs
Avail NTIS HC A99/MF A01 CSCL 17I
A digital processing and analysis scheme for use with digitized synthetic aperture radar data was developed Using data from a four channel system, the imagery is preprocessed using specially designed software and then analyzed using preexisting facilities originally intended for use with MSS type data Geometric and radiometric correction may be performed if desired, as well as classification analysis, Fast Fourier transform, filtering and level slice and display functions The system provides low cost output in real time, permitting interactive imagery analysis System information flow diagrams as well as sample output products are shown Author

N78-14518*# National Aeronautics and Space Administration Lyndon B Johnson Space Center Houston, Tex
INVESTIGATION OF THEMATIC MAPPER SPATIAL, RADIOMETRIC, AND SPECTRAL RESOLUTION
James P Morgenstern (ERIM, Ann Arbor), Richard F Nalepka (ERIM Ann Arbor), and Jon D Erickson *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 693-701 refs
(Contract NAS9-14819)
Avail NTIS HC A99/MF A01 CSCL 08B
Empirical evidence was provided for the definition of system specifications for the LANDSAT Follow-On Thematic Mapper (TM) and other future space Multispectral Sensor (MSS) systems Specific sensor parameters addressed were spatial resolution, radiometric sensitivity, and to a lesser degree spectral bandwidths and locations The study used selected available aircraft MSS data, characterized by narrow spectral bands, fine spatial resolution, and high signal-to-noise, as the basis for simulating spacecraft TM data of various spatial resolutions, radiometric sensitivities, and sets of spectral bands The primary measure used in evaluating the effects of varying spatial and radiometric resolutions was agricultural crop mensuration accuracy using automatic (computer) information extraction techniques Author

N78-14520*# Michigan State Univ East Lansing
ESTIMATION OF OLD FIELD ECOSYSTEM BIOMASS USING LOW ALTITUDE IMAGERY
Salleh Mohd Nor Gene Safir T M Burton J E Hook, and G Schultink *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 711-718 refs

(Grant NGL-23-004-083)
Avail NTIS HC A99/MF A01 CSCL 08H
Color-infrared photography was used to evaluate the biomass of experimental plots in an old-field ecosystem that was treated with different levels of waste water from a sewage treatment facility Cibachrome prints at a scale of approximately 1 1 600 produced from 35 mm color infrared slides were used to analyze density patterns using prepared tonal density scales and multicell grids registered to ground panels shown on the photograph Correlation analyses between tonal density and vegetation biomass obtained from ground samples and harvests were carried out Correlations between mean tonal density and harvest biomass data gave consistently high coefficients ranging from 0 530 to 0 896 at the 0 001 significance level Corresponding multiple regression analysis resulted in higher correlation coefficients The results of this study indicate that aerial infrared photography can be used to estimate standing crop biomass on waste water irrigated old field ecosystems Combined with minimal ground truth data, this technique could enable managers of wastewater irrigation projects to precisely time harvest of such systems for maximal removal of nutrients in harvested biomass Author

N78-14522*# Canada Centre for Remote Sensing, Ottawa (Ontario)
USE OF CLEAR LAKE AS STANDARD REFLECTORS FOR ATMOSPHERIC MEASUREMENT
F J Ahern D G Goodenough, S C Jain, V R Rao, and G Rochon (Universite Laval, Quebec Canada) *In* ERIM Proc of

the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 731-755 refs

Avail NTIS HC A99/MF A01 CSCL 04A

A method is proposed for using clear lakes as dark backgrounds against which the atmospheric path radiance can be determined from satellite observations If the path radiance can be determined to sufficient accuracy, the atmospheric extinction can be inferred with suitable radiative transfer models An extensive program of observation was made to determine the magnitude and variability of the various contributors to the total radiance observed by a satellite It is shown that the volume and surface reflectance contributions (in the absence of sunglint) are small, constant, and can be modeled accurately enough to make these an insignificant source of error The sunglint radiance observed in this investigation may be a significant source of error It is shown that atmospheric extinction can be inferred from the path radiance observation after systematic differences between the model and observations are removed Author

N78-14523*# MacDonald, Dettwiler and Associates Ltd Richmond (British Columbia)

A LOW-COST SYSTEM FOR RECEPTION AND PROCESSING OF LINE-SCAN DATA FROM LANDSAT AND OTHER SOURCES

D S Sloan B C Isherwood and J S MacDonald *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 757-773

Avail NTIS HC A99/MF A01 CSCL 05B

A low-cost transportable earth resources ground station was built in Canada and installed to operational status at Shoe Cove, Newfoundland The system concepts developed for this station provide timely availability of data in both photographic and digital form The system was designed with several objectives in mind (1) to provide a system which could receive store and process line-scan image data from a wide variety of satellites, most especially the LANDSAT and NOAA (VHRR) series as well as aircraft scanner data, and data from future remote sensing and meteorological satellites (2) the system has been designed to be operated by a small staff and to produce black and white images and computer-compatible tapes (CCTs) of all relevant data (3) the system is compact in its physical design so that it is possible to configure it as a self-contained ground station, housed in a 3 x 12 meter trailer (4) the system is designed to process all data at real-time rates or better and is designed in a modular fashion so that it can be easily upgraded to do further processing of the data and/or to handle new satellites and sensors Author

N78-14524*# Department of Energy, Mines and Resources, Ottawa (Ontario)

THE USE OF LANDSAT IMAGERY TO LOCATE UNCHARTED COASTAL FEATURES ON THE LABRADOR COAST

E A Fleming and D D Lelievre (Canadian Hydrographic Service, Dartmouth Nova Scotia) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 775-781

Avail NTIS HC A99/MF A01 CSCL 08B

A survey of several offshore islands rocks and shoals on the Labrador Coast was performed using LANDSAT imagery to assist in the location of uncharted hydrographic features Several satellite coverages of the coast were studied prior to the survey, and suspected shoal points identified Using map-derived control points and monocomparator measurements of the LANDSAT images the positions of these points were determined by mathematical adjustment to an estimated position accuracy of 150 meters As a result, on the survey an uncharted island and eight uncharted drying rocks which might easily have escaped detection from a survey ship were verified and positioned To check the accuracy of the coordinates derived from LANDSAT three islands were positioned by standard ground survey methods The positional differences, all less than 150 meters are not plottable at the scale of the existing offshore charts The LANDSAT positions were also used to control aerial photography of a shoal area for office compilation of a hydrographic chart Author

N78-14531*# Ruhr Planning Authority, Essen (West Germany)

THE APPLICATION OF IR- AND MSS-DATA IN THE RUHR DISTRICT, GERMANY

P Stock *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 837-847 refs

Avail NTIS HC A99/MF A01 CSCL 08B

The methods used by Ruhr Planning Authority to interpret IR pictures are described along with production of maps indicating the thermal distribution in the conurbation Topics studied with the IR data include thermal loading of the Rhine and climatology of the urban and surrounding country areas Author

N78-14542*# National Aeronautics and Space Administration Lyndon B Johnson Space Center Houston, Tex

VIEW ANGLE EFFECT IN LANDSAT IMAGERY

Toyohisa Kaneko (IBM Corp , Houston Tex) and John L Engvall *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 945-951 refs

(Contract NAS9-14350)

Avail NTIS HC A99/MF A01 CSCL 20F

The view angle effect in LANDSAT 2 imagery was investigated The LANDSAT multispectral scanner scans over a range of view angles of -5 78 to 5 78 degrees The view angle effect, which is caused by differing view angles could be studied by comparing data collected at different view angles over a fixed location at a fixed time Since such LANDSAT data is not available consecutive day acquisition data were used as a substitute they were collected over the same geographical location acquired 24 hours apart with a view angle change of 7 to 8 degrees at a latitude of 35 to 45 degrees It is shown that there is approximately a 5% reduction in the average sensor response on the second-day acquisitions as compared with the first-day acquisitions, and that the view angle effect differs field to field and crop to crop On false infrared color pictures the view angle effect causes changes primarily in brightness and to a lesser degree in color (hue and saturation) An implication is that caution must be taken when images with different view angles are combined for classification and a signature extension technique needs to take the view angle effect into account Author

N78-14548*# National Oceanic and Atmospheric Administration, Washington, D C

PROCESSING OF SATELLITE IMAGERY AT THE NATIONAL ENVIRONMENTAL SATELLITE SERVICE

M Crowe *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1015-1020 refs

Avail NTIS HC A99/MF A01 CSCL 05B

The National Environmental Satellite Service (NESS) image product processing system is described Other topics discussed include (1) image processing of polar-orbiter satellite data, (2) image processing of geostationary satellite data, and (3) quality assurance and product monitoring Author

N78-14558*# Lockheed Electronics Co Houston Tex Systems and Services Div

LANDSAT IMAGE INTERPRETATION AIDS

R A Abotteen and H Malek *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1117-1121 refs

(Contract NAS9-15200)

Avail NTIS HC A99/MF A01 CSCL 05B

In the Large Area Crop Inventory Experiment image interpretation aids were produced to assist in selecting and/or identifying representative samples of signatures in a given LANDSAT scene The three methods employed are based on clustering techniques, information extraction and aggregation of like spectral information on a two dimensional spectral plot Author

N78-14559*# Environmental Research Inst of Michigan Ann Arbor

DIGITAL PROCESSING SYSTEM FOR DEVELOPING COUNTRIES

Chris Nanayakkara and Harvey Wagner *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 5 1977 p 1123-1126 refs

Avail NTIS HC A99/MF A01 CSCL 05B

An effort was undertaken to perform simple digital processing tasks using pre-existing general purpose digital computers An experimental software package LIGMALS was obtained and *modified for this purpose The resulting software permits basic* processing tasks to be performed including level slicing gray mapping and ratio processing The experience gained in this project indicates a possible direction which may be used by other developing countries to obtain digital processing capabilities Author

N78-14560*# Environmental Research Inst of Michigan, Ann Arbor Information Systems and Analysis Dept

REMOTE SENSING AND GEOGRAPHICALLY BASED INFORMATION SYSTEMS

Richard C Cicone *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1127-1136 refs

(Contract NAS9-14988)

Avail NTIS HC A99/MF A01 CSCL 08F

The incorporation of remotely sensed digital data in a computer based information system is seen to be equivalent to the incorporation of any other spatially oriented layer of data The growing interest in such systems indicates a need to develop a generalized geographically oriented data base management system that could be made commercially available for a wide range of applications Some concepts that distinguish geographic information systems were reviewed and a simple model which can serve as a conceptual framework for the design of a generalized geographic information system was examined Author

N78-14569*# Purdue Univ Lafayette, Ind Laboratory for Applications of Remote Sensing

EVALUATION OF CHANGE DETECTION TECHNIQUES FOR MONITORING COASTAL ZONE ENVIRONMENTS

R A Weismiller, S J Kristof, D K Scholz P E Anuta, and S M Momin *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1229-1238 refs

(Contract NAS9-14016)

Avail NTIS HC A99/MF A01 CSCL 08C

Development of satisfactory techniques for detecting change in coastal zone environments is required before operational monitoring procedures can be established In an effort to meet this need a study was directed toward developing and evaluating different types of change detection techniques based upon computer aided analysis of LANDSAT multispectral scanner (MSS) data, to monitor these environments The Matagorda Bay estuarine system along the Texas coast was selected as the study area Four change detection techniques were designed and implemented for evaluation (1) post classification comparison change detection, (2) delta data change detection (3) spectral/temporal change classification, and (4) layered spectral/temporal change classification Each of the four techniques was used to analyze a LANDSAT MSS temporal data set to detect areas of change of the Matagorda Bay region Author

N78-14571*# Canada Centre for Remote Sensing Ottawa (Ontario)

A SOLUTION TO THE PROBLEM OF SAR RANGE CURVATURE

R K Raney In ERIM *Proc of the 11th Intern Symp on* Remote Sensing of Environment Vol 2 1977 p 1255-1257 ref

Avail NTIS HC A99/MF A01 CSCL 17I

When synthetic aperture radar systems are pushed to attain finer resolution at larger ranges than was previously the case for remote sensing purposes, the geometric signal aberration known as range curvature arises Known techniques for correcting range curvature are exact at only one selected range, thus forcing neighboring ranges to use the same correction as an approximation A solution to the problem is proposed that is exact at all ranges, thus simplifying and improving the image processing for such systems Author

N78-14575*# GeoSpectra Corp Ann Arbor, Mich

REDUCING LANDSAT DATA TO PARAMETERS WITH PHYSICAL SIGNIFICANCE AND SIGNATURE EXTENSION A VIEW OF LANDSAT CAPABILITIES

Bette C Salmon-Drexler *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1289-1299 refs Sponsored in part by Bur of Land Management

(Contract AT(05-1)-1635)

Avail NTIS HC A99/MF A01 CSCL 05B

The premise is the LANDSAT is capable of sensing only a few physical parameters Much of the contrast provided in LANDSAT data is provided by differences in vegetation cover Although dominant, vegetation is not the only physical parameter that can be detected with LANDSAT a ratio of MSS Channel 5 to MSS Channel 4 (R5 4) two visible channels separates materials by color hue Additional information is attained by the addition of MSS channels 5 and 4 to approximate brightness, permitting separation of materials by color value Other spectral combinations may provide correlations with these physical parameters or new ones An iron absorption in the infrared can also be recognized in LANDSAT data when iron content is present in sufficient percentages, Although by color, limonite-rich soils are distinctive as bright yellow, they are not unique in the R5 4 A fairly strong iron absorption is present in the infrared band MSS Channel 7 for these soils, although the wideband configuration of LANDSAT is not optimal for its enhancement and the effects of vegetation often obscure it Author

N78-14577*# Environmental Research Inst of Michigan, Ann Arbor Information Systems and Analysis Dept

BLOB AN UNSUPERVISED CLUSTERING APPROACH TO SPATIAL PREPROCESSING OF MSS IMAGERY

R J Kauth, A P Pentland, and G S Thomas *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1309-1317 refs

(Contract NAS9-14988)

Avail NTIS HC A99/MF A01 CSCL 05B

A basic concept of Multispectral Scanner data processing was developed for use in agricultural inventories, namely, to introduce spatial coordinates of each pixel into the vector description of the pixel and to use this information along with the spectral channel values in a conventional unsupervised clustering of the scene The result is to isolate spectrally homogeneous field-like patches (called blobs) The spectral mean vector of a blob can be regarded as a defined feature and used in a conventional pattern recognition procedure The benefits of use are ease in locating training units in imagery, data compression of from 10 to 30 depending on the application, reduction of scanner noise and consequently potential improvements in classification/proportion estimation performances Author

N78-14578*# Environmental Research Inst of Michigan, Ann Arbor Information Systems and Analysis Dept

MULTISPECTRAL SYSTEM ANALYSIS THROUGH MODELING AND SIMULATION

W A Malila J M Gleason and R C Cicone *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1319-1328 refs

(Contract NAS-14988)

Avail NTIS HC A99/MF A01 CSCL 05B

The design and development of multispectral remote sensor systems and associated information extraction techniques should be optimized under the physical and economic constraints encountered and yet be effective over a wide range of scene and environmental conditions Direct measurement of the full range of conditions to be encountered can be difficult time consuming and costly Simulation of multispectral data by modeling scene atmosphere sensor and data classifier character-

istics is set forth as a viable alternative particularly when coupled with limited sets of empirical measurements A multispectral system modeling capability is described Use of the model is illustrated for several applications - interpretation of remotely sensed data from agricultural and forest scenes evaluating atmospheric effects in LANDSAT data examining system design and operational configuration and development of information extraction techniques Author

N78-14579*# Environmental Research Inst of Michigan Ann Arbor

A 'DIGITAL' TECHNIQUE FOR MANUAL EXTRACTION OF DATA FROM AERIAL PHOTOGRAPHY

Laurence B Istvan and Mark T Bondy *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1329-1336 refs

Avail NTIS HC A99/MF A01 CSCL 14E

The interpretation procedure described uses a grid cell approach In addition, a random point is located in each cell The procedure required that the cell/point grid be established on a base map and identical grids be made to precisely match the scale of the photographic frames The grid is then positioned on the photography by visual alignment to obvious features Several alignments on one frame are sometimes required to make a precise match of all points to be interpreted This system inherently corrects for distortions in the photography Interpretation is then done cell by cell In order to meet the time constraints first order interpretation should be maintained The data is put onto coding forms along with other appropriate data, if desired This digital' manual interpretation technique has proven to be efficient and time and cost, effective while meeting strict requirements for data format and accuracy Author

N78-14580*# Consiglio Nazionale delle Ricerche Milan (Italy) Istituto per la Geophysica della Litosfera

APPLICATION OF CONVENTIONAL AND ADVANCED TECHNIQUES FOR THE INTERPRETATION OF LANDSAT 2 IMAGES FOR THE STUDY OF LINEARS IN THE FRIULI EARTHQUAKE AREA

P Cardamone G M Lechi, A Cavallin (Univ Degli Studi Milan), C M Marino (Univ Degli Studi Milan) and A Zanferrari (Univ Degli Studi Padua) *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1227-1353 refs

Avail NTIS HC A99/MF A01 CSCL 08K

The results obtained in the study of linears derived from the analysis of LANDSAT 2 images recorded over Friuli during 1975 are described Particular attention is devoted to the comparison of several passes in different bands scales and photographic supports Moreover reference is made to aerial photographic interpretation in selected sites and to the information obtained by laser techniques Author

N78-14585*# National Weather Service, Camp Springs, Md Spaceflight Meteorology Group

METEOROLOGICAL SUPPORT FOR REMOTE SENSING PROGRAMS

James L Cox *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1387-1396

Avail NTIS HC A99/MF A01 CSCL 04B

Many earth-oriented remote sensing spacecraft and aircraft programs are affected by the presence of clouds Like aerial photography they require clear or mostly clear skies To cope with the cloud problem, the National Weather Service through its Spaceflight Meteorology Group (SMG) of the Space Operations Support Division makes cloud cover forecasts, as part of its specialized weather service for various NASA remote sensing and other programs Forecasting requirements vary in time from a few hours out to several days and in aerial extent from a particular locality to nearly global in coverage Depending on the stage of program development, some remote sensing programs may involve special climatological studies for planning purposes or need ground-truth data for comparison with remotely sensed information The importance of computer and weather satellite products to the SMG meteorologist is discussed and the nature of SMG's weather support of past present and future remote sensing programs is described Author

N78-14592*# Geological Survey, Denver Colo

DIGITAL COLOR ANALYSIS OF COLOR-RATIO COMPOSITE LANDSAT SCENES

Gary L Raines *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1463-1472 refs

Avail NTIS HC A99/MF A01 CSCL 05B

A method is presented that can be used to calculate approximate Munsell coordinates of the colors produced by making a color composite from three registered images Applied to the LANDSAT MSS data of the Goldfield Nevada area this method permits precise and quantitative definition of the limonitic areas originally observed in a LANDSAT color ratio composite In addition, areas of transported limonite can be discriminated from the limonite in the hydrothermally altered areas of the Goldfield mining district From the analysis the numerical distinction between limonitic and nonlimonitic ground is generally less than 3% using the LANDSAT bands and as much as 8% in ratios of LANDSAT MSS bands Author

N78-14598*# Lockheed Electronics Co Houston Tex Systems and Services Div

PERFORMANCE TESTS OF SIGNATURE EXTENSION ALGORITHMS

R A Abotteen, S Levy M Mendlowitz T Moritz J Potter S Thadani and O A Wehmanen *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1523-1532 refs

(Contract NAS9-15200)

Avail NTIS HC A99/MF A01 CSCL 12A

Comparative tests were performed on seven signature extension algorithms to evaluate their effectiveness in correcting for changes in atmospheric haze and sun angle in a LANDSAT scene Four of the algorithms were cluster matching and two were maximum likelihood algorithms The seventh algorithm determined the haze level in both training and recognition segments and used a set of tables calculated from an atmospheric model to determine the affine transformation that corrects the training signatures for changes in sun angle and haze level Three of the algorithms were tested on a simulated data set and all of the algorithms were tested on consecutive-day data Author

N78-14602*# Purdue Univ Lafayette Ind Lab for Applications of Remote Sensing

QUANTIFICATION OF SOIL MAPPING BY DIGITAL ANALYSIS OF LANDSAT DATA

F R Kirschner (Soil Conservation Service, Indianapolis Ind), S A Kaminsky, E J Hinzel H R Sinclair (Soil Conservation Service, Indianapolis, Ind) and R A Weismiller *In* ERIM Proc of the Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1567-1573 refs

(Grant NGL-15-005-186)

(Rept-6690) Avail NTIS HC A99/MF A01 CSCL 08B

Soil survey mapping units are designed such that the dominant soil represents the major proportion of the unit At times soil mapping delineations do not adequately represent conditions as stated in the mapping unit descriptions Digital analysis of LANDSAT multispectral scanner (MSS) data provides a means of accurately describing and quantifying soil mapping unit composition Digital analysis of LANDSAT MSS data collected on 9 June 1973 was used to prepare a spectral soil map for a 430-hectare area in Clinton County Indiana Fifteen spectral classes were defined representing 12 soil and 3 vegetation classes The 12 soil classes were grouped into 4 moisture regimes based upon their spectral responses the 3 vegetation classes were grouped into one all-inclusive class Author

N78-14604*# National Environmental Satellite Service, Suitland, Md

THE OPERATIONAL PROCESSING OF WIND ESTIMATES FROM CLOUD MOTIONS PAST, PRESENT AND FUTURE

C Novak and M Young *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1589-1598 refs
Avail NTIS HC A99/MF A01 CSCL 04B

Current NESS winds operations provide approximately 1800 high quality wind estimates per day to about twenty domestic and foreign users This marked improvement in NESS winds operations was the result of computer techniques development which began in 1969 to streamline and improve operational procedures In addition the launch of the SMS-1 satellite in 1974, the first in the second generation of geostationary spacecraft, provided an improved source of visible and infrared scanner data for the extraction of wind estimates Currently, operational winds processing at NESS is accomplished by the automated and manual analyses of infrared data from two geostationary spacecraft This system uses data from SMS-2 and GOES-1 to produce wind estimates valid for 00Z, 12Z and 18Z synoptic times Author

N78-14813# Air Force Systems Command, Wright-Patterson AFB Ohio Foreign Technology Div
INCREASE IN THE FIDELITY OF IMAGE DURING THE PRODUCTION OF DIAPOSITIVES
O V Portnova 22 Apr 1977 19 p Transl into ENGLISH from Geod i Kartografiya (Moscow), no 5 May 1972 p 44-47
(AD-A046226, FTD-ID(RS)T-0325-77, FTD-77-C-000430)
Avail NTIS HC A02/MF A01 CSCL 14/5

The task of improving the quality of materials of aerial photography and their treatment was considered in regard to large scale stereotopographic photography Distortions of images on aerial photographs were examined as they appear in the process of photographing the locality and in the process of producing diapositives in a contact manner Author (GRA)

N78-14817# Centre National d Etudes Spatiales Toulouse (France)
TEST SYSTEM FOR EARTH OBSERVATION - SPOT VOLUME 1 SYSTEMS ANALYSIS AND DEVELOPMENT PLAN [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT VOLUME 1 ANALYSE SYSTEME ET PLAN DE DEVELOPPEMENT]
Mar 1977 400 p In FRENCH 5 Vol
Avail NTIS HC A17/MF A01

A study is presented of an earth observation satellite program, SPOT The spacecraft consists of a multimission platform and a payload, which for the first mission will be for land use observation A launch using Ariane is foreseen for 1983 Mission profile and constraints are discussed and a systems analysis for the first mission is described General principles of project management are dealt with They cover the roles of CNES and ESA in the project A development and test plan is proposed and a cost analysis presented ESA

N78-14818# Centre National d'Etudes Spatiales, Toulouse (France)
TEST SYSTEM FOR EARTH OBSERVATION - SPOT VOLUME 3 MULTIMISSION PLATFORM - SUBSYSTEMS [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT VOLUME 3 PLATEFORME MULTIMISSIONS SOUSSYSTEMES]
Mar 1977 535 p refs In FRENCH 5 Vol
Avail NTIS HC A23/MF A01

The design of the subsystems for the platform is discussed A semimodular version of the structural subsystem was gauged and a dynamic analysis carried out in view of decoupling from launcher and other subsystems A modular version was also gauged and although no dynamic analysis was performed, it was estimated that decoupling performance is as good In examining the thermal control subsystem it was found that the new problems created by this satellite are due to the high power dissipation The solar generator drive and the power supply subsystem were investigated Problems posed by electrical distribution EMC, TTC, onboard processing and attitude/orbit control are dealt with ESA

N78-14819# Centre National d Etudes Spatiales, Toulouse (France)
TEST SYSTEM FOR EARTH OBSERVATION - SPOT VOLUME 4 FIRST MISSION PAYLOAD [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT VOLUME 4 CHARGE UTILE PREMIERE MISSION]
Mar 1977 572 p In FRENCH Original contains color illustrations 5 Vol
Avail NTIS HC A24/MF A01

The first mission payload is comprised of two instruments allowing earth observation along the satellite's vertical The first instrument, MRVIR supplies images in the visible and infrared range, and its resolution is average (80 m in the visible range), the field is 140 km The second instrument, HRV, supplies images in the visible range with a resolution of 20 m and a field of 60 km Some technical and technological problems of the instruments are identified scanning and associated electronics, detector strips and their positioning and the low noise pre-amplifier ESA

N78-14820# Centre National d Etudes Spatiales, Toulouse (France)
TEST SYSTEM FOR EARTH OBSERVATION - SPOT VOLUME 4BIS FIRST MISSION PAYLOAD AND MICROWAVE PAYLOAD, COMPATIBILITY STUDY [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT VOLUME 4BIS CHARGE UTILE PREMIERE MISSION]
Mar 1977 138 p refs In FRENCH 5 Vol
Avail NTIS HC A07/MF A01

The first payload telemetry and possible microwave payloads were studied for the SPOT system The feasibility of an 8 GHz telemetry was investigated for ground and space segment An analysis is presented of passive and active microwave equipment which may be used as payload during later missions ESA

N78-14821# Centre National d'Etudes Spatiales Toulouse (France)
TEST SYSTEM FOR EARTH OBSERVATION - SPOT. VOLUME 5 MULTIPURPOSE GROUND FACILITIES AND DEDICATED IMAGE STATIONS [SYSTEME PROBATOIRE D'OBSERVATION DE LA TERRE SPOT VOLUME 5 MOYENS SOL DE SERVITUDE ET D'ACQUISITION D'IMAGE]
Mar 1977 100 p In FRENCH 5 Vol
Avail NTIS HC A05/MF A01

Ground facilities and image acquisition stations for the SPOT system are analyzed The layout of ground facilities is based on the concept of an interface between the spaceborne platform and the users of imagery produced The role of the command and control center is outlined together with that of a dedicated image system ESA

N78-14894# Instituto de Pesquisas Espaciais Sao Jose dos Campos (Brazil)
BOUNDARY DETECTION IN IMAGES OPTICAL FORMULATION IN TERMS OF SIGNAL DETECTION THEORY M S. Thesis [DETECCAO DE BORDAS EM IMAGENS FORMULACAO EM TERMOS DE TESTES DE HIPOTESES]
Lucila Olivia DaCostaPrado Sep 1977 147 p refs In PORTUGUESE, ENGLISH summary
(INPE-1118-TPT-067) Avail NTIS HC A07/MF A01

Statistical techniques for the boundary detection problem are developed for application to pictures taken by land resources satellites The image is modeled by signal and noise which are independent additive Gaussian and autoregressive in two dimensions The parameters of the model are determined by correlation measurements The optimal formulation in terms of signal detection theory leads to the construction of a test which involves seven overlapping hypothesis A computationally attractive suboptimal test involving non-overlapping hypothesis is developed Simulation results of the algorithm, when applied to groups of four pixels of the image are included Author

N78-15327*# Systematics General Corp McLean, Va
FREQUENCY BAND JUSTIFICATIONS FOR PASSIVE SENSORS, 1 TO 10 GHz

Dec 1976 218 p refs
(Contract NAS5-23434)
(NASA-CR-155531) Avail NTIS HC A10/MF A01 CSCL 17B

Remote sensor systems operating in the microwave region of the frequency spectrum provide information unobtainable with basic imaging techniques such as photography, television or multispectral imaging The frequency allocation requirements for passive microwave sensors used in the earth exploration satellite and space research services are presented for (1) agriculture forestry, and range resources (2) land use survey and mapping, (3) water resources, (4) weather and climate (5) environmental quality and (6) marine resources, estuarine and oceans Because measurements are required simultaneously in multiple frequency bands to adequately determine values of some phenomena, the relationships between frequency bands are discussed The various measurement accuracies, dynamic range resolutions and frequency needs are examined A band-by-band summary of requirements, unique aspects, and sharing analyses of the required frequency bands is included Author

N78-15328*# Systematics General Corp McLean Va
FREQUENCY BAND JUSTIFICATIONS FOR PASSIVE SENSORS 10.0 TO 385 GHz, CHAPTER 1
Dec 1976 255 p refs
(Contract NAS5-23434)
(NASA-CR-155530) Avail NTIS HC A12/MF A01 CSCL 17B

For abstract see N78-15327

N78-15329*# Systematics General Corp McLean, Va
FREQUENCY BAND JUSTIFICATIONS FOR PASSIVE SENSORS 10 0 TO 385 GHz, CHAPTER 2
Dec 1976 301 p refs
(Contract NAS5-23434)
(NASA-CR-155532) Avail NTIS HC A14/MF A01 CSCL 17B

Sensitivity requirements of the various measurements obtained by microwave sensors, and radiometry techniques are described Analytical techniques applied to detailed sharing analyses are discussed A bibliography of publications pertinent to the scientific justification of frequency requirements for passive microwave remote sensing is included Author

N78-15340# Post Office Research Dept Ipswich (England)
THE 20 AND 30 GHz ATTENUATION MEASUREMENTS USING THE ATS-6 SATELLITE
R G Howell J Thirlwell, R R Bell N G Golfin J W Ballance and R H Macmillan *In* ESA ATS-6 Propagation Expts in Europe Oct 1977 p 55-68 refs

Avail NTIS HC A09/MF A01

Simultaneous 20 and 30 GHz attenuation measurements were made by the British Post Office Martlesham Heath using transmissions from the ATS-6 satellite The ratio of 30 GHz to 20 GHz attenuation during rain events was investigated along the 23 deg elevated path while the satellite was at 35 deg E and found to be 2 20 plus or minus 0 13 Amplitude scintillation of the received signals was little affected by rain in the slant-path and was highly correlated at the two frequencies but of greater amplitude at 30 GHz by a factor of about 1 6 At 30 GHz the scintillation was typically 0 7 db p-p but bursts of up to 6 0 db p-p were observed associated with clouds 30 GHz attenuation measurements made as the satellite drifted westward to 130 deg W revealed increasing scintillation and also multipath effects as the slant-path elevation angle decreased to zero Effects of snow are reported and attenuation and rainfall rate cumulative distributions are presented Author (ESA)

N78-15535*+ National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt Md
LANDSAT 1 CUMULATIVE US STANDARD CATALOG, 1976/1977
31 Jul 1977 261 p
(NASA-TM-74993 GSFC/LN-77/013, NTISUB/C/138-013A)
Avail NTIS HC A12 CSCL 05B

The LANDSAT 1 U S Cumulative Catalog lists U S imagery acquired by LANDSAT 1 which has been processed and input to the data files during the referenced year Data, such as data acquired, cloud cover and image quality are given for each scene The microfilm roll and frame on which the scene may be found are also given Author

N78-15544*# National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala
VECTOR STATISTICS OF LANDSAT IMAGERY
Robert R Jayroe Jr and Debrah Underwood Dec 1977 19 p refs
(NASA-TM-78149) Avail NTIS HC A02/MF A01 CSCL 14E

A digitized multispectral image, such as LANDSAT data, is composed of numerous four dimensional vectors, which quantitatively describe the ground scene from which the data are acquired The statistics of unique vectors that occur in LANDSAT imagery are studied to determine if that information can provide some guidance on reducing image processing costs A second purpose of this report is to investigate how the vector statistics are changed by various types of image processing techniques and determine if that information can be useful in choosing one processing approach over another Author

N78-15545*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
LANDSAT US STANDARD CATALOG, 1 OCTOBER - 31 OCTOBER 1977
31 Oct 1977 100 p
(NASA-TM-74992 GSFC/LU-C/010, NTISUB/C/138-010)
Avail NTIS HC A05/MF A01 CSCL 05B

The U S Standard Catalog lists U S imagery acquired by LANDSAT 1 and 2 which has been processed and input to the data files during the referenced month Data, such as date acquired, cloud cover and image quality are given for each scene The microfilm roll and frame on which the scene may be found is also given Author

N78-15546*# National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt, Md
LANDSAT NON-US STANDARD CATALOG, 1 - 31 OCTOBER 1977
31 Oct 1977 81 p
(NASA-TM-74990, GSFC/LN-C/010, NTISUB/C/139-010)
Avail NTIS HC A05/MF A01 CSCL 05B

The Non-U S Standard Catalog lists non-U S imagery acquired by LANDSAT 1 and 2 which has been processed and input to the data files during the referenced month Data, such as date acquired cloud cover and image quality are given for each scene The microfilm roll and frame on which the scene may be found is also given Author

N78-15547*# National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt, Md
LANDSAT 1 NON US CUMULATIVE CATALOG, 1976/1977
31 Jul 1977 68 p
(NASA-TM-74991, GSFC/LN-77/013, NTISUB/C/139-013A)
Avail NTIS HC A04/MF A01 CSCL 05B

The LANDSAT 1 Non-U S Cumulative Catalog lists non-U S imagery acquired by LANDSAT 1 which has been processed and input to the data files during the referenced year Data, such as date acquired, cloud cover and image quality are given for each scene The microfilm roll and frame on which the scene may be found is also given Author

N78-15548*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md
LANDSAT NON-US STANDARD CATALOG Monthly Report, 1 - 31 Aug 1977
31 Aug 1977 140 p

(NASA-TM-74988, GSFC/LN-C/008, NTISUB/C/139-008) Avail NTIS HC A07/MF A01 CSCL 05B

For abstract, see N78-15546

N78-15551*# Mitre Corp., McLean Va METREK Div

DETERMINATION OF SCATTERING FUNCTIONS AND THEIR EFFECTS ON REMOTE SENSING OF TURBIDITY IN NATURAL WATERS

Ali H Ghovanlou, Jai N Gupta, and Robert G Henderson Jul 1977 148 p refs Sponsored by NASA (Contract F19628-77-C-0001)

(NASA-CR-145239) Avail NTIS HC A07/MF A01 CSCL 08H

The development of quantitative analytical procedures for relating scattered signals measured by a remote sensor, was considered The applications of a Monte Carlo simulation model for radiative transfer in turbid water are discussed The model is designed to calculate the characteristics of the backscattered signal from an illuminated body of water as a function of the turbidity level, and the spectral properties of the suspended particulates The optical properties of the environmental waters, necessary for model applications were derived from available experimental data and/or calculated from Mie formalism Results of applications of the model are presented Author

N78-15554*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md

LANDSAT US STANDARD CATALOG, 1 - 31 AUGUST 1977

31 Aug 1977 123 p

(GSFC/LU-C/008, NTISUB/C/138-008) Avail NTIS HC A06/MF A01 CSCL 05B

For abstract, see N78-15545

N78-15555*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md

LANDSAT NON-US STANDARD CATALOG, 1-30 SEPTEMBER 1977

30 Sep 1977 96 p

(NASA-TM-74956, GSFC/LN-C/009 NTISUB/C/139-009) Avail NTIS HC A05/MF A01 CSCL 05B

For abstract, see N78-15546

N78-15556*# National Aeronautics and Space Administration Goddard Space Flight Center Greenbelt, Md

LANDSAT US STANDARD CATALOG, 1-30 SEPTEMBER 1977

30 Sep 1977 119 p

(NASA-TM-74957 BSFC/LU-C/009, NTISUB/C/138-009) Avail NTIS HC A06/MF A01 CSCL 05B

For abstract, see N78-15545

08
INSTRUMENTATION AND SENSORS

A78-12830 **Design of the Seasat-A radar altimeter** J L MacArthur (Johns Hopkins University, Laurel, Md) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p. 10B-1 to 10B-8 8 refs

A third generation satellite radar altimeter to be flown on the Seasat-A mission in 1978 is described Building on Skylab and Geos-C experience, a design has evolved that will allow a long-term goal of 10-cm altimetry to be realized While dependent on recent developments in surface acoustic-wave device technology, the design in all other respects presents no major difficulty. A linear FM/full-deramp waveform and processing technique allows fine range tracking to be done in the frequency domain A digital filter bank will provide 60 contiguous samples of the ocean return waveform with 3 125-ns resolution An adaptive tracker built around a microprocessor will operate on the waveform samples to implement the basic height tracking function, adjusting its parameters in response to sensed waveheight (Author)

A78-12831 * **The Seasat-A Scanning Multichannel Microwave Radiometer** P Gloersen (NASA, Goddard Space Flight Center, Greenbelt, Md) and F T Barath (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 10C-1 to 10C-8 26 refs

A Scanning Multichannel Microwave Radiometer has been designed for the Nimbus-G Spacecraft and incorporated also into the Seasat-A payload for the primary purpose of determining sea surface temperatures and wind stress on a nearly all-weather basis Observations of microwave polarization components will be made at wavelengths of 0 8, 1 4, 1 7, 2 8, and 4 6 cm over a swath 577 km wide below the Seasat-A spacecraft The smallest spatial resolution cell is 15 x 23 km at a wavelength of 0.8 cm, and proportionately larger at the other wavelengths Using experimentally determined algorithms for converting the observed brightness temperatures, the indicated accuracies of the results (excluding conditions of significant rainfall) are within 1 K for sea surface temperature and 2 m/sec for surface wind speeds, over a range from 0-50 m/sec (Author)

A78-12832 * **The Seasat-A satellite scatterometer** W L Grantham, E M Bracalente, and W L Jones (NASA, Langley Research Center, Hampton, Va) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 10D-1 to 10D-9

This report describes the methods used to develop performance requirements and design characteristics of a microwave scatterometer wind sensor planned for Seasat-A User requirements such as wind speed accuracy, resolution cell size, grid spacing, and swath width of the measurements formed the basis for defining instrument characteristics Results are presented that show scatterometer accuracy as a function of orbit position satisfies User requirements for nominal orbit conditions (Author)

A78-12833 * **Seasat-A Synthetic Aperture Radar - Radar system implementation.** T W Thompson and A Laderman (California Institute of Technology, Jet Propulsion Laboratory, Space Sciences Div , Pasadena, Calif) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 10E-1 to 10E-5 Contract No NAS7-100.

The Synthetic Aperture Radar (SAR) onboard the Seasat-A satellite will conduct a number of experiments involving deep ocean waves, coastal wave patterns, polar ice and land forms The SAR will have a 25 m by 25 m resolution over a swath of 100 km width centered about 300 km to the right of the spacecraft track The SAR's high data rate limits operations to times when Seasat-A is in view of a few ground stations with special SAR receiving equipment However, the SAR will collect much useful data about deep ocean and coastal waves in the Atlantic and Pacific Oceans, about ice in the Northwest Atlantic, in the Great Lakes and off the coast of Alaska, and about land over much of the United States and Canada (Author)

A78-12836 **Measurement of sea surface by means of microwave altimeters - A computer simulation for system evaluation.** D W H Hampshire and J M Reeves (Portsmouth Polytechnic, Portsmouth, England) In Oceans '76, Proceedings of the Second Annual Combined Conference, Washington, D C , September 13-15, 1976 New York, Institute of Electrical and Electronics Engineers, Inc , Washington, D C , Marine Technology Society, 1976, p 15C-1 to 15C-6 Research sponsored by the Aeronautical Research Council

The paper describes a simulation being applied to a range of sea states and radar altimeter characteristics as part of a program of assessing the performance of an airborne radar altimeter for sea surface height measurements The basic programming technique is to first simulate the impulse response of the radar above a specified sea The transient response for any transmitted pulse shape is then found using the convolution integral This transient response can then be applied to a simulated receiver characteristic in order to predict the performance of the instrument B J

A78-13083 **Characteristics of polar cap sun-aligned arcs** S Ismail, D D Wallis, and L L Cogger (Calgary, University, Calgary, Alberta, Canada) *Journal of Geophysical Research*, vol 82, Oct 1, 1977, p 4741-4749 24 refs National Research Council of Canada Grants No A-7, No A-6762

Observations of polar cap sun-aligned arcs obtained with the auroral scanning photometer on Isis 2 for the period 1971 to 1975 are examined A 2 1 asymmetry was found in the occurrence frequency between the morning and evening sectors of the polar cap Sun-aligned arcs were observed on only 0 6% of polar cap passes and occurred most frequently during periods of low magnetic activity (Kp and AE) Moreover, for all cases observed during times for which interplanetary magnetic field data were available, the field was directed northward Although the intensity along any single arc varied considerably, it was found that the 5577 A/3914 A intensity ratio remained constant Examination of particle data and the observed intensity ratios indicate that the arcs are excited by low-energy (not greater than 1 keV) electron fluxes (Author)

A78-13218 **Comparison of various methods of determining solar-proton spectra** E A Devicheva, Iu A Samonenko, I N Senchuro, and P I Shavrin (Moskovskii Gosudarstvennyi Universitet, Moscow, USSR) *(Geomagnetizm i Aeronomiia,* vol 16, Nov -Dec 1976, p 976-979) *Geomagnetism and Aeronomy,* vol 16, June 1977, p 492, 493 15 refs Translation

Existing methods of solar cosmic ray spectra are compared by applying them to the proton event of January 24, 1971 It is shown that methods based on the geomagnetic (cutoff) effect yield largely exaggerated values of the characteristic rigidity of the exponential pulse spectrum as compared to other methods, particularly, if the vertical rigidity is taken as the cutoff rigidity V P

A78-13239 **A vector aeromagnetometer instrument system** N V Alekseev, E A Bugrov, V I Pochtarev, A Ia Rotshtein, M A Sergeev, Iu G Turbin, S V Farmakovskii, A D

Cherednichek, and V I Iushchenko (Akademiia Nauk SSSR, Institut Zemnogo Magnetizma, Ionosfery i Rasprostraneniia Radiovoln, Leningradskii Institut Tochnoi Mekhaniki i Optiki, Leningrad, USSR) *(Geomagnetizm i Aeronomiia,* vol 16, Nov-Dec 1976, p 1101-1105) *Geomagnetism and Aeronomy,* vol 16, June 1977, p 564-566 6 refs Translation.

The instrumentation developed for vector aeromagnetometers to study secular variations and the spatial structure of the geomagnetic field is discussed The basic principles of designing circuits for high-frequency measurements of the geomagnetic field components are outlined V P

A78-13435 How to minimize the baseline drift in a COSPEC remote sensor M M Millan and R M Hoff (Department of the Environment, Atmospheric Environment Service, Downsview, Ontario, Canada) *Atmospheric Environment,* vol 11, no 9, 1977, p 857-860 6 refs

A procedure is presented for the electronic set-up of a Correlation Spectrometer to minimize the baseline drift caused by daily changes in the sky spectral radiance In the case of SO2 passive detection, the drift can be kept within 100 ppm-m during the operational day, less, if over shorter periods Several days of experimental measurements are required under well ventilated conditions, with no physical changes to the commercial instrument (Author)

A78-13688 # Detection and measurement of interfaces in remotely acquired data using a digital computer K H Faller (Earth Resources Laboratory, Slidell, La) In Satellite applications to marine technology, Conference, New Orleans, La , November 15-17, 1977, Collection of Technical Papers Conference sponsored by AIAA, AMS, AGU, IEEE, MTS, and SEG New York, American Institute of Aeronautics and Astronautics, Inc , 1977 6 p (AIAA 77-1616)

A technique for the accurate detection and measurement of surface feature interfaces in remotely acquired data has been developed and evaluated The technique has been implemented on a digital computer to automatically process categorized data derived from various sources such as the Landsat multispectral scanner and other scanner-type sensors Application of the technique to multiple Landsat data sets has established the precision of the technique as 3 5 percent, and comparison with measurements made using traditional methodology indicates that the Landsat-based measurement agrees with measurements made on 1 24,000-scale maps to better than 5 percent The technique is currently being utilized in an investigation of the relationship between the shoreline complexity and the estuary and marsh productivity and in an effort with the National Oceanic and Atmospheric Administration and the coastal states to measure and map the shorelines within the states' coastal zone management areas (Author)

A78-13943 PROBE - A new technique for measuring the density profile of a specific constituent using counterpropagating laser pulses. R M Measures (Toronto, University, Downsview, Ontario, Canada) *Applied Optics,* vol 16, Nov 1977, p 3016-3026 6 refs Research supported by the National Research Council of Canada and Environment Canada.

A new approach at attaining density measurements of a specific constituent with spatial resolution using two counterpropagating laser pulses is proposed This PROBE (Profile Resolution Obtained by Excitation) concept involves exciting the species of interest with one pulse then probing the wake of excited atoms or molecules with a second laser pulse The lifetime of the excited state, in terms of the time for the laser pulse to cross the region of interest, turns out to be an important parameter in specifying the form of the relation needed to ascertain the profile of the species under investigation This new technique could find application in several areas, ranging from remote atmospheric pollution monitoring in the ir to trace species profile evaluation within plasma or chemical reactors (Author)

A78-13971 * A model for microwave intensity propagation in an inhomogeneous medium A D Fisher (MIT, Cambridge, Mass) *IEEE Transactions on Antennas and Propagation,* vol AP-25, Nov 1977, p 876-882 20 refs Contract No NAS5-21980

A combined analytic and phenomenological approach, utilizing Maxwell's equations in the Born approximation with radiative transfer theory, is used to describe the propagation of microwave intensity in a scattering medium characterized by three-dimensional random fluctuations in refractive index, as well as nonrandom variations in permittivity, temperature, and loss This approach yields microwave intensities as a function of polarization, direction, and position Numerical techniques are presented to solve the transport equations, which include cases of spatially varying coefficients, and highly peaked phase functions Some computed results illustrating the behavior of microwave intensity in various media are presented Included are the angular and frequency spectra of thermal emission from semi-infinite media, and the diffuse transmission and reflection response of a scattering layer The effects of scatterer geometry and scale sizes, correlation function, and gradients in temperature, loss, and scattering parameters are also demonstrated This model should be particularly useful in interpreting active and passive remote sensing data (Author)

A78-14826 * # Investigation of thematic mapper spatial, radiometric, and spectral resolution J P Morgenstern, R F Nalepka (Michigan, Environmental Research Institute, Ann Arbor, Mich), and J D Erickson (NASA, Johnson Space Center, Houston, Tex) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 693-701 7 refs Contract No NAS9-14819

Low-altitude aircraft scanner data were employed in simulating the spatial resolution, radiometric sensitivity and spectral bandwidth parameters of the proposed Landsat Thematic Mapper (TM) The 30 to 40 m resolution of the TM was found to provide significant improvement over current Landsat resolution (50 to 60 m) in crop mensuration, especially for Western Europe and India where field sizes average from one to four hectares In terms of radiometric sensitivity, a noise equivalent reflectance value of 0 5% was held to be necessary for discrimination of spectrally similar data, in addition, all of the six proposed TM spectral bands were shown to be necessary for monitoring at some point during the growing season J M B

A78-14873 # Capabilities of operational infrared sounding systems from satellite altitude L McMillin (NOAA, National Environmental Satellite Service, Washington, D C) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1207-1215 9 refs

Data processing techniques developed for the Vertical Temperature Profile Radiometers (VTPR) of the NOAA series satellites are considered, with attention given to the problems of retrieving temperature profiles from clear radiances and of deriving clear radiances from measurements contaminated by clouds In addition, sounding capabilities of the stratospheric sounding unit and the infrared and microwave sounding units of the Tiros-N satellite are described It is suggested that microwave measurements may provide meteorological information for cloudy areas J M B

A78-14892 # Use of an inertial navigation system for accurate track recovery and coastal oceanographic measurements B M Oliver and J F R Gower (Department of Fisheries and Environment, Institute of Ocean Sciences, Victoria, British Columbia, Canada) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1399-1413 9 refs

A data acquisition system using a Litton LTN-51 inertial navigation unit (INU) has been tested and used for aircraft track recovery and for location and tracking from the air of targets at sea The characteristic position drift of the INU is compensated for by sighting landmarks of accurately known position at discrete time intervals using a visual sighting system in the transparent nose of the Beechcraft 18 aircraft used The angular direction data from the sight in conjunction with the aircraft's attitude and barometric altitude, enables the aircraft's 'true' position to be determined. A modified cubic spline interpolation routine was then used to approximate the continuous drift of the INU with time For an aircraft altitude of about 300 m, theoretical and experimental tests indicate that calculated aircraft and/or target positions obtained from the interpolated INU drift curve will be accurate to within 10 m for landmarks spaced approximately every 15 minutes in time For applications in coastal oceanography, such as surface current mapping by tracking artificial targets, the system allows a broad area to be covered without use of high altitude photography and its attendant needs for large targets and clear weather Data is collected in digital form enabling the data to be easily processed and the results plotted directly (Author)

A78-14971 # **Estimating clear radiances - A report and a new decision rule** D S Crosby (American University, NOAA, National Environmental Satellite Service, Washington, D C) and D J DePriest (U S Navy, Office of Naval Research, Arlington, Va) In Conference on Aerospace and Aeronautical Meteorology, 7th, and Symposium on Remote Sensing from Satellites, Melbourne, Fla , November 16-19, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 101, 102

A previously developed technique for obtaining estimates of clear IR radiances when some fields of view are contaminated by clouds is noted The technique is applied to data obtained in the 10 5-12 5 micron IR channel of the scanning radiometer on the NOAA satellites in order to estimate sea-surface temperature A statistical procedure is discussed for separating those sets of data which are too contaminated by clouds from those that can be used in the analysis The goodness-of-fit statistics tested were the chi-square, the Kolmogorov-Smirnov, the Cramer-Smirnov-Von Mise, and the Anderson-Darling The last is found to yield the best results in most situations S D

A78-14972 # **Special Sensor H data processing at AFGWC - Preliminary results.** W D Klein, T H Kyle, and W C Smith (USAF, Global Weather Central, Offutt AFB, Neb) In Conference on Aerospace and Aeronautical Meteorology, 7th, and Symposium on Remote Sensing from Satellites, Melbourne, Fla , November 16-19, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 103-108 11 refs

The Special Sensor H (SSH) is a multichannel IR temperature-humidity-ozone sounder used as a step-scanning radiometer that makes measurements at 25 positions across an 1100 nautical mile scan line every 32 sec The paper focuses on a review of the SSH hardware-software data processing system The SSH instrument is described along with performance specifications, and the temperature profile retrieval capabilities of the operational SSH data processing software are discussed Results are presented for a comparative study performed with two retrieval algorithms, viz , the minimum information technique and a statistical eigenvector scheme An SSH water vapor retrieval algorithm is described along with initial results of SSH dewpoint temperature profile and total precipitable water retrievals A method is outlined for computing total ozone from the single SSH ozone channel measurement S D

A78-14973 # **Cloud properties from satellite infrared and visible measurements** J T Bunting (USAF, Geophysics Laboratory, Bedford, Mass) In Conference on Aerospace and Aeronautical Meteorology, 7th, and Symposium on Remote Sensing from Satellites, Melbourne, Fla , November 16-19, 1976, Preprints Boston, Mass , American Meteorological Society, 1977, p 109-114 16 refs

Satellite data on the radiative properties of clouds are compared with simultaneous cloud measurements by aircraft underflights A variety of cloud conditions are sampled over midlatitudes of the U S A during winter and spring months and analyzed with the IR and visible measurements from NOAA satellites Radiances at 12-15 microns determined by vertical temperature profile radiometer instruments are combined with known temperature profiles to estimate cloud altitude and IR transmissivity Broadband visible and IR window measurements taken by the scanning radiometers aboard the same satellites are empirically related to total cloud thickness and mass The data obtained corroborate the hypothesis that clouds which appear coldest in the IR and brightest in the visible have the greatest total mass and vertical thickness S D

A78-15013 # **Measurement of atmospheric ozone by satellite.** J E Lovill, T J Sullivan, and J A Korver (California, University, Livermore, Calif) In Conference on Aerospace and Aeronautical Meteorology, 7th, and Symposium on Remote Sensing from Satellites, Melbourne, Fla , November 16-19, 1976, Preprints. Boston, Mass., American Meteorological Society, 1977, p 325-327 5 refs FAA-supported research, Contract No W-07405-eng-48

A cross-track scanning, multifilter radiometer, returning 16 spectral radiance values, will be orbited aboard the DMSP Block 5D-1 system for the purpose of monitoring global atmospheric ozone trends The ozone data will be processed by the Satellite Ozone Analysis Center which will be dedicated to the following areas (1) the collection of data for use in initializing numerical models, (2) the analysis of ozone variability at the mesoscale with the higher resolution sensor, (3) the analysis of the diurnal variability of total ozone with a two satellite sensor system, and (4) cooperation with the World Meteorological Organization's Global Monitoring and Research Project B J

A78-15662 **An advanced computer calculation of ground clutter in an airborne pulse Doppler radar** M B Ringel (Westinghouse Electric Corp , Baltimore, Md) In NAECON '77, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, May 17-19, 1977 New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 921-928 USAF-supported research

This paper presents the unique features of a computer program that calculates the clutter level in an arbitrary range-Doppler cell of a range-gated pulse Doppler radar The program is capable of accurately computing the details of the so-called altitude line, sidelobe, and mainbeam clutter associated with arbitrary measured antenna/radome data or an analytical representation of them It can handle arbitrary mission geometry with respect to both platform and antenna orientations relative to a round earth In addition, it handles all range and/or Doppler ambiguities associated with the radar pulse repetition frequency (Author)

A78-15664 **Characteristics of sea clutter measured from E-3A high radar platform** P-W Chen, T F Havig, and W C Morchin (Boeing Aerospace Co , Seattle, Wash) In NAECON '77, Proceedings of the National Aerospace and Electronics Conference, Dayton, Ohio, May 17-19, 1977 New York, Institute of Electrical and Electronics Engineers, Inc , 1977, p 934-937

Backscatter data was taken using a developmental Airborne Warning and Control System radar, now known as the AN/APY-1 Clutter statistics for its operating frequency, clutter patch size, and grazing angle were not found in the available literature Therefore this experiment was done to determine the clutter statistics for use in the design of a production system Data acquisition used a digital recording system and processing was done automatically using a ground based computer (Author)

A78-16699 * # **An entree for large space antennas** R V Powell and A R Hibbs (California Institute of Technology, Jet

Propulsion Laboratory, Pasadena, Calif) *Astronautics and Aeronautics,* vol 15, Dec 1977, p 58-64 5 refs

Some of the possible areas of application for large antennas placed in space are discussed, and some initial design concepts for various antenna proposals are described Applications include rural mobile communications, an orbiting deep space relay station, submillimeter radio astronomy, and multispectral radiometry of earth surface features As a first step in developing the needed technology, a deployable 30-m antenna with 1-mm surface accuracy is proposed Flight experience with such an antenna system would enable validation of performance prediction models The 30-m-diam mesh deployable-defurlable antenna experiment would be carried out with the shuttle P T H

A78-17101 **Some characteristics of the equatorial electrojet in Ethiopia /East Africa/** R P Kane and R G Rastogi (Physical Research Laboratory, Ahmedabad, India) *Indian Journal of Radio and Space Physics,* vol 6, June 1977, p 85-101 27 refs Research supported by the Department of Space of India

A78-17113 **Ion temperature estimation with ion trap data from rockets and satellites** A Z Bochev and B C N Rao (National Physical Laboratory of India, New Delhi, India) *Indian Journal of Radio and Space Physics,* vol 6, June 1977, p 151 154

Ion trap measurements of collector current and the retarding grid voltage are used in the estimation of ion temperature and space vehicle potential The relationship between collector current and retarding grid potential is a nonlinear equation of the unknown parameters of space vehicle potential and of ion temperature An appropriate theoretical curve, which fits the observed data points, is determined via minimizing the coefficient of variation The method, which is found to be convergent, is illustrated by an example S C S

A78-17377 * **Remote sensing of earth resources using a spaceborne microwave radiometer** A Leber and T Flattau (Cutler Hammer, Inc , AIL Div , Melville, N Y) In International Instrumentation Symposium, 23rd, Las Vegas, Nev , May 1 5, 1977, Proceedings Pittsburgh, Pa , Instrument Society of America, 1977, p 317-320 10 refs Contract No NAS9-11275

A microwave radiometer was one of five experiments installed onboard the NASA Skylab spacecraft in order to remotely monitor selective earth resources information The essential features of the radiometer are described, and typical data required in space is also presented in order to illustrate the instrument's utility (Author)

A78-18245 **Analysis of 1 4 GHz radiometric measurements from Skylab** R M Lerner and J P Hollinger (U S Navy, Naval Research Laboratory, Washington, D C) *Remote Sensing of Environment,* vol 6, no 4, 1977, p 251-269 16 refs

Data collected from the 1 4 GHz S-194 microwave radiometer aboard Skylab are analyzed in order to determine the extent to which quantitative measurements of sea surface conditions and related wind fields can be made using the S-194 radiometer The discussion covers a demonstration of the reliable operation of the radiometer and the feasibility of satellite-based observations under ideal ocean and atmospheric conditions, an examination of the effects of marine wind speed, sea surface roughness, and foam coverage on radiometer antenna temperature in order to evaluate the potential for passive microwave determination of ocean surface-wind fields from a satellite, an evaluation of the effects of changes in sea salinity of selected target areas, and an estimation of the radiometer's ability to measure sea surface temperature over the widest available variety of environmental conditions Analysis results demonstrate the possibility of making accurate measurements of the earth's ocean areas from a satellite with a passive microwave radiometer S D

A78-20164 **On the role of magnetic mirroring in the auroral phenomena.** W Lennartsson (Kungl Tekniska Hogskolan, Stockholm, Sweden) *Astrophysics and Space Science,* vol 51, no 2, Oct. 1977, p 461-495 84 refs

On the basis of field and particle observations, it is suggested that a bright auroral display is a part of a magnetosphere-ionosphere current system which is fed by a charge-separation process in the outer magnetosphere (or the solar wind) The upward magnetic-field-aligned current is flowing out of the display, carried mainly by downflowing electrons from the hot-particle populations in the outer magnetosphere (the ambient cold electrons being depleted at high altitudes) As a result of the magnetic mirroring of these downflowing current carriers, a large potential drop is set up along the magnetic field, increasing both the number flux and the kinetic energy of precipitating electrons It is found that this simple basic model, when combined with wave-particle interactions, may be able to explain a highly diversified selection of auroral particle observations It may thus be possible to explain both 'inverted-V' events and auroral rays in terms of a static parallel electric field, and the electric field may be compatible with a strongly variable pitch-angle distribution of the precipitating electrons, including distributions peaked at 90 deg as well as zero deg. This model may also provide a simple explanation of the simultaneous precipitation of electrons and collimated positive ions (Author)

N78-10174*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio

DEVELOPMENT OF ENVIRONMENTAL CHARGING EFFECT MONITORS FOR OPERATIONAL SATELLITES

N John Stevens, John C Sturman, and Frank D Berkopec *In its* Proc of the Spacecraft Charging Technol Conf 24 Feb 1977 p 745-751 refs

Avail NTIS HC A99/MF A01 CSCL 22B

Design details and design goals are given of an instrumentation package to monitor the effects of the environmental charging of spacecraft surfaces on the systems of operational spacecraft Author

N78-10436*# General Dynamics Corp , Chicago Ill

REAL TIME DUST FALL MONITOR (RTDFM) Final Report, 1 Dec 1975 - 1 Oct. 1976

C R Claysmith Oct 1976 47 p

(Contract NAS8-31682)

(NASA-CR-150446) Avail NTIS HC A03/MF A01 CSCL 14B

A prototype ultraviolet optical instrument designed and developed to monitor 300 level surface cleanliness is described Size, weight, sensitivity, and simplicity design parameters were satisfied Tests were conducted with various configurations of the detector array and sample surfaces Circuit schematics are included It is shown that output drift is due to effective lamp intensity variations The instrument is intended to be a part of the integrated environmental contamination monitor of the space shuttle Author

N78-10539*# Old Dominion Univ , Norfolk, Va School of Engineering

LABORATORY REQUIREMENTS FOR IN-SITU AND REMOTE SENSING OF SUSPENDED MATERIAL Final Report

Chin Y Kuo and Robert Y K Cheng Mar 1976 90 p refs

(Contract NAS1-11707)

(NASA-CR-145263, TR-76-C2) Avail NTIS HC A05/MF A01 CSCL 08H

Recommendations for laboratory and in-situ measurements required for remote sensing of suspended material are presented This study investigates the properties of the suspended materials, factors influencing the upwelling radiance, and the various types of remote sensing techniques Calibration and correlation procedures are given to obtain the accuracy necessary to quantify the suspended materials by remote sensing In addition, the report presents a survey of the national need for sediment data, the agencies that deal with and require the data of suspended sediment, and a summary of some recent findings of sediment measurements Author

N78-10549# Radiometric Technology Inc , Wakefield Mass

MICROWAVE RADIOMETRIC SENSING OF SURFACE TEMPERATURE AND WIND SPEED FROM SEASAT Final Report

Ronald A Porter and Ping-Tong Ho 22 Feb 1977 167 p refs
(Grant NOAA-6-35-217)
(PB-270323/9, NOAA-77062710) Avail NTIS HC A08/MF A01 CSCL 08J

An evaluation was performed on the effects of scattered solar radiation on sea surface brightness temperatures to be measured with a 6 6 GHz radiometer An algorithm for deriving sea surface temperatures and wind speeds from brightness temperatures has been developed for use on SEASAT A set of conclusions and recommendations for further studies are presented GRA

N78-11446 Drexel Univ Philadelphia, Pa
TECHNIQUES FOR OPENING REGIONAL RADIATION BUDGETS FROM SATELLITE RADIOMETER OBSERVATIONS Ph D Thesis
Jose Fermin Pina 1977 216 p
Avail Univ Microfilms Order No 77-17221

Methods developed for obtaining regional radiation budgets from wide field of view satellite radiometer measurements were discussed The instantaneous technique yields values of the radiant emittance (We) and the radiant reflectance (Wr) which regions have during the time interval of a single satellite pass The number of observations matches the number of regions under study and a unique solution is obtained using matrix inversion Another method, termed the best fit technique yields time averages of We and Wr for large time intervals The number of observations in this technique is much greater than the number of regions considered, and an approximate solution is obtained by the method of least squares Dissert Abstr

N78-11449*# Cornell Univ Ithaca, N Y Center for Radiophysics and Space Research
FAR-INFRARED PHOTOMETRY WITH AN 0 4-METER LIQUID HELIUM COOLED BALLOON-BORNE TELESCOPE Ph D Thesis
Michael Ray Jacobson Aug 1977 282 p refs
(Grant NGR-33-010-172)
(NASA-CR-155234 CRSR-673) Avail NTIS HC A13/MF A01 CSCL 14E

A 0 4-meter aperture, liquid helium cooled multichannel far-infrared balloon-borne telescope was constructed to survey the galactic plane Nine new sources above a 3-sigma confidence level of 1300 Jy, were identified Although two-thirds of the scanned area was more than 10 degrees from the galactic plane, no sources were detected in that region, all nine fell within 10 degrees and eight of those within 4 degrees of the galactic equator Correlations with visible, compact H lines associated with radio continuum and with sources displaying spectra steeply rising between 11 and 20 microns were noted while stellar objects were not detected Author

N78-11453*# Honeywell Radiation Center Lexington Mass
MULTILAYERED (Hg,Cd)Te INFRARED DETECTOR Final Technical Report
W G Rae 16 May 1977 63 p
(Contract NAS9-14180)
(NASA-CR-151548) Avail NTIS HC A04/MF A01 CSCL 20F

Multilayered mercury-cadmium telluride photoconductive detectors were developed which are capable of providing individual coverage of three separate spectral wavelength bands without the use of beam splitters The multilayered three-color detector on a single dewar takes the place of three separate detector/filter/dewar units and enables simpler and more reliable mechanical and optical designs for multispectral scanners and radiometers Wavelength channel design goals (in micrometers) were 10 1 to 11 0 11 0 to 12 0 and 13 0 Detectivity for all channels was 1 x 10 to the 10th power cm-Hz 1/2/Watt A problem occurred in finding an epoxy layer which had good infrared transmission properties and which also was chemically and mechanically compatible with HgCdTe processing techniques Data on 6 candidate bonding materials are surveyed and discussed Author

N78-11496# Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft
EVALUATION OF AN INFRARED LINE SCANNER FOR THE STUDY OF COASTAL WATER CIRCULATION [EVALUATIE INFRARED LINE SCANNER VOOR ONDERZOEK KUSTWATER-CIRCULATIE]
H W BrunsveldvanHulten (Rijkswaterstaat) and C Kraan (Roy Neth Meteorol Inst) Jan 1977 88 p refs In DUTCH ENGLISH summary
(NIWARS-Publ-41) Avail NTIS HC A05/MF A01

Research on the application of infrared techniques in studies on coastal water circulation is reported Results with an airborne infrared line scanner (IRLS) and infrared thermometer (IRT) are presented In addition to some instrumentational characteristics, interpretation of measurements and data processing techniques are mentioned It is shown that such techniques may contribute substantially to the knowledge on water circulation processes Detailed information especially from IRLS is obtained The usefulness of such techniques for different studies is mentioned It is shown that temperature measurements in general are realistic but studies on the radiation temperature and phenomena in the air-sea boundary layer e g , emissivity coefficient are necessary in order to make this technique reliable Author (ESA)

N78-11813*# Washington Univ , St Louis Mo Dept of Earth and Planetary Sciences
IMAGING NATURAL MATERIALS WITH A QUASI-MICROSCOPE Final Report, 1 Jul 1974 - 31 Aug 1977
Susan Bragg and Raymond Arvidson 31 Aug 1977 47 p refs
(Contract NsG-1084)
(NASA-CR-155250) Avail NTIS HC A03/MF A01 CSCL 20F

A Viking lander camera with auxilliary optics mounted inside the dust post was evaluated to determine its capability for imaging the inorganic properties of granular materials During mission operations prepared samples would be delivered to a plate positioned within the camera's field of view and depth of focus The auxiliary optics would then allow soil samples to be imaged with an 11 pm pixel size in the broad band (high resolution, black and white) mode, and a 33 pm pixel size in the multispectral mode The equipment will be used to characterize (1) the size distribution of grains produced by igneous (intrusive and extrusive) processes or by shock metamorphism (2) the size distribution resulting from crushing chemical alteration, or by hydraulic or aerodynamic sorting (3) the shape and degree of grain roundness and surface texture induced by mechanical and chemical alteration and (4) the mineralogy and chemistry of grains Author

N78-12113*# National Aeronautics and Space Administration Langley Research Center Langley Station, Va
AN INTRODUCTION TO ORBIT DYNAMICS AND ITS APPLICATION TO SATELLITE-BASED EARTH MONITORING SYSTEMS
David R Brooks Nov 1977 85 p refs
(NASA-RP-1009 L-11710) Avail NTIS HC A05/MF A01 CSCL 22A

The long term behavior of satellites is studied at a level of complexity suitable for the initial planning phases of earth monitoring missions First-order perturbation theory is used to describe in detail the basic orbit dynamics of satellite motion around the earth and relative to the sun Surface coverage capabilities of satellite orbits are examined Several examples of simulated observation and monitoring missions are given to illustrate representative applications of the theory The examples stress the need for devising ways of maximizing total mission output in order to make the best possible use of the resultant data base as input to those large-scale, long-term earth monitoring activities which can best justify the use of satellite systems Author

N78-12268# Naval Research Lab , Washington, D C
HIGH-RESOLUTION RADAR SCATTERING CHARACTERISTICS OF A DISTURBED SEA SURFACE AND FLOATING DEBRIS Interim Report
Bernard L Lewis James P Hansen, Irwin D Olin, and Vincent Cavaleri 29 Jul 1977 47 p refs

(SF1214141B)
(AD-A044216, NRL-8131) Avail NTIS HC A03/MF A01 CSCL 17/4

A study was made of high-resolution radar returns from a disturbed sea surface and from rigid debris floating on such a surface The goal was to determine if there are differences between the scatter from the sea and that from debris that would permit sea return to be suppressed and debris return to be detected The study involved both theoretical and experimental efforts Measurement revealed that sea return was relatively improbable in any given resolution cell and that when it did occur it lasted only a second or two Also, such return was always heavily amplitude modulated with modulation frequencies much higher than those on debris echoes These findings were explained theoretically and used in developing a debris-avoidance radar concept for high-speed ships Author (GRA)

N78-12513# Image Graphics, Inc , Fairfield, Conn
CARTOGRAPHIC ELECTRON BEAM RECORDER (EBR) SYSTEM Final Contract Report, 16 Jun. 1975 - 18 Jul 1977
Patrick F Grosso and Andrew A Tarnowski 1 Aug 1977 85 p refs
(Contract DAAG53-75-C-0221)
(AD-A044401, ETL-0111) Avail NTIS HC A05/MF A01 CSCL 08/2

This report describes the development of an advanced model of a Cartographic EBR for use in plotting and recording a variety of map and image data on electron sensitive film Performance levels achieved with the minicomputer controlled EBR are satisfactory for the automated production of a number of cartographic products Recording spot sizes of 3 and 6 microns diameter, beam addressability of 32,000 x 32,000, image repeatability of 1/30,000, and geometric fidelity of 0 03% have been demonstrated Image format sizes were 5 inch x 8 inch, 4 inch x 6 inch, 70 mm and 35 mm 32 line widths can be varied automatically from 6 to 250 micrometer Graphic arts quality characters can be recorded from 4 pts to 36 pts (at full scale) Author (GRA)

N78-12514*# Army Cold Regions Research and Engineering Lab , Hanover, N H
AIRBORNE SPECTRORADIOMETER DATA COMPARED WITH GROUND WATER-TURBIDITY MEASUREMENTS AT LAKE POWELL, UTAH. CORRELATION AND QUANTIFICATION OF DATA
Carolyn J Merry Sep 1977 44 p refs Prepared in cooperation with Dartmouth Coll , Hanover, N H
(Grant NsG-5014)
(NASA-CR-155290, AD-A044793, CRREL-SR-77-28) Avail NTIS HC A03/MF A01 CSCL 13/2

During the past three years there has been a renewed interest in the methodology and procedures used to monitor water quality in fresh and salt water regimes However, there still exists a need to calculate quantitatively the amount of surface turbidity by remote sensing methods to provide rapid and synoptic water quality surveys Recently a 500-channel airborne spectroradiometer, which may provide a quantitative means of comparing high resolution multispectral data to water quality parameters has been designed at the the NASA Goddard Institute for Space Studies (GISS) The objective of this study is to correlate and quantify the airborne spectroradiometer multispectral data to ground truth water quality measurements obtained in Lake Powell, Utah, during June 1975 A ground truth water sampling program was accomplished during 9-16 June 1975 for correlation to an aircraft spectroradiometer flight Field measurements were taken of percentage of transmittance, surface temperature, pH and secchi disk depth Also, percentage of transmittance was measured in the laboratory for the water samples In addition, electron micrographs and suspended sediment concentration data were obtained of selected water samples located at Hite Bridge (Mile 171), Mile 168, Mile 150 and Bullfrog Bay (Mile 122) Airborne spectroradiometer spectra were selected which correlated to the Hite Bridge (Mile 171), Mile 168, Mile 150 and Bullfrog Bay (Mile 122) test sites GRA

N78-12618# Physical Dynamics, Inc La Jolla, Calif
MEASUREMENT OF AMBIENT MAGNETIC FIELD GRADIENTS USING A SUPER CONDUCTING MAGNETIC GRADIOMETER Final Technical Report, Jan - Dec 1976
Walter N Podney and George H Gillespie Mar 1977 152 p refs
(Contract F30602-72-C-0494, ARPA Order 1649)
(AD-A044997, PD-76-107, RADC-TR-77-100) Avail NTIS HC A08/MF A01 CSCL 20/3

This report presents the results of investigations involving the relationship of the motion of ocean waves to measurement of fluctuating magnetic fields that result from a wave progressing horizontally in a stratified ocean This report (1) describes design features of a superconducting magnetic gradiometer that will be employed to measure gradients of magnetic fields generated at a fixed point above the ocean surface due to waves passing the oceanographic tower operated by the U S Naval Undersea Center near San Diego, CA In addition, the report gives a formulation describing instrument response to ambient magnetic gradients that are sensibly constant over the distance separating centers of the pickup loops in the gradiometer This report also presents the first measurements of spectra that characterize noise in the frequency range 5 x 10 (-4) to 20 Hz of a superconducting magnetic gradiometer operating in a magnetically quiet environment Two techniques that provide means of suppressing noise from nearby magnetic objects are examined A procedure for operating at the Oceanographic tower that both uses the techniques to suppress noise from magnetization currents in the tower's steel structure and gives a maximum response to gradients from internal waves is presented Author (GRA)

N78-13513# Officine Galileo S p A , Florence (Italy) Div Sistemi
IRFES - INFRA-RED FAN BEAM EARTH SENSOR. PROTOTYPE MODEL Final Report
Paris ESA Nov 1976 384 p refs
(Contract ESTEC-1799/72-AA)
(ESA-CR(P)-974) Avail NTIS HC A17/MF A01

The design is described of the fan beam IR horizon sensor A description is given of sensor optical head, the design and optimization of the sensor electronics, the sensor housing and tests performed A mathematical model is used for the analysis of sensor errors An evaluation is included of sun and moon interference on sensor operation An error and reliability analysis is detailed ESA

N78-13684# Air Force Geophysics Lab , Hanscom AFB, Mass
LWIR (7-24-MICROMETER) MEASUREMENTS FROM THE LAUNCH OF A ROCKET BORNE SPECTROMETER INTO A QUIET ATMOSPHERE (1974)
James W Rogers 24 May 1977 117 p refs
(AD-A045466, AFGL-TR-77-0113, AFGL-ERP-597, DNA-HAES-64) Avail NTIS HC A06/MF A01 CSCL 17/5

A liquid-helium-cooled, long-wavelength infrared (LWIR) spectrometer was successfully launched on 14 Feb 1974 from the University of Poker Flat Research Range at Chatanika, Alaska, part of the DNA ICECAP 74 Program The Spectrometer, which employs a circular-variable filter was almost identical to one flown on 22 Mar 1973 that provided the first measurements of the altitude profile of the infrared spectrum of the upper-atmospheric emissions between 7 and 24 micrometers The 1973 measurements were from an energetically pumped atmosphere during the occurrence of an IBC II aurora The objective of the 1974 flight was to obtain emission data from an aurorally quiet atmosphere to determine the contribution of the auroral energy input to the data obtained in 1973. The payload was successfully launched during nonauroral conditions, and data were obtained on the 15 micrometer carbon dioxide (nu 2) emission from 74 to 160 km and on the 9 6 micrometer ozone (nu 3) emission between 74 and 110 km Above 110 km, significant unidentified emission was again observed at 9 3 micrometers GRA

N78-13716*# Wentz (Frank J) and Associates Cambridge, Mass

COMPUTATION OF THEORETICAL BRIGHTNESS TEMPERATURES CORRESPONDING TO THE CAPE COD CANAL RADIOMETER MEASUREMENTS Final Report
Frank J Wentz Nov 1977 14 p refs
(NASA Order L-24420-A)
(NASA-CR-145277) Avail NTIS HC A02/MF A01 CSCL 08J

Theoretical brightness temperatures are computed from the ground-truth data that was collected during the radiometer measurements of the Cape Cod Canal An approximate correction for antenna pattern effects is made and the results are compared with the radiometer measurements Author

N78-14495*# Kansas Univ Center for Research, Inc , Lawrence Remote Sensing Lab
SPACE RADAR SYSTEM SPECIFICATIONS
F T Ulaby T F Bush and W H Stiles *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 407-425 refs
Avail NTIS HC A99/MF A01 CSCL 17I

System specifications are proposed for an imaging radar whose primary objective is to provide useful information for land applications including hydrology, agriculture and geology Author

N78-14532*# National Oceanic and Atmospheric Administration Washington D C
POTENTIAL APPLICATIONS OF DIGITAL, VISIBLE, AND INFRARED DATA FROM GEOSTATIONARY ENVIRONMENTAL SATELLITES
D B Miller, M P Waters III, J D Tarpley, R N Green and D C Dismachek *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 849-858 refs
Avail NTIS HC A99/MF A01 CSCL 05B

An hourly digital data base from the Visible/Infrared Spin-Scan Radiometer (VISSR) instrument on the GOES-1 and SMS-2 geostationary satellites is described Several examples of developmental applications of these quantitative digital data are presented These include a review of recent attempts to develop products that are of use to meteorologists who provide services to aviation, agriculture, forestry hydrology, oceanography, and climatology The sample products include high resolution thermal gradients of land and ocean surfaces thermal change analyses, fruit frost/freeze application cloud-top altitude analysis analysis of hurricane characteristics and analyses of solar insolation Author

N78-14567*# National Environmental Satellite Service Washington D C
CAPABILITIES OF OPERATIONAL INFRARED SOUNDING SYSTEMS FROM SATELLITE ALTITUDE
Larry McMillin *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1207-1215 refs
Avail NTIS HC A99/MF A01 CSCL 04A

Initial attempts at using satellite radiances resulted in the production of temperature profiles similar to those produced by radiosondes While increases in accuracy were made and additional increases are expected to result from increased instrument capabilities it was recognized that the production of level temperatures is not consistent with the average temperature that is represented by the radiances Author

N78-14568*# Aerojet Electrosystems Co , Azusa Calif
A MULTICHANNEL PASSIVE MICROWAVE ATMOSPHERIC TEMPERATURE SOUNDING SYSTEM
M E Louappe and K A Paradis *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1217-1225 refs
(Contract F04701-75-C-0090)
Avail NTIS HC A99/MF A01 CSCL 04A

The development of a small lightweight low-power seven channel passive microwave radiometer system for use on the Defense Meteorological Satellite Program (DMSP) was described The 50-60 GHz sensor system operates in the region of an intense atmospheric oxygen absorption band to provide atmospheric temperature profiles to 30 kilometer altitudes on a global basis Author

N78-14599*# Atomic Energy Establishment Cairo (Egypt) Remote Sensing Center
INTERPRETATION OF MULTISPECTRAL AND INFRARED THERMAL SURVEYS OF THE SUEZ CANAL ZONE, EGYPT
E M ElShazly M A Abdel Hady Hady M A Abdel Hafez A B Salman M A Morsy M M elRakaiby I E E alAassy, and A F Kamel *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1533-1542 refs
Avail NTIS HC A99/MF A01 CSCL 17E

Remote sensing airborne surveys were conducted as part of the plan of rehabilitation of the Suez Canal Zone using I2S multispectral camera and Bendix LN-3 infrared passive scanner The multispectral camera gives four separate photographs for the same scene in the blue green red, and near infrared bands The scanner was operated in the microwave bands of 8 to 14 microns and the thermal surveying was carried out both at night and in the day time The surveys, coupled with intensive ground investigations were utilized in the construction of new geological structural lineation and drainage maps for the Suez Canal Zone on a scale of approximately 1 20 000 which are superior to the maps made by normal aerial photography A considerable number of anomalies belonging to various types were revealed through the interpretation of the executed multispectral and infrared thermal surveys Author

N78-14601*# Kansas Univ Lawrence Remote Sensing Lab
ESTIMATION OF SOIL MOISTURE WITH RADAR REMOTE SENSING
Percy P Batlivala and Fawwaz T Ulaby *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1557-1566 refs
Avail NTIS HC A99/MF A01 CSCL 08M

The radar response to soil moisture content was investigated using a truck-mounted 1-18 GHz (30-1 67 cm wavelength respectively) active microwave spectrometer (MAS) system The sensitivity to soil moisture content and the accuracy with which it could be estimated were evaluated for both bare and vegetation-covered fields Bare field experiments were conducted to determine the optimum radar parameters (frequency, angle of incidence range, and polarization configuration) for minimizing the response to surface roughness while retaining strong sensitivity to moisture content In the vegetation-covered case, the effects of crop type crop height and row direction relative to the radar look direct were evaluated Author

N78-14605*# Aerojet Electrosystems Co Azusa Calif
DATA PROCESSING FOR THE DMSP MICROWAVE RADIOMETER SYSTEM
J L Rigone and A P Stogryn *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 1599-1608
Avail NTIS HC A99/MF A01 CSCL 05B

A software program was developed and tested to process microwave radiometry data to be acquired by the microwave sensor (SSM/T) on the Defense Meteorological Satellite Program spacecraft The SSM/T 7-channel microwave radiometer and systems data will be data-linked to Air Force Global Weather Central (AFGWC) where they will be merged with ephemeris data prior to product processing for use in the AFGWC upper air data base (UADB) The overall system utilizes an integrated design to provide atmospheric temperature soundings for global applications The fully automated processing at AFGWC was accomplished by four related computer processor programs to produce compatible UADB soundings, evaluate system performance and update the a priori developed inversion matrices Tests with simulated data produced results significantly better than climatology Author

N78-14699# Chalmers Univ of Technology, Goteborg (Sweden) Research Lab of Electro-Optics and Lasers

A PbSe DIODE LASER SPECTROMETER TO BE USED IN AIR POLLUTION MONITORING AND MINERAL PROSPECTING

E Max and S T Eng [1977] 21 p refs Sponsored by Swed Board for Tech Develop
(CTH-IEM-TR-7636) Avail NTIS HC A02/MF A01

The high resolution infrared PbSe diode laser spectrometer developed possesses three cells for measurement and calibration A correlation technique was applied to increase sensitivity Silicon dioxide concentrations of around 5 ppm were monitored at 7 5 microns with the diode operating at 77 K Author (ESA)

N78-14747 British Library Lending Div Boston Spa (England)
THE DIGITAL PROCESSING OF SCANNING RADIOMETER (SR) DATA FROM NOAA WEATHER SATELLITES AS CARRIED OUT IN THE METEOROLOGICAL INSTITUTE OF THE FREE UNIVERSITY OF BERLIN PART 2 NOTES ON THE DIGITAL FILTERING OF SATELLITE PICTURES

Egon Hilt [1977] 8 p refs Transl into ENGLISH from Meteorol Abh , Inst Meteorol Geophys Freie Univ Berlin (West Germany) ser B 6 H 1 1976 p 1-8
(BLLD-M-24895-(5828 4F)) Avail British Library Lending Div , Boston Spa Engl

Detailed descriptions of digital filtering and recursive filtering specifically are presented along with each method's use in on-line processing of satellite data Author

N78-14750 British Library Lending Div Boston Spa (England)
THE DIGITAL PROCESSING OF SCANNING RADIOMETER (SR) DATA FROM NOAA WEATHER SATELLITES AS CARRIED OUT IN THE METEOROLOGICAL INSTITUTE OF THE FREE UNIVERSITY OF BERLIN PART 1 LINEARISING THE SR DATA

Heiner Billing and Dirk Koslowsky [1977] 5 p refs Transl into ENGLISH from Freie Univ Inst , Met u Inst Geophys Wissensch , Met Abt , Neue Folge Ser b, 1, H G, 1975 Beil 74 (Berlin) 5 p
(BLL-M-24896-(5828 4F)) Avail British Library Lending Div , Boston Spa Engl

A digital picture processing procedure developed to correct the distorted scanning radiometer pictures from the NOAA satellites is decribed The procedure is run on the PDP 11/40 in real time Results show that even the boundary regions of the distortion-corrected picture are good enough for recognizing large-scale cloud structures J M S

N78-15028*# Hacking Labs Santa Clara, Calif
DESIGN AND FABRICATION OF NOSECONE FOR WB-57F AIRCRAFT FITTED WITH APQ-102A SIDE LOOKING RADAR Final Report

Dec 1977 104 p refs
(Contract NAS9-15189, HL Proj 22)
(NASA-CR-151592) Avail NTIS HC A06/MF A01 CSCL 01C

The design, fabrication, and testing of a nose cone which included a radome for a NASA WB-57F high altitude natural resources mapping aircraft was reviewed The plane was fitted with a APQ-102A side looking radar operating at 9 6 GHz The radar is directed normally to the direction of the flight and downward by a changeable angle, and it is assumed that the axis of the plane will not deviate from this direction by more than + or - 6 deg The radome is required to subtend an angle of 160 deg centered 30 deg below the left horizon Author

N78-15142*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt Md
SIGNIFICANT INITIAL RESULTS FROM THE ENVIRONMENTAL MEASUREMENTS EXPERIMENT ON ATS-6

T A Fritz (NOAA Boulder, Colo) C W Arthur (California Univ Los Angeles), J B Blake (Aerospace Corp , Los Angeles), P J Coleman, Jr (California Univ Los Angeles), J P Corrigan (NASA Goddard Space Flight Center) W D Cummings (Grambling State Univ La), S E DeForest (Alabama Univ , Huntsville), K N Erickson (Minnesota Univ , Minneapolis), A Konradi (NASA Johnson Space Center) W Lennartsson (NASA Marshall Space Flight Center) et al Dec 1977 34 p refs
(NASA-TP-1101, G-7702F-15) Avail NTIS HC A03/MF A01 CSCL 22A

The Applications Technology Satellite (ATS-6), launched into synchronous orbit on 30 May 1974 carried a set of six particle detectors and a triaxial fluxgate magnetometer The particle detectors were able to determine the ion and electron distribution functions from 1 to greater than 10 to the 8th power eV It was found that the magnetic field is weaker and more tilted than predicted by models which neglect internal plasma and that there is a seasonal dependence to the magnitude and tilt ATS-6 magnetic field measurements showed the effects of field-aligned currents associated with substorms and large fluxes of field-aligned particles were observed with the particle detectors Encounters with the plasmasphere revealed the existence of warm plasma with temperatures up to 30 eV A variety of correlated waves in both the particles and fields were observed pulsation continuous oscillations, seen predominantly in the plasmasphere bulge, ultralow frequency (ULF) standing waves ring current proton ULF waves and low frequency waves that modulate the energetic electrons In additon large scale waves on the energetic-ion-trapping boundary were observed, and the intensity of energetic electrons was modulated in association with the passage of sector boundaries of the interplanetary magnetic field Author

N78-15626*# Old Dominion Coll , Norfolk Va School of Engineering
ESTIMATION OF GROUND TEMPERATURE FROM GFCR RADIOMETRIC SIGNAL Progress Report, Feb - May 1977

S K Gupta and S N Tiwari Jun 1977 80 p refs
(Grant NsG-1282)
(NASA-CR-145291) Avail NTIS HC A05/MF A01 CSCL 08G

A procedure was developed which demonstrates the feasibility of estimating actual surface temperature from the effective brightness temperature which can be conveniently measured by a radiometer from remote sensing platforms Atmospheric corrections to the effective brightness temperature are computed corresponding to the base model' atmosphere and several modifications of this caused by deviations of the various atmospheric or surface parameters from their base model values Simple analytical relations were established between the deviations of these parameters and the additional temperature corrections required to compensate for them Effects of simultaneous variation of several parameters also were examined Use of these analytical relations instead of radiative transfer calculations results in tremendous savings in data reduction costs Author

N78-15632# Air Force Geophysics Lab , Hanscom AFB, Mass
ROCKETBORNE MEASUREMENT OF AN INFRARED ENHANCEMENT ASSOCIATED WITH A BRIGHT AURORAL BREAKUP Interim Report, Nov 1975 - Dec 1976

K D Baker, Doran J Baker, James C Ulwick, and A T Stair, Jr 5 Jul 1977 100 p refs
(AD-A046474, AFGL-TR-77-0157, DNA-HAES-50, ERP-605) Avail NTIS HC A05/MF A01 CSCL 18/3

A Paiute-Tomahawk sounding rocket containing a 1 5-5 3 micrometers cryogenically cooled spectrometer was flown into a very bright (IBC III-) auroral breakup from Poker Flat Alaska The main emission features at 2 8, 4 3, and 5 3 micrometers were all found to be enhanced due to the large energy input to the atmosphere associated with the aurora The most prominent enhancement occurred in the 4 3 micrometers region Author (GRA)

N78-15643# Earth Satellite Corp , Washington, D C
A PRELIMINARY STUDY OF THE APPLICABILITY OF NIMBUS 6 ESMR TO SURFACE WIND SPEED ESTIMATES Final Report, May 1975 - Sep 1976

Romeo R Sabatini Lawrence J Heitkemper, and Dennis L Hlavka Sep 1976 50 p refs
(Contract N00228-75-C-2269)
(AD-A046629, NEPRF-TR-6-76(ESC)) Avail NTIS HC A03/MF A01 CSCL 04/2

The utility of the Nimbus 6 ESMR for sea-surface wind determination is explored in this study by (1) analysis of wind equations derived from theoretical calculations of brightness temperatures above model atmospheres and assumptions of linear increases in sea-surface emissivities with wind, and (2) actual analysis of Nimbus 6 ESMR brightness temperatures in areas of known wind Unfortunately a calibration problem in the Nimbus 6 ESMR prevented quantitative comparisons of brightness temperatures and wind, and the derivation of a sound empirical relationship between wind and sea-surface emissivities needed to estimate winds from satellite-measured brightness temperatures Notwithstanding the erroneous calibration analyses of ESMR brightness temperatures maps do show definite increases in horizontally and vertically polarized brightness temperatures with wind Such increases are dramatically brought out in a Mistral occurrence over the Mediterranean Sea An error analysis on derived wind equations establishes the accuracy of wind speed determination from Nimbus 6 ESMR under various conditions
GRA

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09
GENERAL

A78-10353 **Pending issues before the Legal Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space** K Chen (United Nations, Office of Legal Affairs, New York, N Y) *Journal of Space Law*, vol 5, Spring-Fall 1977, p 29-35 13 refs.

The present article consists mainly of a summary of views expressed at the sixteenth (1977) session of the Legal Sub-Committee of the Committee on the Peaceful Uses of Outer Space, held from March 14 to April 8 this year, concerning the unresolved issues of the following priority items on its agenda (1) draft treaty relating to the moon, (2) elaboration of principles governing the use by states of artificial earth satellites for direct television broadcasting, and (3) legal implications of remote sensing of the earth from space A brief description is also given to the fourth item, i.e., 'matters relating to the definition and/or delimitation of outer space and outer space activities,' which did not have priority and was not discussed in any detail in the Sub-Committee (Author)

A78-10358 **The development of international law relating to remote sensing of the earth from outer space** R F Stowe (U S Department of State, Washington, D C.) *Journal of Space Law*, vol. 5, Spring-Fall 1977, p. 101-109 16 refs

The Legal Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space has surveyed the legal implications of remote sensing of the earth by satellite. Among the issues considered by the committee are the right to sense, and the procedures for the dissemination of available data to interested parties Future areas for committee work have been identified, including the recommendation of guidelines for remote sensing programs S C S.

A78-12214 **Remote sensing - A burgeoning science.** D G Goodenough (Department of Energy, Mines and Resources, Centre for Remote Sensing, Ottawa, Canada) *Engineering Journal*, vol 60, Sept -Oct 1977, p 23 26 22 refs.

Remote sensing objectives and techniques are described Topics considered include data processing, platforms and sensors, and processing and analysis devices A nighttime thermogram of a shopping center is presented as an example, a light tone indicates heat loss areas, which correspond to areas where a waterproof enclosure membrane had broken, as verified by on-site inspection Remote sensing can facilitate environmental monitoring, winter navigation in ice-infested waters, global crop information systems, and energy exploration M L

A78-12925 **International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings (Congresso Internazionale per l'Elettronica, 24th, Rome, Italy, March 28-30, 1977, Atti)** Congress sponsored by the Ministero delle Poste e Telecomunicazioni Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977 392 p In Italian and English

Remote sensing of earth resources, pollution monitoring systems, and the sensors and instrumentation applicable to monitoring and sensing are discussed Topics of the papers include Landsat data employed in resource inventories, ground stations for receiving and interpreting Landsat imagery, aerological assessments with acoustic or optical radar systems, sulfur dioxide pollution monitoring, agricultural applications of satellite data, microprocessors employed by data acquisition systems, measurement of the low tropospheric temperature and the atmospheric transparency, detection of water pollution with ultrasonic impulses, and the automatization of a Doppler satellite tracking station J M B.

A78-12926 # **The use of the Landsat series satellites for the monitoring and management of territory (L'utilizzazione dei satelliti della serie Landsat per il controllo e la gestione del territorio)** P Castruccio (Ecosystems International, Inc, Baltimore, Md) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 15-22 In Italian

Remote sensing of earth resources conducted by the Landsat satellites is discussed, and methods of interpreting remote sensing data are compared Characteristics of the multispectral scanners and return beam vidicon apparatus employed by Landsat A and B are reviewed Applications of remote sensing data, such as the inventory of agricultural production, the creation of land and water resource maps, weather forecasting, monitoring of water pollution, and the identification of mineral deposits, are considered Automated data interpretation and visual identification of significant features are described J M B

A78-12932 # **User experience with the applications of Landsat data** G Thorley (U S Geological Survey, Reston, Va) and D Hood (U S Geological Survey, Sioux Falls, D Dak) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 63-71

The use of Landsat data in resource assessment and management is discussed, with attention given to cost analysis of the interpretive techniques, as well as to technical problems such as inadequate resolution of the imagery or infrequent coverage of an area Projects involving forest inventories, the inspection of water impounded by dams, the detection of geologic structures corresponding to mineral, petroleum or natural gas deposits, and crop monitoring are considered Limitations of Landsat data arising from the presence of cloud cover or the deficiencies of the multispectral scanning apparatus are also mentioned J M B

A78-12943 # **Remote sensing from space and models of the management of renewable resources (Telerilevamento spaziale e modelli di gestione delle risorse rinnovabili)** F Capozza (Bari, Università, Bari, Italy) In International Electronics Congress, 24th, Rome, Italy, March 28-30, 1977, Proceedings Rome, Rassegna Internazionale Elettronica Nucleare ed Aerospaziale, 1977, p 247-253 In Italian

This paper contains a short introduction to space remote sensing technology, Earth Resources Satellites programs and their potential uses in renewable earth resources inventory and management A few notes about multispectral image preprocessing and pattern recognition techniques are given Some possible models, relevant in earth resources management information system are indicated (Author)

A78-13495 **The European Space Agency and remote sensing by satellite.** R Gibson (ESA, Paris, France) *ITC Journal*, no 3, 1977, p 467-481

Satellite remote sensing programs under development by the ESA are reviewed, with attention given to the earth resources satellite data network (Earthnet), Spacelab projects, and automatic satellite projects Earthnet, consisting of three stations providing coverage of the Western European region (including most of Greenland and the continental shelf), will receive Landsat and Seasat data Spacelab, capable of providing synoptic coverage at infrequent intervals, may be used to procure cartographic mapping or surveys of semistatic features. Automatic satellite programs employing multispectral scanners for land surface and coastal zone applications, or synthetic aperture radar for all-weather sensing, are also considered J M B

A78-13667 * # **Surveying the earth's environment from space - Spectral, areal, temporal coverage trends.** R G Nagler (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) In Satellite applications to marine technology, Conference, New Orleans, La., November 15-17, 1977, Collection of Technical

Papers New York, American Institute of Aeronautics and Astronautics, Inc , 1977, p 157-166 Contract No NAS7-100 (AIAA 77-1585)

Attention is given to various areas of satellite applications to monitoring the earth's environment These trends primarily concern spectral, areal, and temporal coverage Various environmental monitors are discussed in terms of derived economic benefits. Several types of remote sensors for earth applications are described, noting spectral channels, resolution cell size, swath width, and data rate A sample environmental monitoring system is presented which includes five geostationary satellites, and three or four low earth orbit spacecraft S C S

A78-14776 * International Symposium on Remote Sensing of Environment, 11th, University of Michigan, Ann Arbor, Mich., April 25-29, 1977, Proceedings Volumes 1 & 2 Symposium sponsored by the Environmental Research Institute of Michigan, University of Michigan, NASA, et al Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977 Vol 1, 867 p., vol 2, 867 p Price of two volumes, $60

Consideration is given to remote sensor development and sensor data analysis and interpretation, and to the following fields of application of remote sensors geology and mineral resources, meteorology, agriculture, forestry and rangeland, ocean and coastal regions, and environmental quality Attention is also given to economic and institutional issues and technology transfer in the field of remote sensing, to microwave remote sensing and to the current and future role of remote sensing in operational programs B J

A78-14777 # The problems and opportunities W A Nierenberg (California, University, La Jolla, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1

Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 3-25

A review is presented of remote sensing of the ocean surface, with some emphasis on the use of microwave scatterometers, Doppler sensors and satellite-borne very high resolution radiometers Attention is given (in the 16 figures) to the effects of ocean variability on remote sensing, radar measurement of surface winds, the Skylab S-193 Scatterometer response to wind at sea, and NOAA-3 imagery off the coast of California B J

A78-14778 * # Sensing the earth's environment from space - User needs and technology opportunities R G Nagler (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 35-50 9 refs Contract No NAS7-100

Results of a number of studies involving industry, universities and government agencies working in concert to identify specific measurement and data needs in the field of satellite remote sensing are discussed Comparisons are made with existing sensor capabilities and with the trends in the supporting technology A series of tables is presented describing, among other things, user subcommittees using remote sensing data, atmosphere, ocean, land and cryosphere measurement needs and funded capabilities, and the capability status of such sensors as passive and active microwave sensors, visible and IR radiometers and laser sensors B J

A78-14785 * # A survey of SAR image-formation processing for earth resources applications R W Bayma (Michigan, Environmental Research Institute, Ann Arbor, Mich), R L Jordan (California Institute of Technology, Jet Propulsion Laboratory, Pasadena, Calif), and B N Manning (Goodyear Aerospace Corp , Litchfield Park, Ariz) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 137-159 6 refs

Currently there is considerable interest in active microwave sensors for earth resources applications A particular example is the Seasat-A radar However, to obtain spatial resolutions comparable to optical sensors at radar frequencies, sophisticated image formation processing techniques must be applied to the raw data This paper briefly compares processing requirements for non-coherent optical and coherent radar imaging systems, and then discusses the image formation processing requirements for synthetic aperture radar (SAR) systems Both optical and digital techniques are addressed, and examples of hardware and imagery for each processing technique are presented (Author)

A78-14790 # Operational utilization of remotely sensed data J B Jones (NOAA, National Weather Service, Silver Spring, Md) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 221-228

Ways that data from environmental satellites and other remote sensing platforms are used in some of NOAA's operational service programs are described Attention is given to the application of remote sensing data to the monitoring of hurricanes, and severe local storms and tornados and to forecast guidance, public weather and hydrology Such specialized services as space programs (effects of weather on X-band communications), marine operations, search and rescue, and wildlife management, are also considered B J

A78-14795 # An overview of remote sensing technology transfer in Canada and the United States W M Strome (Department of Energy, Mines and Resources, Canada Centre for Remote Sensing, Ottawa, Canada) and D T Lauer (U S Geological Survey, EROS Data Center, Sioux Falls, S Dak) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 325-331 10 refs

The paper is concerned with motivation and communication problems that hinder the greater use of remote sensing technology Motivation problems result because decision makers worry about the risk of adopting a new technology, or fear that their position will be undermined Some communications problems are due to the different training backgrounds of the designers of the technology, the field managers who would apply the technology, and their superiors who would make the purchasing decision Programs designed to alleviate motivation and communication problems are considered M L

A78-14796 # The transfer of remote sensing technology in the developing nations - An observation. A. A Abiodun (Ife, University, Ile-Ife, Nigeria) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p. 339-351 24 refs

The paper is concerned with the utilization of remote sensing technology by the developing nations It is suggested that there should be a shift of emphasis from centralized training to regional training programs, which would result in larger local participation and on-the-spot application of the technology to solve local problems It is hoped that developing countries will be encouraged to develop their own technological capability rather than rely on contracts with firms from industrialized countries Some lack of coordination and communication gaps hinder, it is thought, UN and similar training programs on the use of remote sensing The need to avoid overselling the benefits of remote sensing programs is noted M L

A78-14823 * # An operational, multistate, earth observation data management system L F Eastwood, Jr , T R Hays, C T Hill,

R J Ballard, R P Morgan, G G Crnkovich, J K Gohagan, and M A Schaeffer (Washington University, St Louis, Mo) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 1 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 659-670 5 refs Contract No NAS5-20680

The purpose of this paper is to investigate a group of potential users of satellite remotely sensed data - state, local, and regional agencies involved in natural resources management We assess this group's needs in five states and outline alternative data management systems to serve some of those needs We conclude that an operational Earth Observation Data Management System (EODMS) will be of most use to these user agencies if it provides a full range of information services - from raw data acquisition to interpretation and dissemination of final information products (Author)

A78-14842 # **Indicators of international remote sensing activities** G W Spann (METRICS, Inc , Atlanta, Ga) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2. Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 885-891

A survey was conducted to determine the extent of worldwide remote sensing activities, including the use of satellite and high/medium altitude aircraft data The specific objectives of the survey, which used nine indicators, were a country-by-country evaluation of remote sensing activities for all countries known to be involved in this area, classification of each country into one of three categories according to the nature and extent of remote sensing data use, and evaluation of remote sensing activities of international organizations B.J

A78-14858 # **Remote sensing utilization of developing countries - An appropriate technology** M W Conitz (Agency for International Development, Washington, D C) and D S Lowe (Michigan, Environmental Research Institute, Ann Arbor, Mich) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1055-1064

Applications of remote sensing to the development programs of African, Asian and South American nations are discussed The projects, based on the use of Landsat data and sponsored by the Agency for International Development, include detection of iron ore deposits in Bolivia, identification of an economically important palm tree in the eastern Peruvian jungle, investigation of drainage patterns in Lesotho, development of crop acreage statistics for Thailand, and demographic applications in Kenya J M B

A78-14859 * # **A survey of users of earth resources remote sensing data** G E Wukelic, J G Stephan, H E Small, and T F. Ebbert (Battelle Columbus Laboratories, Columbus, Ohio) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1067-1076 NASA-supported research

The use of Landsat imagery and digital data, Skylab data and high-altitude aerial imagery by industry, government, academic and foreign analysts was surveyed The study indicated that while most users are satisfied with current Landsat product quality and spectral coverage, there does exist a significant demand for extension of the spectral coverage to thermal and microwave regions, for resolutions in the 20 to 40 and 10 to 20 meter range, and for more rapid data delivery Problems involving the acceptance of digital processing techniques by some users are also mentioned J M B

A78-14889 # **Applications of Landsat data to the integrated economic development of Mindoro, Philippines** T W Wagner (Michigan, Environmental Research Institute, Ann Arbor, Mich) and J C Fernandez (Bureau of Mines, Manila, Philippines) In International Symposium on Remote Sensing of Environment, 11th, Ann Arbor, Mich , April 25-29, 1977, Proceedings Volume 2 Ann Arbor, Mich , Environmental Research Institute of Michigan, 1977, p 1375-1380

Landsat data of Mindoro Island in the Philippines was processed to provide thematic maps showing patterns of agriculture, forest cover, terrain, wetlands and water turbidity A hybrid approach using both supervised and unsupervised classification techniques resulted in 30 different scene classes which were subsequently color-coded and mapped at a scale of 1 250,000 The images, maps, and aerial statistics are being used to provide data to seven technical departments in planning the economic development of Mindoro Multispectral aircraft imagery has been collected to complement the application of Landsat data and validate the classification results (Author)

A78-16544 # **Earth Resources Technology Satellite /ERTS/ - An assessment** G C Agarwal (Survey of India, Hyderabad, India) *International Society for Photogrammetry, International Congress for Photogrammetry, 13th, Helsinki, Finland, July 11-23, 1976, Paper* 29 p 30 refs

In view of the existing controversy concerning the potential of remote sensing, an attempt is made to appraise realistically the potential of the multispectral imaging systems used on board the ERTS satellites The salient features of the 3-camera television system and the multispectral scanner are discussed, and their spectral bands are tabulated The possibilities and limitations of ERTS imagery are examined for such applications as geological studies (mineral resources), soil surveys, agricultural uses, water resources, land use, and cartography V P

A78-17141 **The versatile satellite** R W Porter Oxford and New York, Oxford University Press, 1977 181 p $11 00

The introductory book discusses several uses of satellites in the fields of communication, meteorology, navigation, surveying, field biology, and astronomy Satellite design, history, and orbiting physics are examined, and the development of man-satellite systems is considered The presentation includes photographs and diagrams An account of the motion of a small point mass subject to an inverse square force of attraction is offered M L

A78-18189 * **Uses of the Space Shuttle in the NASA Applications Program** D G McConnell (NASA, Washington, D C) In Space research XVII, Proceedings of the Open Meetings of Working Groups on Physical Sciences, June 8-19, 1976 and Symposium on Minor Constituents and Excited Species, Philadelphia, Pa , June 9, 10, 1976 Oxford and New York, Pergamon Press, 1977, p 839-845 11 refs

Examples are given of Shuttle and Spacelab payloads proposed in the NASA Applications Program These range from processing of materials under near-zero gravity conditions to studies of microphysical processes occurring in clouds, and from high resolution Fourier interferometers for studying trace constituents in the atmosphere to complementary groups of sensors for viewing the earth (Author)

A78-18522 # **Results and prospects of the study of natural resources by aerospace methods (Rezul'taty i perspektivy izucheniia prirodnykh resursov aerokosmicheskimi metodami)** S V Zonn (Akademiia Nauk SSSR, Institut Geografii, Moscow, USSR) *Akademiia Nauk SSSR, Izvestiia, Seriia Biologicheskaia,* Sept -Oct 1977, p. 673-682 16 refs In Russian

The deciphering of geographic features from small- and medium-scale televised photographs and aerospace spectrograms is discussed Agricultural landscapes are examined, and different plant and soil characteristics are distinguished Reliability of categorization is considered with respect to the altitude at which the photograph was obtained Future research goals and programs are described M L

A78 18721 # **A study of the earth by aircraft - Results obtained by radio techniques (Issledovanie zemli s letatel'nykh**

apparatov - Rezul'taty, poluchennye s pomoshch'iu radiofizicheskikh metodov) N A Armand and A E Basharinov *Akademiia Nauk SSSR, Vestnik*, no 8, 1977, p 28-38 In Russian

A broad description of utilizing radio techniques for remote sensing applications is presented Primary advantages of using radio waves rather than other methods are identified, including that radio waves are neither absorbed nor dispersed by clouds, and that radio waves have great penetrating capacity Active and passive modes of radio methods are described Several areas in which radio methods may be used are outlined, such as for meteorology, oceanography, agriculture, geology, hydrology, monitoring ice formations, and measuring water temperature as a function of wind and wave velocity S C S

A78-19595 * Spacelab - A new tool for cooperative research E R Schmerling (NASA, Washington, D C) In Dynamical and chemical coupling between the neutral and ionized atmosphere, Proceedings of the Advanced Study Institute, Spatind, Norway, April 12-22, 1977 Dordrecht, D Reidel Publishing Co , 1977, p 373-379

For work in earth orbit, the European Space Agency, ESA, in cooperation with NASA, has developed a flexible laboratory system called Spacelab, which will fit into the Space Shuttle Spacelab will offer new possibilities for conducting research related to the behavior and properties of the neutral and ionized atmosphere Up to 400 km altitude, the total payload weight will be in excess of 25,000 kg The main advantages of Spacelab consist of high payload weight, power, the return of the instrumentation, and the availability of man for real-time operation of the equipment Limitations are related to the local contamination, the restriction of mission duration to periods from one to four weeks, and limited altitudes and inclinations (for early missions) Spacelab is, therefore, not suited for many types of in-situ sensing, or for long-term monitoring Attention is given to the proposed science program, passive observations, and chemical releases and active experiments G R

N78-10968*# General Accounting Office, Washington, D C Procurement and Systems Acquisition Div

LANDSATS ROLE IN AN EARTH RESOURCES INFORMATION SYSTEM: NATIONAL AERONAUTICS AND SPACE ADMINISTRATION. OFFICE OF SCIENCE AND TECHNOLOGY POLICY

10 Jun 1977 47 p Sponsored in part by NASA
(NASA-CR-155217, PB-269456/0, PSAD-77-58) Avail NTIS HC A03/MF A01 CSCL 05B

The need for a clear statement of government policy regarding support of an operational LANDSAT system is discussed Conclusions and recommendations are given which will allow congress and the executive branch to have a better understanding to reach a decision GRA

N78-11448*# National Aeronautics and Space Administration Washington, D C

INVESTIGATION OF NATURAL ENVIRONMENT BY SPACE MEANS GEOBOTANY, GEOMORPHOLOGY, SOIL SCIENCES, AGRICULTURAL LANDS, LANDSCAPE STUDY

S V Zonn, ed , L A Vedeshin ed and L A Grinberg, ed Sep 1977 288 p Transl into ENGLISH from 'Issled Prirodnoy sredy Kosmicheskimi, Sredstuvami Geobotan Geomorfol , Pochvoyedeniye, Selskokhozyayst-Vennyye Ugodya, Landshaftovedeniye Moscow Acad of Soc of USSR 1976 p 1-223 Presented at Conf of Socialist Country Specialists on Remote Sensing of the Earth with Aerospace Means Moscow 8-14 Oct 1975 Translation was announced as N76-11511 Transl by Sci Transl Serv Santa Babara Calif
(Contract NASw-2791)
(NASA-TM-75041) Avail NTIS HC A13/MF A01 CSCL 08F

Reports given by Soviet specialists at a meeting of Socialist countries on remote sensing of the earth using aerospace methods are presented Author

N78-11450# Committee on Science and Technology (U S House)

EARTH RESOURCES INFORMATION SYSTEMS

Washington GPO 1977 93 p refs Rept for Subcomm on Space Sci and Applications of the Comm on Sci and Technol , 95th Congr , 1st Sess , Nov 1977
(GPO-95-881) Avail Subcomm on Space Sci and Applications

A series of hearings were held on the definition and scope of an earth resources information system and on the institutional arrangements required to transform LANDSAT from an experimental to an operational system Mr Charles W Mathews, formerly the NASA Associate Administrator for the Office of Applications submitted two reports which were used by the Subcommittee as a point of departure during the hearings The subcommittee obtained views from several Federal agencies and departments including the Office of Science and Technology Policy, the Department of Agriculture, the Department of Interior, the Army Corps of Engineers, and the National Aeronautics and Space Administration Discussions were held with State agencies and organizations with experience using LANDSAT data and with representatives from Comsat General Electric Co Earth Satellite Corp and the Geosat Committee Author

N78-12508*# Caspan Corp , Houston, Tex

INDEXING, SCREENING, CODING AND CATALOGING OF EARTH RESOURCES AIRCRAFT MISSION DATA Final Report

[1977] 21 p
(Contract NAS9-15145)
(NASA-CR-151549, SB-6238(A)77C-219) Avail NTIS HC A02/MF A01 CSCL 05B

Tasks completed are as follows (1) preparation of large Area Crop Inventory experiment for data base entry,(2) preparation of Earth Observations Aircraft Flight summary reports for publication, (3) updating of the aircraft mission index coverage map and Ames aircraft flight map, (4) preparation of earth observation helicopter flight reports for publication, (5) indexing of LANDSAT imagery, (6) formulation of phase 3 biowindows 1, 2, 3, and 4 listings by country, footprint, and acqusition dates, (7) preparation of flight summary reports, and (8) preparation of an Alaska state index coverage map Author

N78-12509# Committee on Science and Technology (U S House)

EARTH RESOURCES INFORMATION SYSTEM

Washington GPO 1977 677 p refs Hearings before Subcomm on Space Sci and Applications of the Comm on Sci and Technol , 95th Congr , 1st Sess , No 18, 21-23 Jun 1977
(GPO-94-462) Avail Subcomm on Space Sci and Applications

The possibility for establishing an Earth Resources Information System is explored Federal stimulation and subsidy of early industry investment in an operational system is cited for promoting widespread acceptance of LANDSAT GRA

N78-13510*# National Aeronautics and Space Administration Goddard Space Flight Center, Greenbelt, Md

A COST-BENEFIT EVALUATION OF THE LANDSAT FLOW-ON OPERATIONAL SYSTEM

Mar 1977 124 p refs
(NASA-TM-78052, X-903-77-49) Avail NTIS HC A05/MF A01 CSCL 05C

Disciplines to benefit from the LANDSAT Follow-on System include agriculture, petroleum and mineral exploration, hydrologic land use, water resources management, forestry, land use planning and monitoring and soil management The annual quantified benefits are in the range of 420 to 970 million (FY 1976 dollars) The operational system sized to achieve the quantified benefits involves a single orbiting satellite with a backup satellite in launch readiness The ground system includes a basic processing system which feeds information to three user systems - one for agriculture, one for hydrologic land use, and a third for all other users The resulting present worth benefit cost ratio is at least equal to four with a reasonable likelihood of exceeding nine This benefit cost ratio is evaluated for an infinite time horizon at the discount rate of 10 percent Author

N78-13511# Lockheed Missiles and Space Co, Palo Alto, Calif
INVESTIGATION OF EARTH FROM SPACE. JOINT EXPERIMENT OF USSR AND GDR SCIENTISTS ON THE SOIUZ-22 SPACECRAFT
R Z Sagdeev 1977 20 p Transl into ENGLISH from Vestn Akad Nauk SSSR (USSR), no 3, 1977 p 6-20
Avail NTIS HC A02/MF A01 National Translation Center, John Crerar Library, Chicago, Illinois 60616

Methods of remote sensing used in studying the earth were reviewed Techniques mentioned included spectrum analysis and aerial photography, with emphasis on multizonal photography Experiments and investigations performed by Soyuz spacecraft using multizonal photography were discussed Specific photographic systems were explained including their orientations and operation in regard to the spacecraft and their expected accuracies in resolution B L P

N78-13519# Swedish Space Corp, Solna
QUICK-LOOK CAPABILITY IN A EUROPEAN EARTH RESOURCES SATELLITE DATA NETWORK, VOLUME 1 Final Report
Paris ESA 15 Apr 1977 150 p refs Prepared jointly with Stansaab Elektronik AB 2 Vol
(Contract ESA-SC/128-HQ)
(FU15-4-Vol-1, ESA-CR(P)-977-Vol-1) Avail NTIS HC A07/MF A01

Plans of the European Space Agency for creation of an earth resources satellite ERS data network (Earthnet) comprising both national and European facilities are described The network will receive, process, and distribute ERS data to a widespread group of earth scientists Initially, the network will accept data from the American satellites in the LANDSAT series, Nimbus-G, HCMM, and SEASAT User requirements for quick-look data in the area covered by the network were identified, and elements required for an optimum quick-look system to meet user requirements were assessed ESA

N78-13978# Centre National d'Etudes Spatiales Paris (France)
FRENCH SPACE PROGRAM
1977 138 p refs In FRENCH Presented at the 20th COSPAR Plenary Meeting and Assoc Activities, Tel Aviv, 7-18 Jun 1977
Avail NTIS HC A07/MF A01

The report to COSPAR on the French space programs is presented The organization and basic activities of CNES are mentioned Separate sections deal with astronomy outside the solar system solar physics and solar system, physics of the ionosphere and magnetosphere, aeronomy, meteorology, oceanology, remote sensing geodesy and aerodynamics space biology and medicine, and materials sciences ESA

N78-14464*# Environmental Research Inst of Michigan, Ann Arbor Center for Remote Sensing Information and Analysis
PROCEEDINGS OF THE ELEVENTH INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, VOLUME 1
1977 832 p refs Proc held at Ann Arbor, Mich 25-29 Apr 1977, sponsored by FHA NOAA Geological Survey, Dept of Agriculture, Army Res Center, TVA, Coast Guard NASA, ERDA, and EPA Original contains color illustrations
(NASA-CR-155361) Avail NTIS HC A99/MF A01 CSCL 05B

The application of modern sensor technology and associated data processing capabilities to the assessment of earth resources and environmental monitoring is described Problems associated with meeting future needs are explored

N78-14465*# Jet Propulsion Lab, Calif Inst of Tech, Pasadena
SENSING THE EARTH'S ENVIRONMENT FROM SPACE USER NEEDS AND TECHNOLOGY OPPORTUNITIES
Robert G Nagler *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 35-50 refs

(Contract NAS7-100)
Avail NTIS HC A99/MF A01 CSCL 04B

The specific measurements and data needs of users of remotely sensed environmental data were identified in a number of studies supported by NASA in cooperation with industry, universities and the operational government agencies involved The present capabilities of space and aircraft sensors, data systems, and satellite support systems were assessed and compared with the trends in the supporting technology Areas of high benefit in which there is a large gap between the efforts underway and the need are identified The problems in narrowing these gaps are briefly discussed Author

N78-14470*# California Univ, Santa Barbara Dept of Geography
THE IMPACT OF REMOTE SENSING ON UNITED STATES' GEOGRAPHY THE PAST IN PERSPECTIVE, PRESENT REALITIES, FUTURE POTENTIALS
John E Estes John R Jensen, and David S Simonett *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 101-121 refs

Avail NTIS HC A99/MF A01 CSCL 08F

The use of remotely sensed data by cartographers and other physical geographers is reviewed The current status of remote sensing in the academic, governmental and private sector is assessed, as well as its capability for providing information within the context of the explanatory forms used by geographers A R H

N78-14477*# National Weather Service, Silver Spring, Md
OPERATIONAL UTILIZATION OF REMOTELY SENSED DATA
James B Jones *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 221-228

Avail NTIS HC A99/MF A01 CSCL 05B

The use of data from environmental satellites and other remote sensing platforms in some of NOAA's operational services are described Topics discussed include hurricanes severe local storms and tornadoes forest guidance, weather forecasting, hydrology, space program support, oceanography search and rescue, and wildlife management Applications which have become routine, and those which are in advanced field test are included Some applications yield a clear cut economic benefit In other cases, benefits -- if any -- are obscure In yet other cases, benefits in one sector may be offset by detriments in another Illustrative examples are given Author

N78-14478*# Interior Dept Washington, D C
REBIRTH OF REMOTE SENSING DO WE KNOW ENOUGH FOR OUR OWN GOOD?
Robert L Herbst *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 229-235

Avail NTIS HC A99/MF A01 CSCL 05B

Obstacles or deficiencies in on-going satellites that impede operational use of data are described Because spectral and spatial characteristics of LANDSAT D sensors are different from earlier satellites, they deter operational planning and data use and an operational program operated in parallel with experimental technology development is needed Particular attention is given to the satellite sensor readout system, its current applications, and needs for the future A R H

N78-14479*# Environmental Research Inst of Michigan, Ann Arbor
GATHERING AND USING INFORMATION ON A GLOBAL SCALE
Charles W Mathews *In its* Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 237-241

Avail NTIS HC A99/MF A01 CSCL 05B

The importance of information gathered, integrated and analyzed over broad regions of the world is discussed Means of acquiring information on critical areas are outlined, and the particular role that remote sensing can play is described in each

case The possible implementation of a global information system and some of the current difficulties in initiation of such a system on an operational basis are explored In this way, issues will be surfaced for consideration Topics include the importance of innovative leadership, and some actions that the government might take both in Congress and in the Executive Branch, the relationship of U S government activities to international interests and to industry and the need to stimulate more private sector initiative and to transfer responsibilities from government to commercial interests Author

N78-14480*# Agency for International Development, Washington D C
US INITIATIVES FOR REMOTE SENSING APPLICATIONS IN THE DEVELOPING WORLD
John K Wilhelm *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 243-246

Avail NTIS HC A99/MF A01 CSCL 05B
Efforts of the Agency for International Development to stimulate interest in remote sensing and the use of operational data are described A R H

N78-14481*# International Astronautical Federation, Paris (France)
THE PRESENT STATUS OF REMOTE SENSING IN THE UNITED NATIONS, 8 APRIL 1977
Eilene Galloway *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 247-256 refs
Avail NTIS HC A99/MF A01 CSCL 05B
Problems arising from remote sensing of the earth by satellites have been the subject of indepth research and analysis by the United Nations Every aspect of this multidisciplinary subject has been explored in more than 100 reports and papers published as UN documents dealing with all the implications of remote sensing scientific technological, institutional political economic, cultural, and legal National, regional and international situations have been analyzed, and the General Assembly has passed resolutions requesting that the Committee on the Peaceful Uses of Outer Space give a high priority to remote sensing The identification and analysis of issues has been going on for several years, the objective being international agreement on general principles to guide nations in the conduct of their remote sensing activities Author

N78-14486*# Geological Survey Sioux Falls, S Dak
AN OVERVIEW OF REMOTE SENSING TECHNOLOGY TRANSFER IN CANADA AND THE UNITED STATES
W M Strome (Canada Centre for Remote Sensing) and D T Lauer *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 325-331 refs

Avail NTIS HC A99/MF A01 CSCL 05B
To realize the maximum potential benefits of remote sensing, the technology must be applied by personnel responsible for the management of natural resources and the environment In Canada and the United States, these managers are often in local offices and are not those responsible for the development of systems to acquire, preprocess and disseminate remotely sensed data nor those leading the research and development of techniques for analysis of the data However, the latter organizations have recognized that the technology they develop must be transferred to the management agencies if the technology is to be useful to society Problems of motivation and communication associated with the technology transfer process and some of the methods employed by Federal, State Provincial, and local agencies, academic institutions, and private organizations to overcome these problems are explored Author

N78-14487*# United Nations New York
TECHNICAL ASSISTANCE AND THE TRANSFER OF REMOTE SENSING TECHNOLOGY
Ralph Chipman *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 1 1977 p 333-338 refs
Avail NTIS HC A99/MF A01 CSCL 05B
The transfer of technology from industrialized countries to the third world is a very complicated process and one that requires a great deal of research and development The political and social obstacles to this transfer are generally greater than the technical obstacles, but technical assistance programs have neither the competence nor the inclination to deal with these factors adequately Funding for technical assistance in remote sensing is now expanding rapidly, and there is a growing need for institutions to study and promote the effective use of this technology for economic development The United Nations, the Food and Agriculture Organization, the World Bank, the United States Agency for International Development and the Canadian technical assistance agencies take different approaches to the problem and deal with the political pressures in different ways Author

N78-14488*# Ife Univ, Ile-Ife (Nigeria) Dept of Agriculture Engineering
THE TRANSFER OF REMOTE SENSING TECHNOLOGY IN THE DEVELOPING NATIONS AN OBSERVATION
Adigun Ade Abiodun *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 339-351 refs
Avail NTIS HC A99/MF A01 CSCL 05B
The cooperation and assistance of industrialized nations and the United Nations and its agencies in promoting the transfer of remote sensing technology in developing nations was discussed Training programs, workshops and seminars as well as on-going globally scattered demonstration projects were evaluated and it was suggested that emphasis should shift from centralized training to scheduled regional training programs, resulting in larger local participation and on-the-spot application of the technology to solve local problems Author

N78-14515*# Washington Univ, St Louis, Mo Center for Development Technology
AN OPERATIONAL, MULTISTATE, EARTH OBSERVATION DATA MANAGEMENT SYSTEM
Lester F Eastwood, Jr Christopher T Hill Robert P Morgan, John Kenneth Gohagan Timothy R Hays, Richard J Ballard, Gregory G Crnkovich, and Mark A Schaeffer *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 1 1977 p 659-670 refs

Avail NTIS HC A99/MF A01 CSCL 05A
State, local and regional agencies involved in natural resources management were investigated as potential users of satellite remotely sensed data This group's needs are assessed and alternative data management systems serving some of those needs are outlined It is concluded that an operational earth observation data management system will be of most use to these user agencies if it provides a full range of information services -- from raw data acquisition to interpretation and dissemination of final information products Author

N78-14529*# Environmental Research Inst of Michigan Ann Arbor Center for Remote Sensing Information and Analysis
PROCEEDINGS OF THE ELEVENTH INTERNATIONAL SYMPOSIUM ON REMOTE SENSING OF ENVIRONMENT, VOLUME 2
1977 826 p refs Symp held at Ann Arbor, Mich, 25-29 Apr 1977 Sponsored in part by NASA, FHA NOAA, Geolog Survey Dept of Agr, Army Res Center, TVA Coast Guard, ERDA and EPA Original contains color illustrations
(NASA-CR-155362) Avail NTIS HC A99/MF A01 CSCL 05B
Application and processing of remotely sensed data are discussed Areas of application include pollution monitoring water quality, land use, marine resources ocean surface properties, and agriculture Image processing and scene analysis are described along with automated photointerpretation and classification techniques Data from infrared and multispectral band scanners onboard LANDSAT satellites are emphasized

N78-14535*# Metrics Inc., Atlanta Ga
INDICATORS OF INTERNATIONAL REMOTE SENSING ACTIVITIES
G William Spann *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment, Vol 2 1977 p 885-891

Avail NTIS HC A99/MF A01 CSCL 05B

The extent of worldwide remote sensing activities including the use of satellite and high/medium altitude aircraft data was studied Data were obtained from numerous individuals and organizations with international remote sensing responsibilities Indicators were selected to evaluate the nature and scope of remote sensing activities in each country These indicators ranged from attendance at remote sensing workshops and training courses to the establishment of earth resources satellite ground stations and plans for the launch of earth resources satellites Results indicate that this technology constitutes a rapidly increasing component of environmental, land use and natural resources investigations in many countries and most of these countries rely on the LANDSAT satellites for a major portion of their data Author

N78-14552*# Agency for International Development, Washington, D C
REMOTE SENSING UTILIZATION OF DEVELOPING COUNTRIES. AN APPROPRIATE TECHNOLOGY
Merrill W Conitz and Donald S Lowe *In* ERIM Proc of the 11th Intern Symp Remote Sensing of Environment, Vol 2 1977 p 1055-1064 refs
Avail NTIS HC A99/MF A01 CSCL 05B

The activities of the Agency for international development were discussed Regional and national training centers were established to create an understanding of the role and impact of remote sensing on the developing process Workshops, training seminars, and demonstration projects were conducted Research on application was carried out and financial and technical assistance to build or strengthen a country s capability were granted Author

N78-14553*# Battelle Columbus Labs., Ohio
A SURVEY OF USERS OF EARTH RESOURCES REMOTE SENSING DATA
G E Wukelic, J G Stephan H E Small, and T F Ebbert *In* ERIM Proc of the 11th Intern Symp on Remote Sensing of Environment Vol 2 1977 p 1067-1076 refs Sponsored by NASA
Avail NTIS HC A99/MF A01 CSCL 05B

The results of a NASA supported Battelle survey to obtain user views on the nature and value of LANDSAT data use, on current LANDSAT capabilities and on ways to improve data use were summarized Questionnaire and interview responses from over 1000 private and public sector users were analyzed and discussed Author

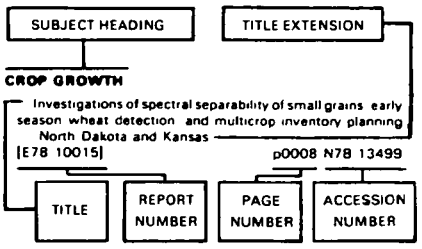
N78-14612# Environmental Research Inst of Michigan, Ann Arbor Infrared and Optics Div
REMOTE SENSING A PARTIAL TECHNOLOGY Final Report, 1 Jun. 1976 - 31 May 1977
George J Zissis May 1977 790 p
(Contract NSF ERS-76-14462)
(PB-271278/4, ERIM-123600-1-F NSF/RA-770167) Avail NTIS HC A99/MF A01 CSCL 08F

A partial assessment of remote sensing technology is provided, intended to (1) define and structure the technology assessment problem (2) compile the necessary data bases, (3) identify some possible impacts as they relate to remote sensing technology, with emphasis on the visible and infrared portions of the electromagnetic spectrum, especially in satellite systems like LANDSAT, (4) develop an assessment procedure, and (5) do a few pilot analyses to test the merits of this procedure GRA

N78-15557# Joint Publications Research Service, Arlington, Va
TRANSLATIONS ON USSR RESOURCES, NO 768
23 Jan 1978 114 p refs Transl into ENGLISH from Russian journals
(JPRS-70524) Avail NTIS HC A06/MF A01

The report contains information on energy fuels, and related equipment, manpower, metallurgy and mineral fields, fishing industry and marine resources and water resources Author

Typical Subject Index Listing



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

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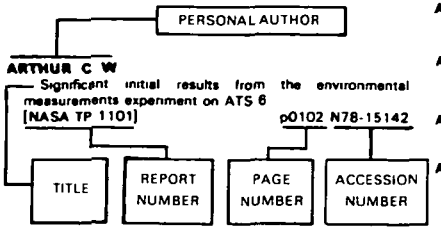

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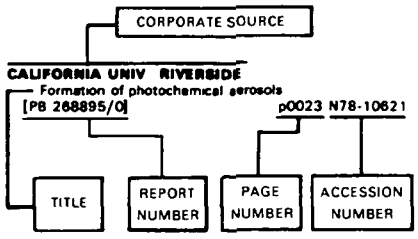

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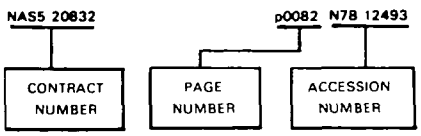

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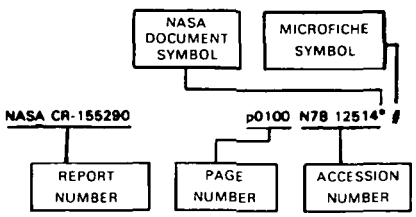

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15. Supplementary Notes

16 Abstract

This bibliography lists 775 reports, articles, and other documents introduced into the NASA scientific and technical information system between January 1 and March 31, 1978. 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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19 Security Classif (of this report) Unclassified	20 Security Classif (of this page) Unclassified	21 No of Pages 186	22. Price* $9.00 HC

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